MATHEMATICS

ZIMSEC TOPICAL COLLECTION EXERCISES

ORDINARY LEVEL

NOVEMBER 2020 – JUNE 2010

Table of Contents

ALGEBRAIC EXPRESSIONS

Simplify $4b - 3(4 - 2b)$. [2]

4004/1 J2020 Q19(a)

Expand and simplify

$-3(x - 7) + 5(2 - 4x)$ [2]

4030/1 J2018 Q15(a)

Simplify

(i) $ax - x(a - b) + 2bx$, [2]

(ii) $(x - 2)^2 - x^2$. [2]

4004/2 N2018 Q1(a)

Remove brackets and simplify

$(4a + b)(5a - 3b)$. [2]

4030/1 J2016 Q4(b)

Remove the brackets and simplify

$x - 2y - 3(x - 2y)$. [2]

4030/1 N2016 Q5(b)

Remove the brackets and simplify

$(a - b)(2a - b)$. [2]

4030/2 N2016 Q1(a)

Expand $(2a - b)(1 + c)$. [2]

4008/1 J2014 Q4(a)

Remove the brackets and simplify

$(a + 2)(a - 3) - 3(a - 5)$. [3]

4028/2 J2014 Q1(b)

Simplify $5m - 2(x - 3m)$. [1]

4008/1 N2013 Q8(a)

Mary has $\$(3x - 4y)$ and Diana has $\$(2y - x)$.

(i) Write down in terms of x and y, the simplified expression for the amount of money that Mary has more than Diana.

(ii) Given that Mary has \$12 and Diana has \$8, find the value of x and the value of y. [6]

4008/2 J2012 Q2(b)

Simplify $4x^2 - 3x(2x - 5)$. [2]

4008/1 N2012 Q4(b)

Expand and simplify $(3x + 2y)(2x - y)$. [2]

4008/4028/1 J2011 Q19(a)

Simplify $6x + 12x \div 3$. [1]

4008/4028/1 J2010 Q3(b)

Remove brackets and simplify the expression

$3(5 - x) - 2x(x + 3)$. [2]

4028/2 J2010 Q1(a)

ALGEBRAIC FRACTIONS

Express $\frac{2}{2-3n} - \frac{1}{n}$ as a single fraction in its simplest form. [3]

4004/1 J2020 Q9

Express $\frac{v-u}{(u-v)^2} - \frac{2}{v-u}$ as a single fraction in its lowest terms. [3]

4004/1 N2020 Q13

Express $3 - \frac{x+2}{x-1}$ as a single fraction in its simplest form. [3]

4004/2 J2019 Q4(a)

Express $\frac{6}{2x-x^2} - \frac{3}{x}$ as a single fraction in its simplest form. [3]

4004/2 N2019 Q6(c)

Simplify $\frac{3x^2}{x^2-5x} \div \frac{x}{x^2-25}$ [3]

4030/1 J2018 Q13

Simplify $\frac{2a+6}{a-3} \div \frac{a+3}{a^2-2a-3}$ [3]

4004/1 N2018 Q12

Express $\frac{x-3}{x-2} - \frac{x+2}{x+3}$ as a single fraction in its lowest terms. [3]

4004/2 N2018 Q1(c)

Express $\frac{3a}{2a-b} + \frac{3b}{2b-4a}$ as a single fraction in its simplest form. [3]

4030/1 J2017 Q9

Simplify $\frac{m^2-m-12}{m^3-9m}$ [3]

4030/2 J2017 Q3(b)

Express $\frac{3}{v-3} - \frac{2}{v-2}$ as a single fraction in its simplest form. [2]

4030/2 N2017 Q1(d)

Simplify $\frac{1}{a^2-3a+2} \div \frac{1}{1-a}$ [3]

4030/1 J2016 Q19

Express as a single fraction in its simplest form
$\frac{2x+9}{7} - \frac{x+1}{28}$. [4]

4030/2 N2016 Q1(c)

Simplify $\frac{x^2-y^2}{x^2+xy} \div \frac{2y-2x}{xy}$. [4]

4008/1 J2015 Q21

Express $\frac{7x+2}{5} - \frac{5x+3}{6}$ as a single fraction in its simplest form. [2]

4008/1 J2015 Q22(b)

Express $\frac{2x-1}{4} - \frac{3x-5}{12}$ as a single fraction in its simplest form. [3]

4028/2 N2015 Q3(b)

Simplify $\frac{m^2-mn}{n^2-np} \div \frac{m}{n-p}$. [1]

4008/1 J2014 Q4(b)

Express as a single fraction in its simplest form
$\frac{x-4}{16-x^2} \div \frac{2}{x+4}$ [3]

4028/2 J2014 Q2(c)

Express $\frac{6x+5}{7} - \frac{4x-6}{21}$ as a single fraction in its simplest form. [3]

4008/1R N2014 Q10

Express $\frac{x+2}{2x-3} - \frac{1}{x}$ as a single fraction in its simplest form. [4]

4008/2 N2014 Q2(c)

Express $\frac{2}{x+2} - \frac{1}{3}$ as a single fraction in its simplest form. [3]

4008/2R N2014 Q2(b)

Simplify $\frac{x^2+7x+6}{x^2-36}$ [3]

4028/1 J2013 Q7

Express as a single fraction in its lowest terms
$\frac{x+1}{x-2} - \frac{x+2}{1-x}$ [3]

4028/2 J2013 Q1(c)

Simplify $\frac{x^2+3x+2}{x+2}$ [3]

4008/1 N2013 Q13(a)

Express $\frac{8}{x+1} - 3$ as a single fraction in its simplest form. [2]

4008/2 N2013 Q1(b)

Express $\frac{2a-5}{a-4}-\frac{1}{2}$ as a single fraction in its simplest form. [3]

4008/2 J2012 Q1(a)(i)

(i) Express $\frac{x}{3}+\frac{x-4}{5}$ as a single fraction in its simplest form.

(ii) Hence or otherwise solve the equation $\frac{x}{3}+\frac{x-4}{5}=4$. [4]

4008/4028/2 J2011 Q2(b)

Express as a single fraction in its lowest terms $\frac{3}{x^2-x}-\frac{5}{x^2-1}$. [2]

4008/2 N2011 Q1(c)

Express $\frac{3}{x-2}-\frac{4}{x+1}$ as a simple fraction in its simplest form. [3]

4008/4028/1 N2010 Q12

Express $\frac{1}{x-1}+\frac{2}{x+1}$ as a single fraction in its simplest form.

Hence or otherwise, solve the equation $\frac{1}{x-1}+\frac{2}{x+1}=\frac{3}{x}$. [4]

4008/2 N2010 Q2(a)

APPROXIMATIONS & ESTIMATIONS

Express 208.9
(b) correct to 3 significant figures. [1]
(c) correct to the nearest hundred. [1]

4004/1 J2020 Q1

Express 19.796 correct to
(a) two decimal places, [1]
(b) one significant figure, [1]
(c) the nearest whole number. [1]

4004/1 N2020 Q1

Triangle ABC has sides $AB = 6{,}5\ cm$, $BC = 7{,}8\ cm$ and $AC = 9{,}1\ cm$, measured to the nearest mm.
(i) Express the length of side AB as a range, in the form ……. $\leq AB <$ ……. [2]
(ii) Calculate the least possible perimeter of the triangle. [2]

4004/2 N2020 Q3(c)

It is given that $y = 5.3$ and $z = 4.2$, both given to 1 decimal place. Find the minimum possible value of yz. Give the answer correct to 2 decimal places. [2]

4004/2 N2019 Q1(b)

(a) (ii) Express 3598 correct to 2 significant figures. [1]
(b) Find the approximate value of $\sqrt{3598}$. [1]

4030/1 J2018 Q1

The length of a side of a regular hexagon is 3,4 cm correct to one decimal place. Find the least possible perimeter of the regular hexagon. [2]

4030/1 J2018 Q15(b)

(a) Write 45,3981 correct to 4 significant figures. [1]
(b) A student spends 8 seconds, correct to the nearest second, to solve a problem. Find the limits between which this time lies in the form $a \leq t < b$ where a and b are constants and t is the time. [2]

4004/1 N2018 Q9

Express 68,975 to
(i) the nearest ten, [1]
(ii) the nearest tenth, [1]
(iii) one significant figure. [1]

4030/1 J2017 Q1

The radius of a circle is 32 cm measured to the nearest centimetre.
(i) Write down the least possible value of the radius, [1]
(ii) **Take π to be $\frac{22}{7}$.**
Calculate the least possible value of the circumference of the circle. [2]

4030/2 J2017 Q5(a)

Express 99.987
(a) correct to one decimal place, [1]
(b) correct to one significant figure. [1]

4030/1 N2017 Q1

Estimate the value of $\frac{7{,}63\times5{,}81\times9{,}3}{27{,}1\times31{,}2}$ by rounding off each number correct to one significant figure. [2]

4030/1 N2017 Q6(a)

It is given that the length, l, of a side of a square is $7\ cm$, measured to the nearest centimetre.
(a) Write the range in which the length of the side of the square must lie, giving your answer in the form $\boldsymbol{a \leq l < b}$ where $\boldsymbol{a}$ and $\boldsymbol{b}$ are to be found. [2]
(b) Calculate the least possible perimeter of the square. [1]

4030/1 N2017 Q13

Express 31,095 correct to
(i) 2 decimal places, [1]
(ii) 2 significant figures. [1]

4030/1 J2016 Q2(a)

A length h measured to 1 decimal place is given as 9,5 cm. State its limits. [2]

4030/1 J2016 Q3(b)

The side of an equilateral triangle is 6 cm to the nearest centimetre. Calculate the least possible perimeter of the triangle. [2]

4030/1 N2016 Q20(b)

Express 0,098
(a) correct to two decimal places. [1]
(b) correct to 2 significant figures. [1]

4008/1 J2015 Q1

Express 2046.489 correct to
(a) the nearest ten, [1]
(b) 2 decimal places, [1]
(c) 2 significant figures. [1]

4008/1 J2014 Q1

Express 0.0796 correct to 3 decimal places. [1]

4008/1 N2014 Q1(b)

Express 0.07649
(b) correct to 2 significant figures, [1]
(c) correct to the nearest hundredth. [1]

4008/1R N2014 Q1

(b) Given the expression $\frac{(3{,}65+5{,}49)\times 9{,}84}{5{,}16\times(12{,}1-8{,}52)}$, rewrite the expression, giving each number correct to the nearest whole number, [1]
(c) Estimate, using the answer to **(b)**, the value of the given expression correct to the nearest whole number. [1]

4008/1R N2014 Q2

The dimensions of a rectangle, correct to the nearest centimetre, are 9 cm by 7 cm. Calculate the minimum possible area of the rectangle. [3]

4008/1R N2014 Q12

A rectangle measures 8 cm by 6 cm to the nearest centimetre. Calculate the least possible value of the area of the rectangle. [3]

4008/2 N2014 Q3(a)

The dimensions of a rectangle, measured to the nearest centimetre, are 42 cm and 81 cm.
(i) State the least possible width of the rectangle.
(ii) Calculate the least possible perimeter of the rectangle. [3]

4028/2 J2013 Q5(a)

A cube has an edge of length 1.99 cm correct to three significant figures.
(a) Estimate correct to one significant figure, the volume of the cube. [2]
(b) State the lower limit of the length of the edge in centimetres. [1]

4008/1 J2012 Q3

Express 754,96 correct to
(i) one decimal place, [1]
(ii) one significant figure. [1]

4008/1 N2012 Q1(a)

The radius of a circle, r cm, is given as 11 cm correct to the nearest whole number.
Find
(i) the limits between which r lies, [1]
(ii) the least possible circumference of the circle in terms of π. [2]

4008/1 N2012 Q19(b)

A rectangle measures 10,2 cm by 7,1 cm, correct to one decimal place. Find the minimum possible perimeter of the rectangle. [3]

4008/4028/1 J2011 Q9

Given $P = \frac{0.00274\times 3460}{(9.88+23.8)^2}$
(a) Rewrite this expression with each number correct to one significant figure. [2]
(b) Estimate the value of P correct to one significant figure. [1]

4008/1 N2011 Q2

A rectangle is 9,1 cm long and 5,7 cm wide correct to one decimal place.
(a) State the least possible width of the rectangle. [1]
(b) Find the limits within which the perimeter of the rectangle lies. [2]

4008/1 N2011 Q12

Express 0.096 correct to two decimal places. [1]

4008/4028/1 J2010 Q1(a)(i)

By correcting each number to 1 significant figure, estimate the value of $\frac{371\div 849}{\sqrt{668-643}}$. [3]

4008/4028/1 N2010 Q8

The length, l cm, of the edge of a cube is given as 5,1 cm correct to one decimal place.
(a) Give the limits for l. [2]
(b) Find the least possible surface area of the cube. [2]

4008/4028/1 N2010 Q16

CHANGE OF SUBJECT OF FORMULA

It is given that $s = \frac{a}{1-r}$.

(i) Find the value of S when $a = 81$ and $r = \frac{1}{3}$. [2]

(ii) Make r the subject of the formula. [3]

4004/2 J2020 Q9(b)

Given that $\sqrt{ax+b} = d$, express x in terms of a, b and d. [3]

4004/2 J2019 Q4(c)

It is given that $g = \sqrt{\frac{h-4}{5+h}}$.

(a) Find g when $h = 20$. [2]

(b) Express h in terms of g. [3]

4004/1 N2019 Q19

It is given that $A = \frac{h(12+b)}{2}$.

(i) Find the value of A when $b = 1{,}5$ and $h = 0{,}8$. [2]

(ii) Express h in terms of A and b. [3]

4004/2 N2019 Q8(a)

The formula for converting a temperature in degrees centigrade (°C) to a temperature in degrees Fahrenheit (°F) is $F = 32 + \frac{9C}{5}$.

(a) Find F when $C = 30°$. [1]

(b) Make C the subject of the formula. [2]

4030/1 J2018 Q14

It is given that $H = mp + \frac{1}{2}f^2p$.

(i) Calculate the value of H when $m = 2, p = 3$ and $f = -4$. [2]

(ii) Make f the subject of the formula. [3]

4030/2 J2018 Q2(c)

Make x the subject of the formula $R = \sqrt{\frac{ax-p}{Q+bx}}$. [4]

4004/2 N2018 Q3(b)

It is given that $p = \pi w^2\left(r - \frac{w}{2}\right)$.

(a) Make r the subject of the formula. [2]

(b) Find r in terms of π when $w = 6$ and $p = 72$. [2]

4030/1 J2017 Q15

Make m the subject of the formula $T = 2\pi\sqrt{\frac{em}{g}}$. [3]

4030/2 J2017 Q4(b)

When a rod of length l cm is heated to a temperature of t°C, it expands. Its new length, x cm, is given by the formula $x = l + alt$.

(a) Make a the subject of the formula. [2]

(b) (i) Find x when $l = 2$ cm, $a = 0{,}01$ and $t = 50$°C. [2]

(ii) Find a when $x = 3{,}1$ cm, $l = 3$ cm and $t = 40$°C. [2]

4030/1 N2017 Q27

Given that $ax = \sqrt{b^2 - x^2}$, express x in terms of a and b. [3]

4030/2 N2017 Q2(c)

Given that $x = aq^2 + bq^2$, express q in terms of a, b and x. [3]

4030/1 J2016 Q10

Make x the subject of the formula $wx^2 = n$. [2]

4030/2 J2016 Q2(d)

Given that $h = \frac{m(v^2-u^2)}{2gx}$, make u the subject of formula. [3]

4030/1 N2016 Q13

Given that $x = y + \sqrt{m + x^2}$, make m the subject of the formula. [3]

4030/2 N2016 Q2(b)

Given that $f = \frac{mv-mu}{t}$, express m in terms of f, v, u and t. [2]

4008/1 J2015 Q16(b)

Given that $P = \frac{n}{2}\{2a + (n-1)d\}$,

(i) express a in terms of d, n and P,

(ii) find the value of a when $n = 10$, $d = 4$ and $P = 20$. [5]

4028/2 J2015 Q5(b)

Make a the subject of the formula $\frac{1}{a} + \frac{1}{b} = 3$. [3]

4028/1 N2015 Q8

Make x the subject of the formula $y = \frac{p-2x}{x}$. [3]

4028/2 N2015 Q5(a)

If $yk = ax - bk$, make k the subject of the formula. [2]

4008/1 J2014 Q9(b)

Given that $V = \frac{1}{3}\pi r^2 h$,

(a) express r in terms of V, π and h, [2]

(b) find r if $\pi = \frac{22}{7}, V = 29\frac{1}{3}$ and $h = 7$. [2]

4008/1 N2014 Q14

Given that $\mathrm{A} = \mathrm{P} + \frac{\mathrm{PRT}}{100}$,

(i) calculate A when $\mathrm{P} = 350$, $\mathrm{T} = 1\frac{1}{2}$ and $\mathrm{R} = 5$.

(ii) make P the subject of the formula. [4]

4008/2R N2014 Q5(a)

The surface area, A, of a solid cylinder of height h and base radius r is given by the formula $A = 2\pi r(r + h)$.

(i) Make h the subject of the formula.

(ii) Find h when $A = 77\ cm^2, r = 2.5\ cm$ and $\pi = \frac{22}{7}$. [4]

4028/2 J2013 Q4(b)

The temperature T°C at a height of H metres above sea level, is given by the formula $T = 20 - \frac{H}{150}$.

(a) Calculate the temperature at 4 500 metres. [1]

(b) Make H the subject of the formula. [2]

(c) Find the height at which the temperature is 12°C. [1]

4008/1 N2013 Q19

If $dx = r + qx$,

(i) find the value of d when $q = 3, r = -1$ and $x = 2$,

(ii) express x in terms of d, q and r. [4]

4008/2 N2013 Q4(a)

Given that $p = (x - q)(x + q)$,

(a) express q in terms of x and p, [2]

(b) find the values of q when $x = 3$ and $p = -7$. [2]

4008/1 J2012 Q16

Given that $T = \frac{11v}{6} + 20$,

(i) make v the subject of the formula,

(ii) find v when $T = v$. [5]

4008/2 J2012 Q3(a)

Make y the subject of the formula $x = \sqrt{cy - d}$. [3]

4008/1 N2012 Q6

Make u the subject of the formula $T = \frac{mu^2}{K} - 5mg$. [3]

4008/4028/1 J2011 Q6

It is given that $r = 2q - 5$ and $q = 3p + 2$.

(i) Express r in terms of p.

(ii) Given also that $p = -3$, find the numerical value of r. [3]

4008/2 J2011 Q2(a)

If $\frac{x}{a} + \frac{y}{b} = 1$, make x the subject. [3]

4008/1 N2011 Q16(b)

Given that $b = \frac{1}{2}\sqrt{a^2 - x^2}$, make x the subject of the formula. [2]

4008/2 N2011 Q3(b)

It is given that $t = 2\pi\sqrt{\frac{d}{g}}$.

(a) Find t when $\pi = \frac{22}{7}, d = 490$ and $g = 10$. [2]

(b) Make d the subject of the formula. [2]

4008/4028/1 J2010 Q24

It is given that $T = 2\pi\sqrt{\frac{l}{g}}$.

(a) Find T when $l = 156.8$, $g = 9.8$ and $\pi = 3.1$ [2]

(b) Make l the subject of the formula. [2]

4008/4028/1 N2010 Q20

It is given that $s = ut - \frac{1}{2}gt^2$.

(i) Find the value of s if $g = 9.8$, $u = 20$ and $t = 2$.

(ii) Make g the subject of the formula. [5]

4008/2 N2010 Q3(a)

CHANGE OF UNITS

Convert,
(a) 3,84 hectares to m^2, [1]
(b) 4,8 days to hours, giving your answer to the nearest hour, [1]
(c) $38^{\circ}54'$ to degrees. [1]

4004/1 N2020 Q8

Express 2 460 cm^3 in litres. [1]

4004/1 N2019 Q1(a)

Express the time 00 25 in 12−hour notation. [1]

4030/1 J2018 Q3(a)

An open cylindrical water container has an internal height of 1,5 m and internal diameter of 0,75 m. Calculate the volume of the container, in litres.
$\boldsymbol{Take\ \pi = \frac{22}{7}}$. [3]

4030/2 J2018 Q7(a)(i)

(a) Convert 00 45 in 12−hour notation. [1]
(c) Convert 5 km^2 to hectares. [1]

4004/1 N2018 Q4

Convert a speed of 12 m/s to a speed in km/h. [2]

4004/1 N2018 Q22(a)

A triangular plot has two of its boundaries measuring 400 m and 440 m with an included angle of 46°. Calculate the area of the plot, giving the answer in hectares. [4]

4004/2 N2018 Q11(b)

Express
(a) 6 minutes to 8 at night as a time in 24−hour notation. [1]
(b) 43,35 hours in hours and minutes. [2]

4030/1 J2017 Q5

The length of each side of an equilateral triangle is 8 cm.
(i) Calculate the area of the triangle. [2]
(ii) Express the area of the triangle in square metres. [2]

4030/2 J2017 Q3(c)

Calculate the number of minutes between 1935 and midnight of the same day. [2]

4030/1 N2017 Q5(a)

Express 0,5 litres in cm^3. [1]

4030/1 J2016 Q8(a)

A motorist left Masvingo for Beitbridge at 2102. The motorist spent 1 hour 30 minutes mending a puncture and 3 hours driving. The motorist's average speed for the journey was 64 km/h.
(a) Express 2102 as a time on the 12-hour notation. [1]
(b) Find the arrival time in Beitbridge in 24-hour notation. [1]

4030/1 J2016 Q20

Express 90 km/h in m/s. [2]

4030/1 J2016 Q24(b)(i)

Express
(a) 61,7° in degrees and minutes, [1]
(b) $11\frac{2}{3}\ m/s$ in km/h. [2]

4030/1 N2016 Q7

A jet plane leaves Harare for Praira at 2323. The journey takes 5 hours 33 minutes and Praira's time is 2 hours behind Harare's time.
Express 2323 in 12−hour notation. [1]

4008/1 J2015 Q3(a)

A luxury coach leaves Bulawayo for Harare every morning at 7.30 am and arrives in Harare at 1.00 pm. Express the departure time as a time in the 24−hour notation. [1]

4028/1 N2015 Q18(a)

Express 9 minutes after midnight as time on the 24−hour clock. [1]

4008/1 J2014 Q7(a)

Express 15 minutes before midnight as time in the 24−hour notation. [1]

4008/1 N2014 Q4(b)

Find the capacity, in litres, of a cylindrical tank of height 3,5 m and diameter 4 m. [3]
[Take π to be $\frac{22}{7}$]

4008/1R N2014 Q17(b)

Express (a) 3 m^2 in cm^2, [1]
(b) 32,5 m/s in km/h. [2]

4028/1 J2013 Q5

(a) Write 3,35 minutes in minutes and seconds. [1]

(b) If 1 kilometre is $\frac{5}{8}$ of a mile, convert 75 miles to kilometres. [2]

4008/1 N2013 Q4

(a) Express 200 km/h as a speed in km/min. [1]

(b) Find the time taken for a racing driver to cover a 120 km race if he travels at a speed of 200 km/h, giving your answer in minutes. [2]

4008/1 N2013 Q9

A boy completes a 400−metre race in one minute. Express his speed in kilometres per hour. [2]

4008/1 J2012 Q12(b)

Express 7.45 pm as time in the 24−hour notation. [1]

4008/1 N2012 Q8(a)

Find, in km/h, the rate at which a car travels if it covers 24 metres in 1 second. [2]

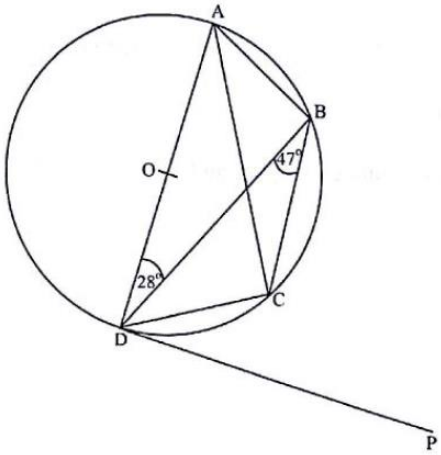
4008/4028/1 J2010 Q8(b)

120 kg of a certain metal has a volume of 0,4 m^3. Find the density of the metal, giving your answer in g/cm^3. [2]

4028/2 J2010 Q2(b)

CIRCLE GEOMETRY

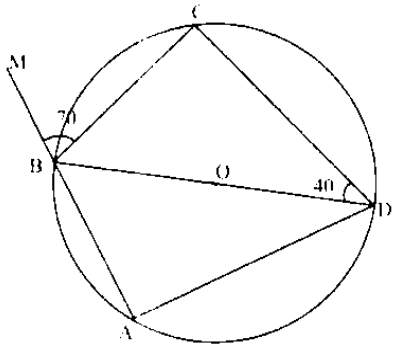
In the diagram, A, B, C and D are points on the circumference of a circle, centre O. PD is a tangent to the circle at D, $A\hat{D}B = 28°$ and $C\hat{B}D = 47°$.



Calculate (a) $B\hat{A}D$, [1]
(b) $C\hat{D}P$, [1]
(c) $C\hat{A}B$, [1]
(d) $B\hat{C}D$. [1]

4004/1 J2020 Q18

In the diagram, ABCD is a cyclic quadrilateral with centre O. AB is produced to M. $M\hat{B}C = 70°$ and $B\hat{D}C = 40°$.

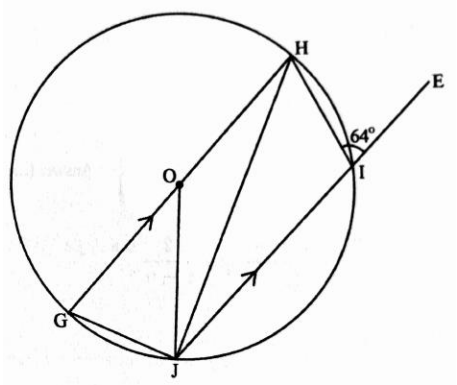


Find (i) $B\hat{C}D$, [1]
(ii) $A\hat{B}D$, [2]
(iii) $A\hat{D}O$. [2]

4004/2 J2020 Q5(c)

In the diagram G, H, I and J, are points on the circumference of a circle centre O,
GH is parallel to JE and $H\hat{I}E = 64°$.

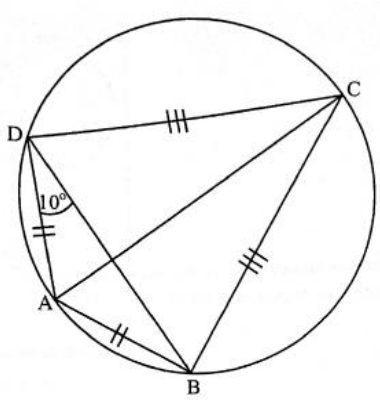
Calculate (a) $J\hat{G}H$, [1]
(b) $G\hat{H}J$, [1]
(c) $H\hat{J}I$. [1]



4004/1 N2020 Q12

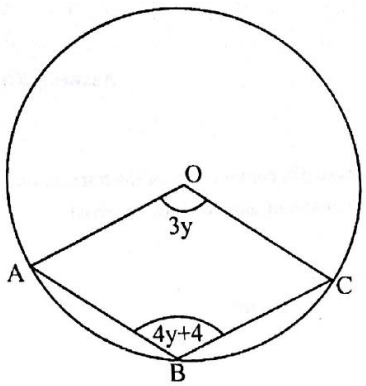
In the diagram, ABCD is a cyclic quadrilateral in which $AB = AD$ and $BC = DC$. AC is the diameter of the circle and $A\hat{D}B = 10°$.

(a) State the special name given to the cyclic quadrilateral ABCD. [1]



(b) Find (i) $A\hat{C}D$, [1]
(ii) $A\hat{D}C$. [1]

4004/1 J2019 Q5

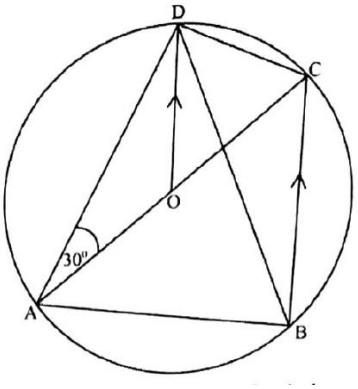


In the diagram above, A, B and C are points on the circumference of a circle centre O. $A\hat{O}C = 3y$ and $A\hat{B}C = 4y + 4$.

(i) Write down an expression, in terms of y, for reflex $A\hat{O}C$. [1]

(ii) Find the value of y. [3]

4004/2 J2019 Q2(c)



In the diagram, points **A**, **B**, **C** and **D** are on the circumference of a circle centre **O**. **AOC** is a straight line, **OD** is parallel to BC and **DÂO** = 30°.

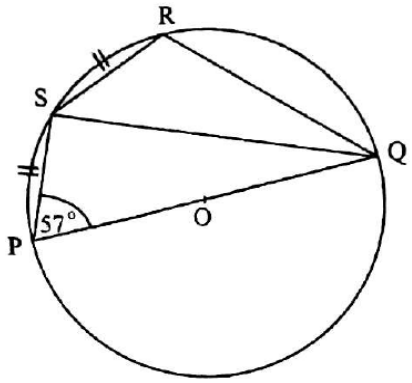
Calculate (a) $O\hat{D}B$, [1]

(b) $A\hat{B}D$, [1]

(c) $A\hat{C}B$. [1]

4004/1 N2019 Q11

In the diagram, **P**, **Q**, **R** and **S** are points on the circumference of a circle centre **O**. **POQ** is a diameter of the circle. Arcs **PS** and **SR** are equal. $Q\hat{P}S = 57°$.



(i) Name the angle which is equal to $S\hat{Q}R$. [1]

(ii) Find $P\hat{Q}S$. [1]

(iii) Find $Q\hat{R}S$. [1]

(iv) Find $Q\hat{S}R$. [2]

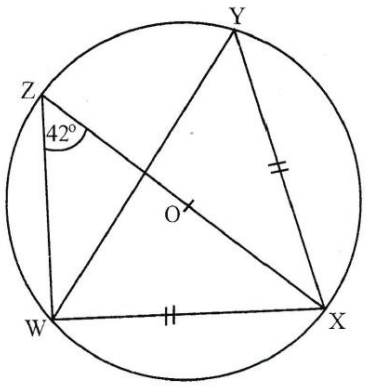
4004/2 N2019 Q3(a)

In the diagram W, X, Y and Z are points on the circumference of a circle centre O, WX = XY and $X\hat{Z}W = 42°$.

Calculate (i) $W\hat{Y}X$, [1]

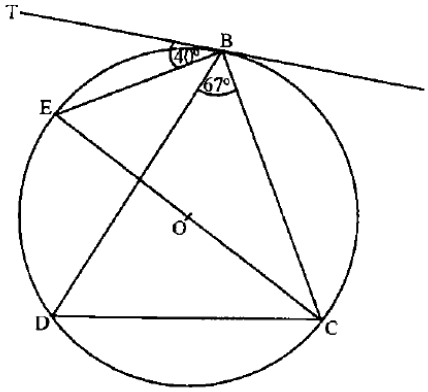
(ii) $Y\hat{W}Z$, [1]

(iii) $W\hat{X}Y$. [1]



4030/1 J2018 Q7

In the diagram, B, C, D and E are points on the circumference of a circle centre O. TB is a tangent to the circle at B, $C\hat{B}D = 67°$ and $E\hat{B}T = 40°$.



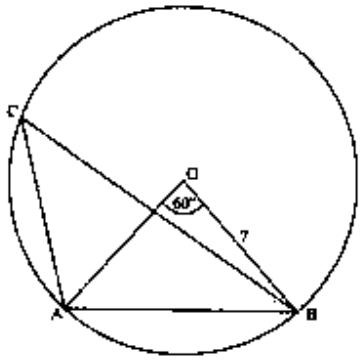
Calculate (i) $E\hat{B}D$, [1]

(ii) $B\hat{C}E$, [1]

(iii) $B\hat{E}C$, [1]

(iv) $B\hat{D}C$. [1]

4030/2 J2018 Q4(a)



In the diagram points **A**, **B** and **C** are on the circumference of circle centre **O**, **OB** = 7 cm and $A\hat{O}B = 60°$. In this question take π to be $\frac{22}{7}$.

Calculate

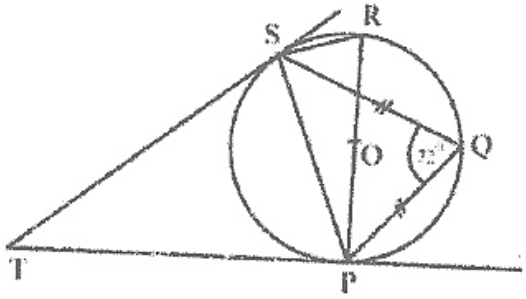
(a) $A\hat{C}B$, [1]

(b) $O\hat{A}B$, [1]

(c) the length of minor arc **AB**, [2]

(d) the area of the minor sector **AOB**. [2]

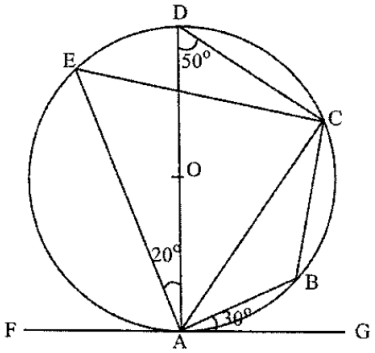
4004/1 N2018 Q23



In the diagram P, Q, R and S are points on the circumference of a circle centre O. POR is the diameter of the circle, PT and ST are tangents to the circle, $S\hat{Q}P = 72°$ and chords PQ and QS are equal.

Calculate (i) $P\hat{S}Q$, [2]
(ii) $S\hat{R}P$, [1]
(iii) $S\hat{P}R$, [2]
(iv) $P\hat{T}S$. [2]

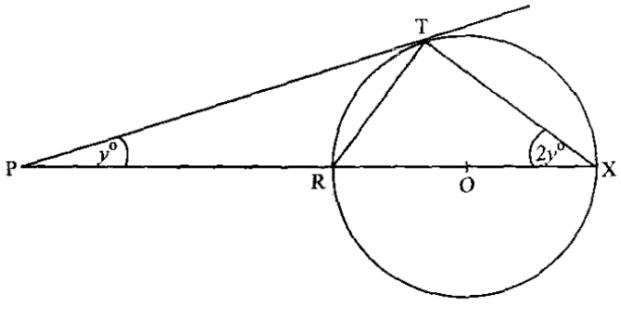
4004/2 N2018 Q7(b)



In the diagram, points A, B, C, D and E are on the circumference of a circle centre O. FAG is a tangent to the circle at A. $B\hat{A}G = 30°$, $A\hat{D}C = 50°$ and $D\hat{A}E = 20°$.

Calculate (a) $A\hat{E}C$, [1]
(b) $A\hat{B}C$, [1]
(c) $E\hat{A}F$, [1]
(d) $A\hat{C}E$. [1]

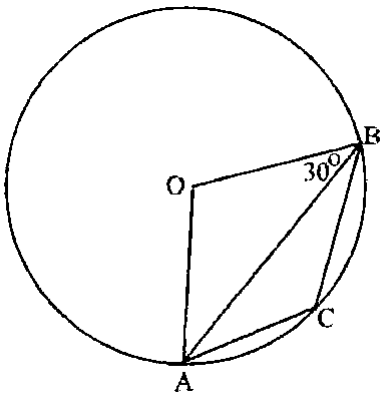
4030/1 J2017 Q19



In the diagram, the points R, T and X are on the circumference of a circle centre O. The diameter XR is produced to P and PT is a tangent to the circle at T. $R\hat{P}T = y°$ and $R\hat{X}T = 2y°$.

Find (i) $R\hat{T}P$ in terms of y, [1]
(ii) the value of y. [3]

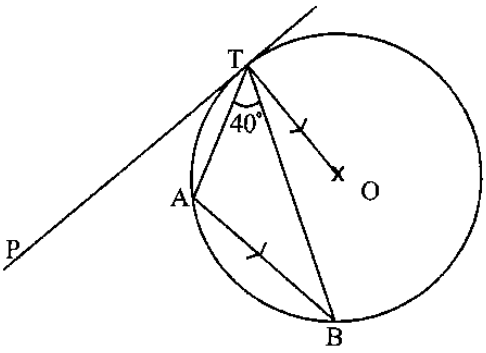
4030/2 J2017 Q4(c)



In the diagram, the points A, B and C are on the circumference of a circle centre O. $O\hat{B}A = 30$.

Calculate (a) $A\hat{O}B$, [2]
(b) $A\hat{C}B$. [2]

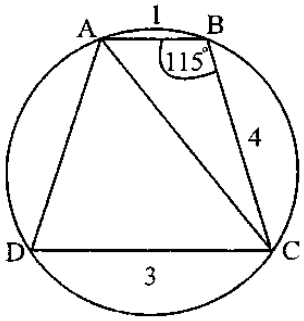
4030/1 N2017 Q21



The diagram shows points A, B and T on the circumference of a circle centre O. PT is a tangent to the circle at T. AB is parallel to TO and $ATB = 40°$.

(i) Name **two** angles equal to $A\hat{B}T$. [2]
(ii) Calculate $B\hat{A}T$. [2]

4030/2 N2017 Q2(b)



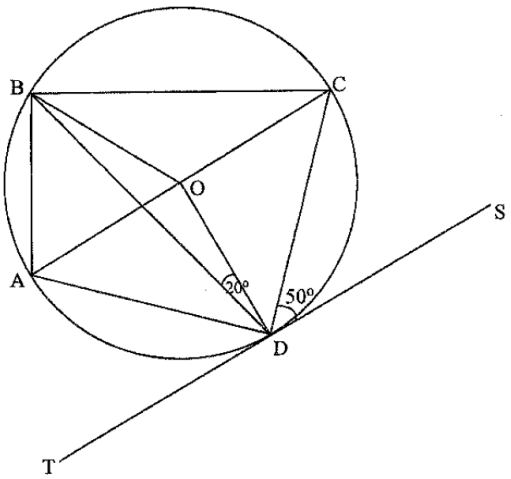
In the diagram ABCD is a cyclic quadrilateral in which AB = 1 cm, BC = 4 cm, CD = 3 cm and $A\hat{B}C = 115°$.

(i) Calculate AC. [5]

(ii) Calculate $D\hat{A}C$. [5]

4030/2 N2017 Q7(a)

In the diagram, points A, B, C and D are on the circumference of a circle with centre O. $C\hat{D}S = 50°$ and $B\hat{D}O = 20°$. Line TS is a tangent to the circle at D.



Calculate

(a) $D\hat{B}C$, [1]

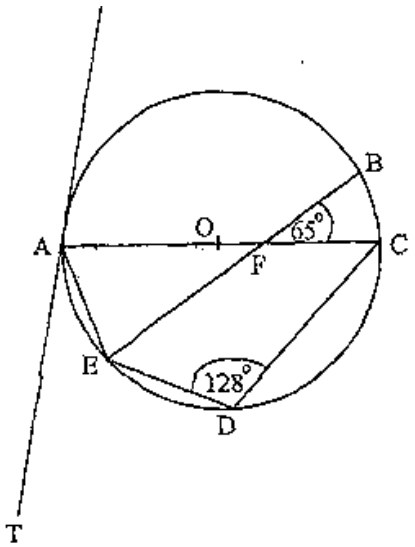
(b) $D\hat{O}C$, [1]

(c) $O\hat{D}C$, [1]

(d) $A\hat{B}D$, [1]

(e) $D\hat{A}C$. [1]

4030/1 J2016 Q25



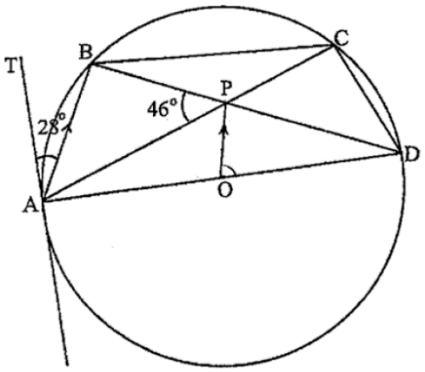
In the diagram, the points A, B, C and D and E lie on the circumference of the circle with centre O. EB AC meet at F. TA is a tangent to the circle at A.

$C\hat{D}E = 128°$ and $B\hat{F}C = 65°$.

Calculate (a) $T\hat{A}E$, [1]

(b) $A\hat{E}B$. [2]

4030/1 N2016 Q14



In the diagram, A, B, C and D are points on the circumference of a circle centre O. P is a point on BD such that OP is parallel to AB and APC is a straight line.

TA is a tangent to the circle at A where $B\hat{A}T = 28°$ and $A\hat{P}B = 46°$.

Calculate

(i) $A\hat{D}B$, [1]

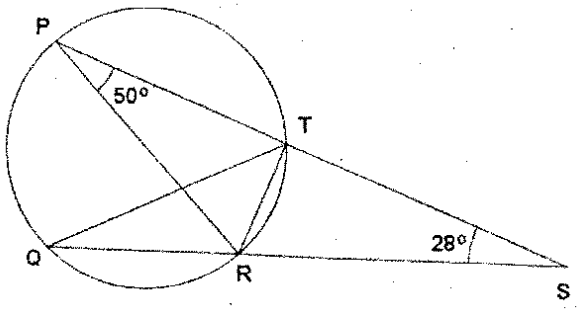
(ii) $B\hat{A}P$, [2]

(iii) $C\hat{B}D$, [2]

(iv) $P\hat{O}D$. [2]

4030/2 N2016 Q4(b)

In the diagram P, Q, R and T are points on the circumference of a circle. PTS and QRS are straight lines. PR is a diameter, $Q\hat{S}P = 28°$ and $R\hat{P}S = 50°$.



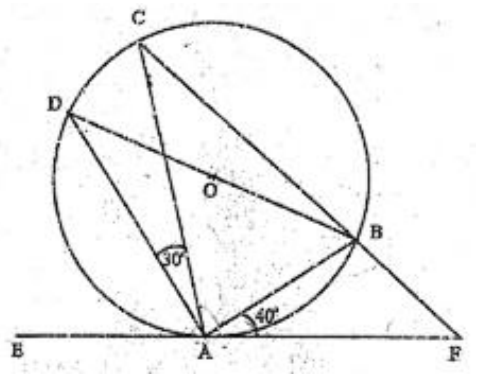
Calculate

(a) $P\hat{R}T$, [1]

(b) $Q\hat{T}S$, [1]

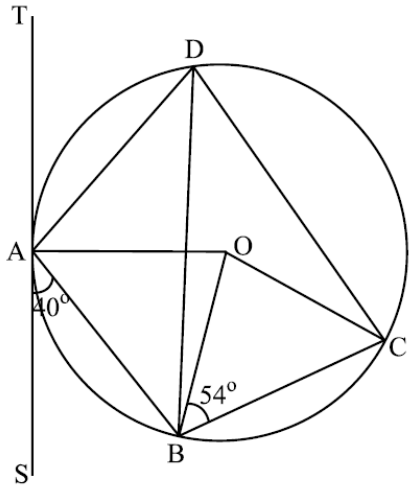
(c) $Q\hat{T}R$. [1]

4008/1 J2015 Q10



The diagram shows points A, B, C and D on the circumference of a circle centre O. EAF is a tangent to the circle at A. Given that $B\hat{A}F = 40°$ and $C\hat{A}D = 30°$, calculate (i) $A\hat{D}B$, (ii) $D\hat{A}E$, (iii) $A\hat{B}F$, (iv) $C\hat{D}B$. [7]

4028/2 J2015 Q4(a)

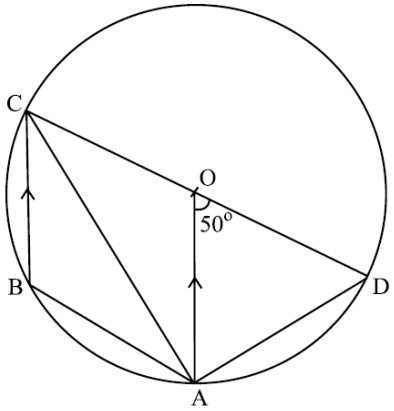


In the diagram, O is the centre of the circle. TAS is a tangent to the circle at A. $B\hat{A}S = 40°$ and $O\hat{B}C = 54°$.

Calculate (a) $O\hat{A}B$, [1]
(b) $A\hat{O}B$, [1]
(c) $A\hat{D}C$, [2]
(d) reflex $A\hat{O}C$. [2]

4028/1 N2015 Q26

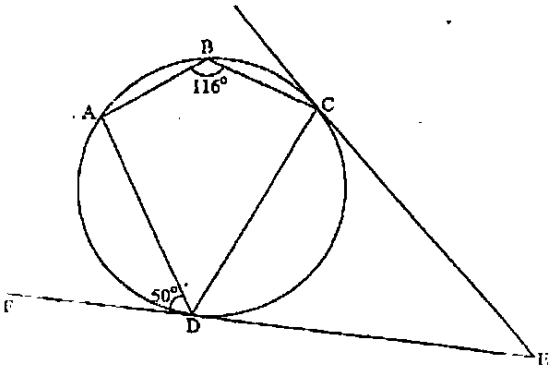
In the diagram, ABCD is a circle with centre O. CD is a diameter of the circle. $A\hat{O}D = 50°$ and OA is parallel to CB.



Find (i) $O\hat{C}A$, [1]
(ii) $O\hat{A}D$, [2]
(iii) $A\hat{B}C$, [2]
(iv) $C\hat{A}B$. [2]

4028/2 N2015 Q5(b)

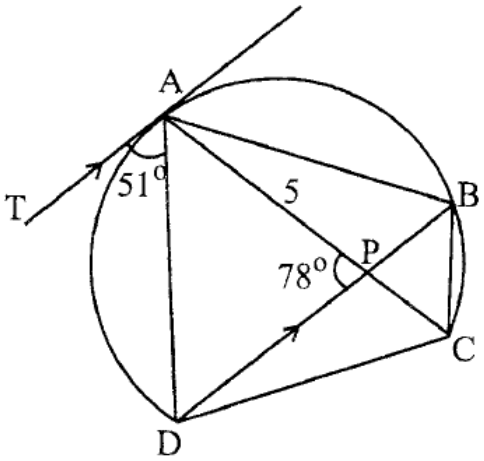
In the diagram, ABCD is a circle. Tangents at C and D meet at E and ED is produced to F such that $A\hat{D}F = 50°$ and $A\hat{B}C = 116°$.



Calculate
(a) $A\hat{D}C$, [1]
(b) $C\hat{D}E$, [1]
(c) $C\hat{E}D$. [1]

4008/1 J2014 Q11

In the diagram, ABCD is a cyclic quadrilateral. TA is a tangent at A and is parallel to DB. AC and BD intersect at P such that AP = 5 cm.



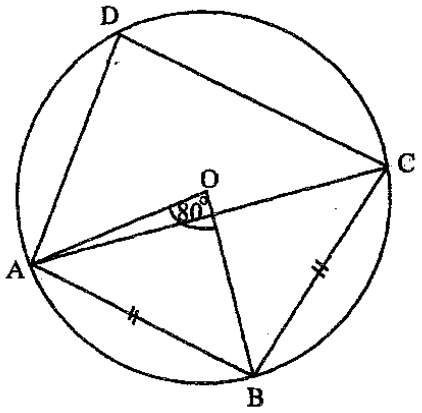
(a) Given that $T\hat{A}D = 51°$ and $A\hat{P}D = 78°$, calculate (i) $A\hat{C}D$,
(ii) $B\hat{A}C$,
(iii) $B\hat{C}A$. [5]

(b) Write down the reason why ΔAPD is isosceles. [1]

(c) Calculate the length of AD. [2]

(d) Name in the correct order, the triangle which is
(i) similar to ΔAPD,
(ii) congruent to ΔABP. [2]

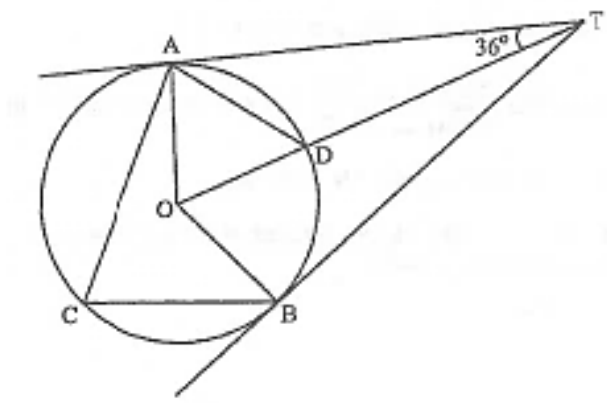
4028/2 J2014 Q5



In the diagram, ABCD is a circle centre O.
$A\hat{O}B = 80°$ and AB = BC.

Calculate (i) $A\hat{C}B$, [1]
(ii) $A\hat{D}C$, [1]
(iii) $O\hat{A}C$. [1]

4008/1 N2014 Q8



In the diagram, TA and TB are tangents to the circle, centre O, at A and B respectively. C is a point on the major arc ACB and D is a point on the minor arc ADB such that TDO is a straight line and
$A\hat{T}O = 36°$.

(a) Name the **two** congruent triangles. [1]

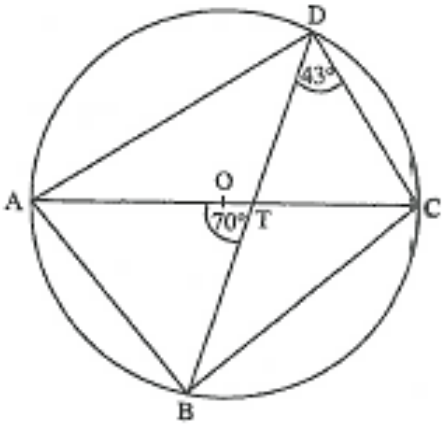
(b) Calculate (i) $A\hat{O}D$, [1]
(ii) $A\hat{O}B$. [1]

4008/1R N2014 Q3

In the diagram, ABCD is a circle with centre O and diameter AOC. Line AOC meets BD at T, making $A\hat{T}B = 70°$ and $B\hat{D}C = 43°$.

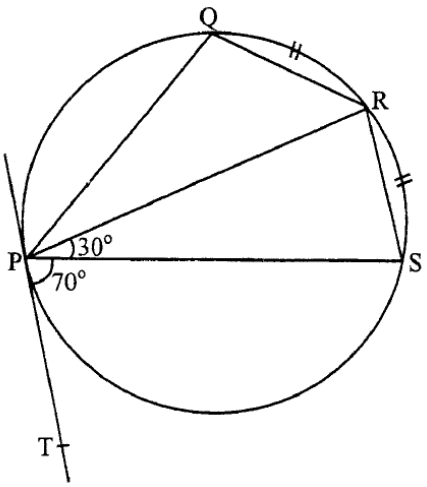
(i) Calculate
1. $B\hat{A}C$,
2. $D\hat{B}C$,
3. $B\hat{A}D$.

(ii) Write down the triangle that is similar to triangle ATB.



(iii) If $\frac{AT}{DT} = \frac{3}{2}$, find the ratio $\frac{\text{area of triangle BAT}}{\text{area of triangle DCT}}$. [6]

4008/2R N2014 Q5(b)



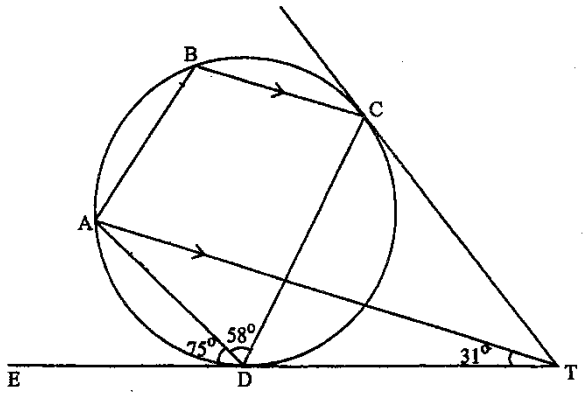
In the diagram P, Q, R and S are points on the circumference of a circle and arcs QR and RS are equal. TP is a tangent to the circle at P, $T\hat{P}S = 70°$ and $R\hat{P}S = 30°$.

Calculate (a) $Q\hat{P}R$, [1]

(b) $P\hat{R}S$, [1]

(c) $P\hat{Q}R$. [1]

4028/1 J2013 Q8



In the diagram, ABCD is a cyclic quadrilateral. TC and TDE are tangents to the circle and BC is parallel to AT. $A\hat{D}E = 75°$, $A\hat{D}C = 58°$ and $A\hat{T}D = 31°$.

Find (i) $A\hat{B}C$,

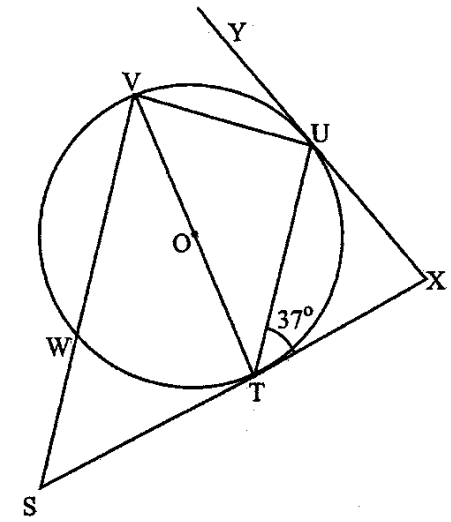
(ii) $C\hat{T}D$,

(iii) $T\hat{A}D$,

(iv) $A\hat{T}C$,

(v) $B\hat{A}T$. [6]

4028/2 J2013 Q4(a)



In the diagram, TUVW is a circle centre O. TOV is a diameter. STX and XUY are tangents to the circle at T and U respectively. SWV is parallel to TU and $U\hat{T}X = 37°$.

(i) Find 1. $T\hat{S}V$,

2. $S\hat{V}T$,

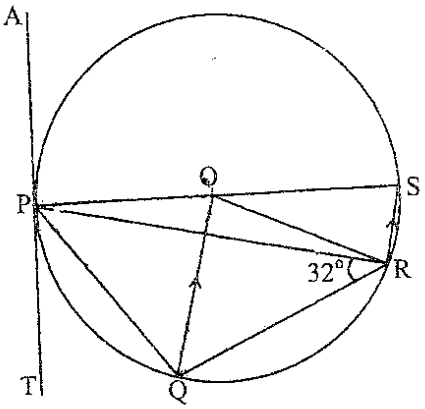
3. $U\hat{V}T$,

4. $T\hat{X}U$.

(ii) Name the triangle that is similar to ΔUVT.

(iii) Given that TU = 4,7 cm,
calculate the radius of the circle. [8]

4008/2 N2013 Q5(b)



In the diagram, P, Q, R and S are points on the circle centre O. AT is a tangent to the circle at P and QO is parallel to RS. Given that $P\hat{R}Q = 32°$, calculate

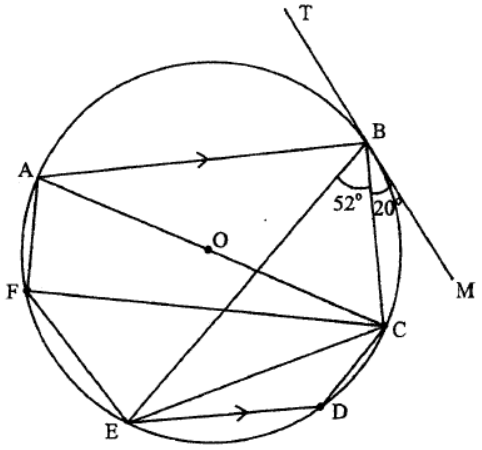
(i) $Q\hat{P}T$,

(ii) $Q\hat{P}S$,

(iii) $P\hat{S}R$,

(iv) $P\hat{R}O$. [6]

4008/2 J2012 Q5(b)



ABCDEF is a circle centre O. TBM is a tangent to the circle at B. $E\hat{B}C = 52°$, $C\hat{B}M = 20°$ and AB is parallel to ED.

Find (a) $E\hat{F}C$, [1]

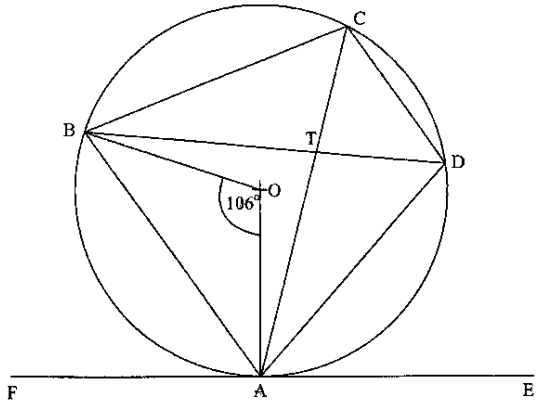
(b) $B\hat{E}C$, [1]

(c) $A\hat{B}E$, [1]

(d) $C\hat{E}D$. [2]

4008/1 N2012 Q23

In the diagram, ABCD is a circle centre O. FAE is a tangent, $A\hat{O}B = 106°$ and the chords AC and BD intersect at T.



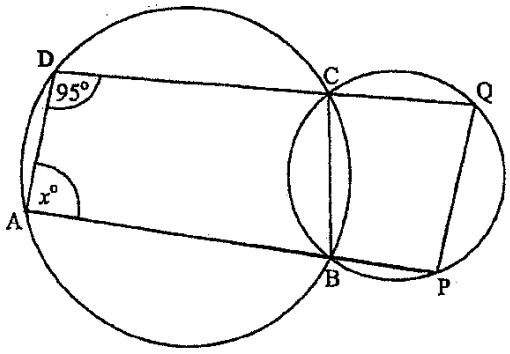
(i) Name **two** angles which are equal to $D\hat{A}E$.

(ii) Name the triangle that is similar to triangle ADT.

(iii) Calculate

1. $A\hat{D}B$,
2. $A\hat{B}O$,
3. $B\hat{A}F$. [6]

4008/2 N2012 Q4(a)



In the diagram, ABCD and PBCQ are intersecting circles. DCQ and ABP are straight lines.

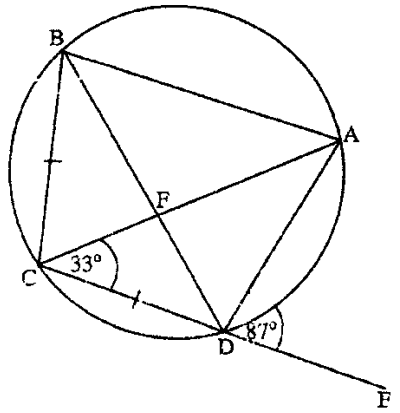
(a) Given that $A\hat{D}C = 95°$, calculate

(i) $A\hat{B}C$, [1]

(ii) $P\hat{Q}C$. [1]

(b) Given also that $D\hat{A}B = x°$, find an expression for $B\hat{P}Q$ in terms of x. [1]

4008/4028/1 J2011 Q12



The diagram shows points A, B, C and D on the circumference of a circle such that BC = CD. AC and BD intersect at F and CD is produced to E.

$A\hat{C}D = 33°$ and $A\hat{D}E = 87°$. Calculate

(i) $A\hat{B}D$,

(ii) $C\hat{B}D$,

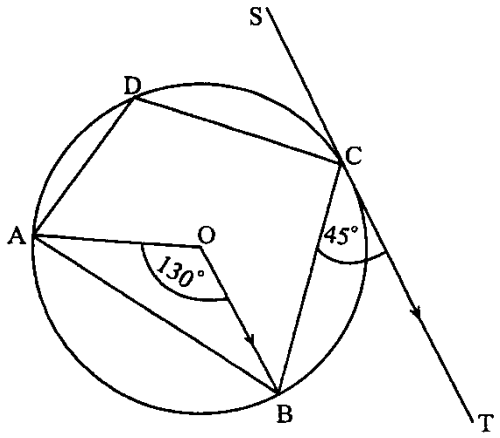
(iii) $B\hat{A}C$,

(iv) $A\hat{D}B$,

(v) $C\hat{F}D$. [6]

4008/2 J2011 Q3(a)

A, B, C and D lie on the circumference of a circle centre O. SCT is a tangent to the circle at C and is parallel to OB. $A\hat{O}B = 130°$ and $B\hat{C}T = 45°$.



(a) Write down the geometrical word which completes the following statement "ABCD is a ……. quadrilateral. [1]

(b) Find the values of

(i) $O\hat{B}C$, [1]

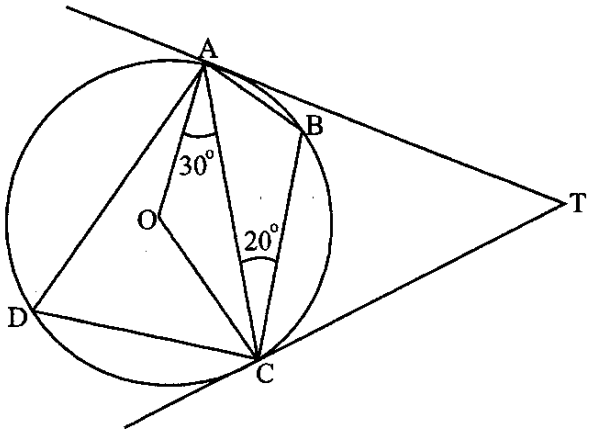
(ii) $O\hat{B}A$, [1]

(iii) $A\hat{D}C$, [1]

(iv) $O\hat{C}T$, [1]

(v) reflex angle AOC. [2]

4008/1 N2011 Q24



In the diagram, A, B, C and D are points on the circumference of a circle centre O. AT and CT are tangents to the circle, $O\hat{A}C = 30°$ and $A\hat{C}B = 20°$.

Find

(i) $A\hat{O}C$,

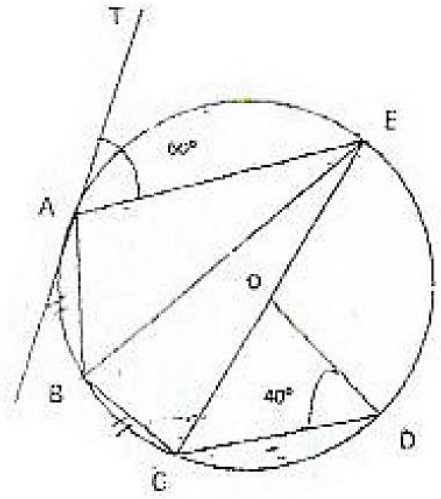
(ii) $A\hat{D}C$,

(iii) $B\hat{C}T$,

(iv) $C\hat{A}B$

(v) $A\hat{T}C$. [5]

4008/2 N2011 Q5(a)



In the diagram, COE is a diameter of the circle ABCDE, centre O and TA is a tangent to the circle at A. $T\hat{A}E = 60°$, $O\hat{D}C = 40°$ and arc AB = arc BC.

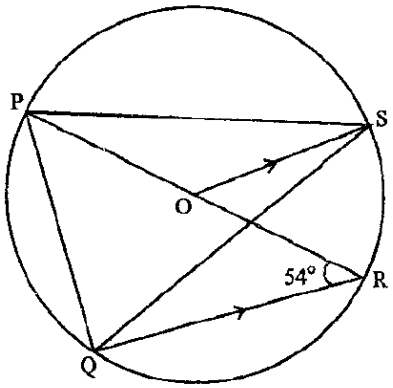
Find (a) $C\hat{B}E$, [1]

(b) $A\hat{B}E$, [1]

(c) $B\hat{E}C$, [2]

(d) $E\hat{O}D$. [1]

4008/4028/1 J2010 Q28



In the diagram, P, Q, R and S are points on the circumference of the circle with centre O. OS is parallel to QR and $P\hat{R}Q = 54°$. POR is a straight line.

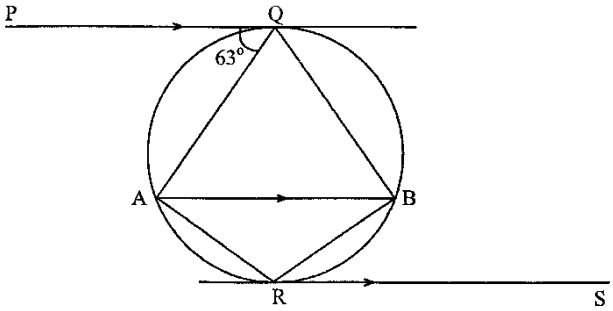
Calculate (i) $R\hat{O}S$, [1]

(ii) $R\hat{P}S$, [1]

(iii) $P\hat{Q}S$. [2]

4028/2 J2010 Q5(b)

In the diagram, PQ and RS are parallel tangents to the circle AQBR. Chord AB is also parallel to the two tangents and $P\hat{Q}A = 63°$.

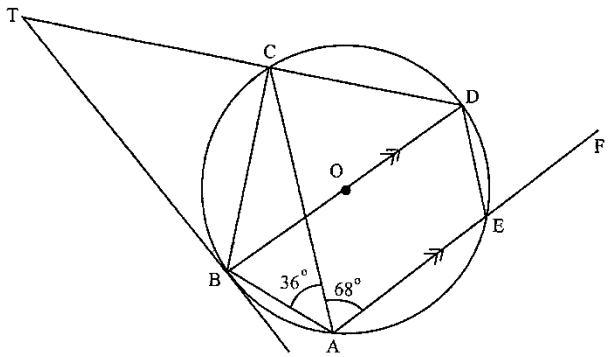


(a) Find (i) $\hat{QAB}$, [1]

(ii) $\hat{BAR}$. [2]

(b) Write down the special name of the cyclic quadrilateral AQBR. [1]

4008/4028/1 N2010 Q14



In the diagram, A, B, C, D and E are points on the circumference of a circle centre O. BT is a tangent to the circle and TCD and AEF are straight lines.
$\hat{CAE} = 68°$, $\hat{CAB} = 36°$ and BD is parallel to AE.

Find the size of (i) $\hat{CBO}$,

(ii) $\hat{BTC}$,

(iii) $\hat{DEF}$,

(iv) $\hat{ACB}$. [6]

4008/2 N2010 Q5(a)

CONSTRUCTIONS & LOCI

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be done on a single diagram.

(a) Construct
  (i) triangle ABC in which $AB = 7\ cm$, $B\hat{A}C = 45°$, $BC = 8\ cm$. [4]
  (ii) the locus of points equidistant from B and C. [2]
  (iii) the locus of points 5 cm from C. [1]

(b) A point R in triangle ABC is such that it is nearer B than C and is less than 5 cm from C. Show by shading, the region in which R must lie. [2]

(c) Measure and write down the size of $A\hat{B}C$. [1]

4004/2 J2020 Q4

Answer the whole of this question on a sheet of plain paper.
Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be done on a single diagram.

(a) (i) Construct a triangle PQR such that $QR = 7{,}5\ cm$, $P\hat{Q}R = 90°$ and $Q\hat{R}P = 30°$. [5]
  (ii) Construct the locus of points equidistant from P and R, [2]
  (iii) Construct the locus of points that are 3 cm from Q. [1]

(b) Mark and label the points D_1 and D_2, that are equidistant from points P and R and are 3 cm from Q. [2]

(c) A point *X*, inside the triangle is such that it is nearer P than R and more than 3 cm from Q. Shade the region in which *X* must lie. [2]

(d) Measure and write down the length of PR. [1]

4004/2 N2020 Q5

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be done on a single diagram.

(a) Triangle ABC is such that $AB = BC = 7\ cm$ and $A\hat{B}C = 120°$. Construct
  (i) triangle ABC, [3]
  (ii) bisector of $A\hat{B}C$, [2]
  (iii) perpendicular bisector of side BC. [2]

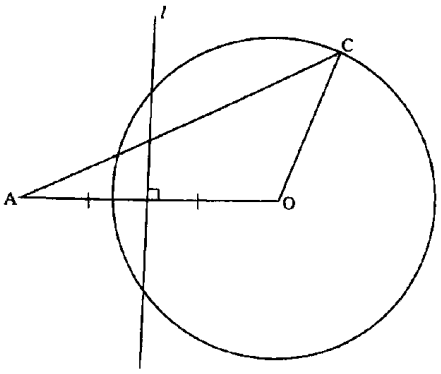
(b) Point D is on the same side of AB as C and is such that AD $= 7cm$ and $B\hat{A}D = 45°$.
  (i) Construct $B\hat{A}D$. [2]
  (ii) Mark and label point D. [1]
  (iii) Shade the region inside the triangle, on the same side of AB as C, which contains the points which are nearer BC than BA and nearer B than C. [2]

4004/2 J2019 Q5

The diagram shows triangle **AOC** and a circle with centre **O, OC**= 4 cm and line, *l*, is the perpendicular bisector of **AO**.

(a) Describe fully the locus represented on the diagram by the
  (i) circle, [1]
  (ii) line *l*. [1]

(b) **P** is both inside the circle and inside triangle **AOC** but nearer to **A** than **O**. Show by shading in the diagram the region in which **P** must lie.



4004/1 N2019 Q12

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be done in a single diagram.

ABCD is a trapezium in which AB = 6,5 cm, AD = 5,2 cm, A$\hat{B}$C $= 120°$ and AD is perpendicular to AB. DC is parallel to AB.

(a) (i) Construct the trapezium ABCD. [6]
  (ii) Construct the bisector of $A\hat{B}C$. [2]

(b) Describe the locus of points that the bisector of $A\hat{B}C$ represents. [2]

(c) Measure and write down the length of BC.

[1]

4004/2 N2019 Q5

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be done on a single diagram.

(a) Construct
  (i) triangle PQR in which $PQ = 7{,}5\ cm$, $R\hat{P}Q = 90°$ and $P\hat{Q}R = 30°$, [4]
  (ii) the locus of points equidistant from Q and R, [2]
  (iii) a circle with diameter QR. [1]

(b) (i) Measure and write down the length of the
    1. radius of circle in **a(iii)**, [1]
    2. side PR in triangle PQR. [1]
  (ii) Mark and label the points X and Y on the circle which are equidistant from Q and R. [2]
  (iii) Write down the special name given to quadrilateral PRYQ. [1]

4030/2 J2018 Q6

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be done on a single diagram.

(a) Construct triangle ABC with $A\hat{B}C = 45°$, $BC = 6{,}5\ cm$ and $AB = 6\ cm$. [4]

(b) Construct the locus of points 4 cm from A. [1]

(c) Bisect $B\hat{C}A$. [2]

(d) Mark and label X_1 and X_2, the points that are on the bisector of $B\hat{C}A$ and are 4 cm from A. [2]

(e) Describe the locus represented by the bisector of $B\hat{C}A$. [1]

4004/2 N2018 Q4

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be done on a ***single diagram.***

(a) Construct
  (i) triangle ABC in which $AB = 8\ cm$, $AC = 6.5\ cm$ and $B\hat{A}C = 60°$, [3]
  (ii) the locus of points equidistant from AB and BC, [2]
  (iii) the perpendicular bisector of BC. [2]

(b) (i) Shade the region, inside the triangle, containing the set of points which are nearer to BC than AB and also nearer to C than B. [2]
  (ii) Measure and write down the length of BC. [1]

(c) Describe the locus represented by the perpendicular bisector of BC in **(a)(iii)**. [2]

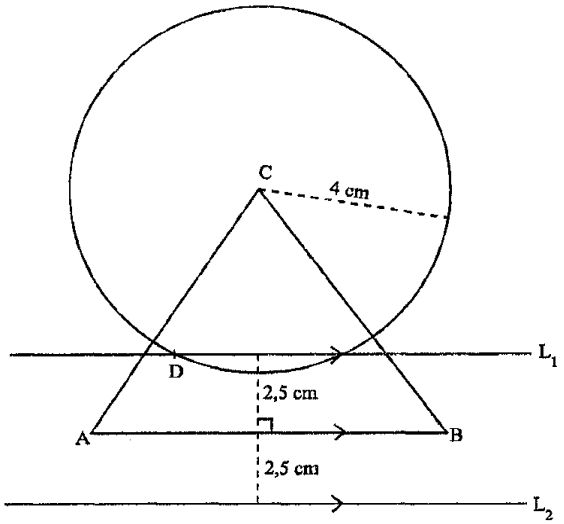
4030/2 J2017 Q6

Use pencil, ruler and compasses only for all constructions and show clearly all construction lines and arcs.
All constructions should be on a single diagram.

(a) (i) Construct, in a single diagram, triangle AXB such that $AX = 5\ cm$, $BX = 7{,}5\ cm$ and $A\hat{X}B = 60°$. [3]
  (ii) Construct the locus of points which are
    1. equidistant from XA and XB. [2]
    2. 3,5 cm from X. [1]
  (iii) Show by shading, the region R, in the triangle, such that R is closer to XA than XB and XR is less than or equal to 3,5 cm. [2]

(b) Measure and write down the length of AB. [1]

4030/2 N2017 Q6



The diagram shows a triangle ABC, circle centre C of radius 4 cm and two straight lines L_1 and L_2.

(a) Describe fully the locus represented by the circle, centre C. [2]

(b) Describe fully the locus represented by the lines L_1 and L_2. [2]

(c) Describe the position of point D. [2]

4030/1 J2016 Q26

Use ruler and compasses only for all constructions and show clearly all the construction lines and arcs.

(a) (i) Construct triangle ABC in which AB = BC = 8 cm and $A\hat{B}C = 60°$.
Line AB has been drawn. [3]

(ii) Bisect $A\hat{B}C$. [2]

(iii) Mark point N on the bisector of $A\hat{B}C$ such that BN = 12 cm. [1]

(iv) Complete the quadrilateral ABCN. [1]

(b) (i) State the special name given to the quadrilateral. [1]

(ii) Describe **fully** the locus represented by the bisector BN. [2]

(c) Measure and write down

(i) the length of BN, [1]

(ii) the size of $B\hat{C}N$. [1]

4030/2 J2016 Q6

Use ruler and compasses only for all constructions and show clearly all the construction lines and arcs.

(a) On a single diagram, construct

(i) triangle PQR in which PR = 9 *cm*, PQ = 7 *cm* and $Q\hat{P}R = 45°$. [3]

(ii) the locus of points which are equidistant from PQ and PR. [2]

(iii) the locus of points which are equidistant from P and Q. [2]

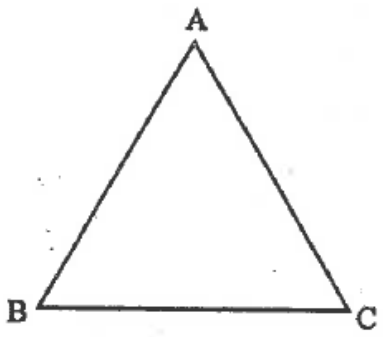
(iv) mark and label clearly, the point X which is equidistant from PQ and PR and is also equidistant from P and R. [1]

(b) Measure and write down

(i) the length of XR, [1]

(ii) $P\hat{R}Q$. [1]

4030/2 N2016 Q5



(a) On the diagram construct using **ruler** and **compasses** only, the locus of points which are

(i) 2 cm from BC and on the same side of BC as A, [2]

(ii) 3 cm from A. [1]

(b) Mark and label two points P and Q which are 2 cm from BC and 3 cm from A. [2]

4008/1 J2015 Q25

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.

All constructions should be done on a ***single diagram.***

From a point, M, on level ground, the angle of elevation of a bird on top of a vertical pole is 30°. From another point, N, 10 metres closer to the pole such that M and N are on the same side of the pole, the angle of elevation of the same birth is 45°.

(a) Using a scale of 1 cm to represent 2 metres, construct a diagram to show the positions of M, N and the vertical pole. [6]

(b) Use the diagram to find

(i) height of the pole,

(ii) distance of M from the bottom of the pole. [5]

4028/2 J2015 Q6

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.

All constructions should be done on a single diagram.

(a) Construct on a **single** diagram

(i) parallelogram ABCD with AB = 8 cm, BC = 10 cm and $A\hat{B}C = 120°$,

(ii) the locus of points equidistant from B and C,

(iii) the bisector of $A\hat{B}C$. [9]

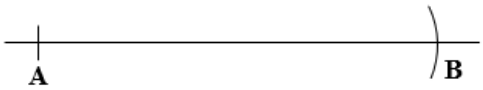
(b) Mark and label the point X that lies on the bisector of $A\hat{B}C$ and is equidistant from B and C. [1]

(c) Describe the locus that the bisector of angle ABC represents. [2]

4028/2 N2015 Q6

In the answer space below, is a line segment AB which is 7 cm long.

(a) Using a ruler and compasses only, construct the locus of points



(i) 3 cm from B, [1]

(ii) above AB, which are 2 cm from line AB. [2]

(b) (i) Mark and label P_1 and P_2 which are 3 cm from B and 2 cm from line AB, [2]

(ii) Measure the distance P_1P_2. [1]

4008/1 J2014 Q22

Answer the whole of this question on a sheet of plain paper.

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.

(a) On a **single** diagram, construct

(i) quadrilateral WXYZ in which WX = 5,3 cm, $W\hat{X}Y = 120°$, XY = 5 cm, YZ = 9,1 cm and WZ = 8,5 cm,

(ii) the locus of points which are equidistant from

1. W and Y,
2. X and Z. [7]

(b) Mark and label clearly, the point O, **inside** the quadrilateral WXYZ, which is equidistant from W, X, Y and Z. [1]

(c) (i) Draw a circle centre O and radius OX.

(ii) Measure and write down the radius of the circle. [2]

(d) State the special name given to quadrilateral WXYZ. [1]

4028/2 J2014 Q6

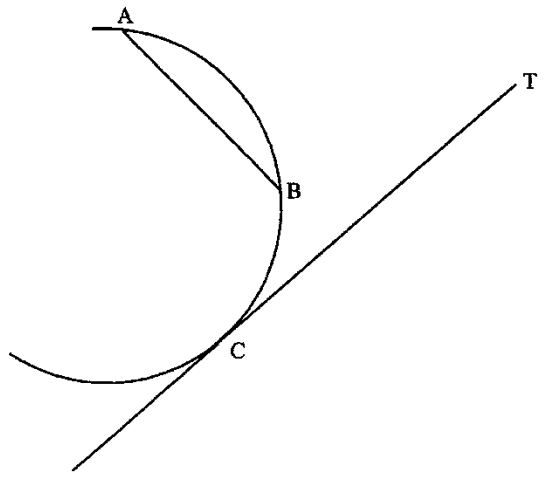
Using ruler and compasses only, construct, showing all lines and arcs,

(a) ΔABC in which $A\hat{B}C = 135°$, BC = 6 cm and C is above AB, [3]

(b) a perpendicular from C to meet AB produced at X. [2]

4008/1 N2014 Q21

A, B and C are points on the arc of a circle. TC is a tangent to the arc at C.



(a) Construct

(i) the locus of a point equidistant from A and B, [2]

(ii) the perpendicular to TC at C. [2]

(b) Measure and write down the length of the radius of the circle. [1]

4008/1R N2014 Q23

Answer the whole of this question on a sheet of plain paper.

Use ruler and compasses only for all constructions and show clearly all the construction lines and arcs.

A triangular field PQR has dimensions PQ = 30 m, $P\hat{Q}R = 60°$ and $R\hat{P}Q = 45$.

(a) Using a scale of 1 cm to represent 3 m, construct the triangle PQR. [6]

(b) A well is to be dug in the field such that it is equidistant from PQ and PR and 15 m from R.

Construct the locus of points which are

(i) equidistant from PQ and PR,

(ii) 15 m from R. [3]

(c) Mark and label the point W, the position of the well. [1]

(d) Find the actual distance of the well from Q. [2]

4008/2 N2014 Q6

Answer the whole of this question on a sheet of plain paper.

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.

All constructions should be done on a single diagram.

(a) Construct a quadrilateral ABCD in which AB = 8,5 cm, AD = 7 cm, DC = 5 cm, $A\hat{D}C = 90°$ and $B\hat{A}D = 60°$. [6]

(b) Measure and write down the length of BC. [1]

(c) Construct the locus of a point
(i) that is 4,5 cm from B,
(ii) X, on the same side of AD as C, such that the area of triangle ACD = area of triangle AXD. [3]

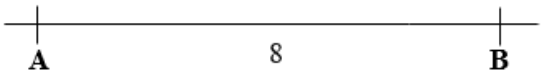
(d) Mark and label X_1 and X_2, the points that are 4,5 cm from B and are such that the area of triangle AX_1D = the area of triangle AX_2D. [2]

4008/2R N2014 Q6

In the working space is a line segment AB which is 8 cm long.
Point **Q** is such that the area of $\Delta ABQ = 12cm^2$.

(a) Calculate the perpendicular height of the ΔABQ. [2]

(b) Construct the possible positions of Q, above AB, which are such that the area of $\Delta ABQ = 12cm^2$. [3]



4028/1 J2013 Q20

Answer the whole of this question on a sheet of plain paper.
Use ruler and compasses only and show clearly all construction lines and arcs.

(a) On a **single** diagram, construct
(i) quadrilateral ABCD in which AD = BC = AB = 6 cm, DC = 9,5 cm and $B\hat{C}D = 60°$,
(ii) the locus of points 4,5 cm from A,
(iii) the locus of points equidistant from AD and DC,
(iv) the locus of points equidistant from D and C. [10]

(b) On your diagram, mark and label the point P which satisfies the loci in **(a)(iii)** and **(iv)**. [1]

4028/2 J2013 Q6

Answer the whole of this question on a sheet of plain paper.
Use ruler and compasses only and show clearly all construction lines and arcs.

(a) Construct on a **single** diagram,
(i) quadrilateral ABCD in which AB = 6 cm, $A\hat{B}C = 120°$, BC = 7 cm, CD = 9 cm and AD = 7 cm,
(ii) the locus of points equidistant from AB and AD,
(iii) the locus of points, inside the quadrilateral ABCD, that are 3 cm from BC,
(iv) the shortest line from point C to AB produced. [10]

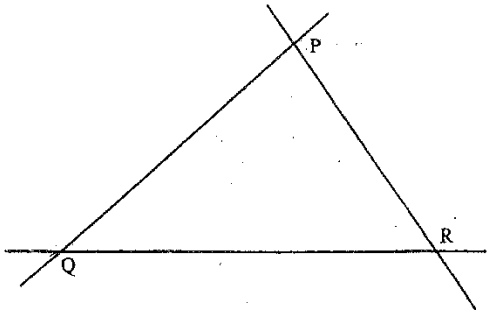
(b) Mark and label clearly the point P, inside the quadrilateral, which is equidistant from AB and AD and 3 cm from BC. [1]

4008/2 N2013 Q6

Use ruler and compasses only for all constructions. Show clearly construction lines and arcs.
Construct on the diagram below,

(a) the locus of a point which is equidistant from PQ and QR, [2]

(b) the locus of a point X such that the area of ΔQXR = area of ΔQPR. [2]



4008/1 J2012 Q19

Answer the whole of this question on a sheet of plain paper.
Use ruler and pair of compasses only for all constructions and show clearly all the construction lines and arcs.

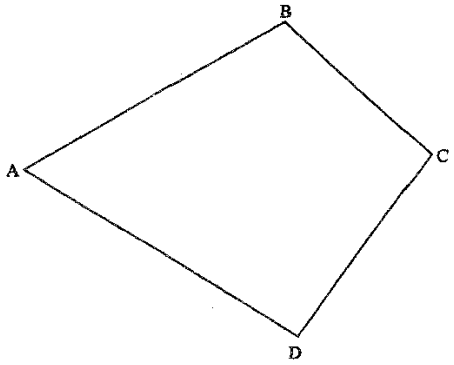
(a) On a **single** diagram, construct
(i) trapezium ABCD in which AB = 8,5 cm, $A\hat{B}C = 120°$, BC = 6 cm, CD = 12 cm and AB is parallel to DC,
(ii) the locus of points which are equidistant from C and D,
(iii) the circle of which CD is the diameter. [7]

(b) Measure and write down $C\hat{B}D$. [1]

(c) CD satisfies a certain locus. Describe this locus **fully**. [2]

4008/2 J2012 Q4

In this question use ruler and compasses only.



(a) Leaving your construction lines and arcs, construct
  (i) the perpendicular bisector of AB, [2]
  (ii) the locus of all points inside the quadrilateral ABCD which are 5 cm from D. [1]

(b) Shade the region inside the quadrilateral ABCD which is nearer A than B and more than 5 cm from D. [1]

4008/1 N2012 Q21

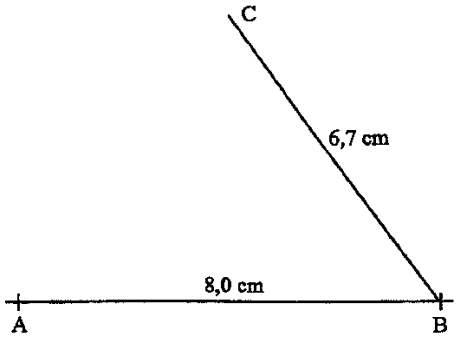
Answer the whole of this question on a sheet of plain paper.

Use ruler and compasses only and show clearly all construction lines and arcs.

(a) **On a single diagram**, construct
  (i) triangle PQR with QR = 8 cm, $P\hat{Q}R = 45°$ and $Q\hat{R}P = 60°$.
  (ii) the bisector of $P\hat{R}Q$.
  (iii) Measure and write the length of PR.
  (iv) Calculate the area of triangle PQR. [10]

(b) Describe **fully** the locus represented by the bisector of $P\hat{R}Q$ in **(a)**. [2]

4008/2 N2012 Q5



In the diagram, AB and CB are intersecting straight lines.

Use ruler and pair of compasses only to construct on the diagram

(a) (i) the perpendicular bisector of BC, [2]
  (ii) a line on the same side of AB as C and is also 2,0 cm from AB. [2]

(b) Mark the point X which is 2,0 cm from AB and equidistant from B and C. [1]

4008/4028/1 J2011 Q23

Answer the whole of this question on a sheet of plain paper.

*Use ruler and compasses only and show clearly all construction lines and arcs. All constructions should be in a **single** diagram.*

A secondary school, Boterekwa, is to be built to service three primary schools Tugwi, Shinga and Hlangu. Shinga is 16 km from Tugwi on a bearing of 150°. Hlangu is 15 km North-East of Shinga.

(a) Using a scale of 1 cm to represent 2 km, construct a diagram to show the positions of the positions of the three primary schools. [7]

(b) Boterekwa is 8 km from Shinga and equidistant from Tugwi and Hlangu.
  (i) Construct the locus of points 8 km from Shinga and the locus of points equidistant from Tugwi and Hlangu.
  (ii) Mark and label B_1 and B_2 the possible positions of Boterekwa. [4]

(c) Use your diagram to find the shorter distance between Boterekwa and Tugwi. [2]

4008/2 J2011 Q6

Answer the whole of this question on a sheet of plain paper.

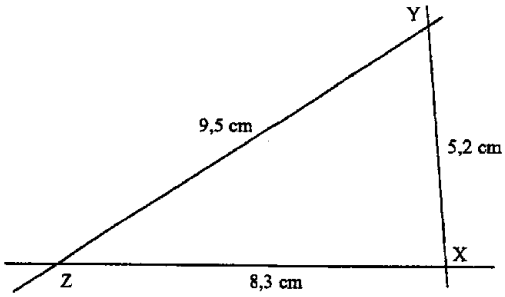
Use ruler and compasses only and show clearly all construction lines and arcs.

(a) On a single diagram, construct
  (i) quadrilateral ABCD in which AB = 9 cm, BC = 6 cm, AD = 7.3 cm, DC = 5.5 cm and $B\hat{A}D = 45°$,
  (ii) the locus of points equidistant from A and B,
  (iii) the locus of points 5.7 cm from B. [7]

(b) Measure and write down the size of $A\hat{D}C$. [1]

(c) Point P is inside the quadrilateral and is such that it is equidistant from A and B and is 5.7 cm from B. Measure and write down the distance of P from D. [1]

4008/2 N2011 Q6



On the diagram, **use ruler and compasses only** to construct.

(a) the perpendicular from X to YZ, [2]

(b) the locus of a point, 2,2 *cm* from YZ and on the same side of YZ as X. [2]

4008/4028/1 J2010 Q26

Answer the whole of this question on a sheet of plain paper.

Use ruler and pair of compasses only for all constructions and show all the construction lines and arcs.

(a) Construct on a **single** diagram

(i) quadrilateral ABCD in which AB = 8 cm, $A\hat{B}C = 90°$, $B\hat{C}D = 120°$, BC = 10 cm, and CD = 5 cm, [6]

(ii) the locus of points equidistant from B and C, [2]

(iii) the locus of points equidistant from DC and DA. [2]

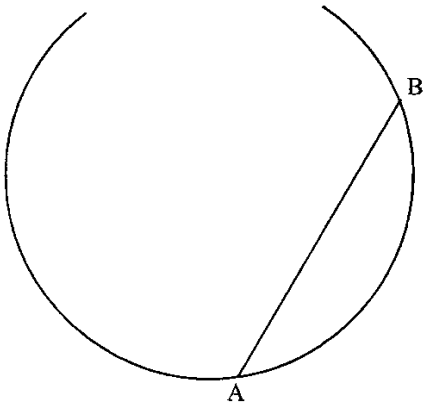
(b) (i) Mark and label the point P which is equidistant from B and C and equidistant from DC and DA. [1]

(ii) Draw a circle with centre P and radius PC. [1]

(iii) Measure and write down the length of PC. [1]

4028/2 J2010 Q6

On this question use ruler and compasses only for all constructions and show clearly all construction lines and arcs.



The diagram shows an arc of a circle in which AB is a chord.

(a) Construct the locus of points equidistant from A and B. [2]

(b) C is another point on the arc such that $B\hat{A}C = 90°$. By construction mark and label point C. [2]

(c) Write down the radius of the circle. [1]

4008/4028/1 N2010 Q23

Answer the whole of this question on a sheet of plain paper.

Use ruler and compasses only and show all construction lines and arcs.

All constructions must be done on a single diagram.

A farmer has a plot in the shape of a quadrilateral ABCD, in which AB = 110 m, BC = 100 m, CD = 60 m, AD = 70 m and $A\hat{B}C = 60°$.

(a) Using a scale of 1 cm : 10 m, construct the quadrilateral ABCD. [5]

(b) Draw the locus of points

(i) 30 m from AB,

(ii) equidistant from A and B,

(iii) inside the quadrilateral which are 60 m from B. [5]

(c) The farmer wishes to dig a well inside the plot such that it is at least 30 m from AB, at least 60 m from B and nearer to A than to B. Shade the region in which the well must be. [2]

4008/2 N2010 Q6

CONSUMER ARITHMETIC

A salesman's total monthly salary consists of a basic salary of $200 and a 2% commission on his monthly sales. In one month, his total salary was $560. Calculate

(a) his commission for that month, [1]

(b) the sales he made for that month. [2]

4004/1 J2020 Q13

(a) Mrs. Chuhwa invested a certain amount of money with a bank that offered 4,5% p.a. simple interest. After 8 months her money amounted to $504,70 before any bank charges were deducted. Calculate the amount of money that Mrs. Chuhwa had initially invested. [3]

(b) (i) Mrs. Bande bought a set of sofas for $368 cash, including 15% VAT. Calculate the price of the sofas excluding VAT. [2]

(ii) Mr. Ndloru decided to buy a similar set of sofas on laybye terms. He paid a deposit of $150 plus three equal monthly instalments of $87 including VAT. Calculate the difference in the amounts of money the two customers paid. [3]

4004/2 N2020 Q6

(a) Convert 647 cents to dollars. [1]

(b) The exchange rate for converting United States dollars to South African rand is $US\$1 : R13.80$

Calculate the equivalent of $US\$75.90$ in Rands. [2]

4004/1 J2019 Q7

(a) Tariro bought US$7.00 for 91.70 Pula from a bank.

(i) Find the exchange rate in the form US$1 : mPula. [1]

(ii) The bank charged 1% commission for the transaction. Calculate the amount of money Tariro received. [2]

(b) In a sale, the original price of a suit is reduced by 16% to $210. Calculate the original price of the suit before the sale. [3]

(c) William invested $P, at a rate of 3% per annum simple interest. After 5 years he got $2010 simple interest.

Calculate the value of $P. [2]

(d) John invested $600 for 3 years at 4% per annum compound interest. Calculate the total amount he received after 3 years. [3]

4004/2 J2019 Q3

(a) Convert US$5,40 to South African Rands. Use an exchange rate of US$1 to 12 Rands, [1]

(b) A farmer borrowed $2 000 at a simple interest rate of 20% per annum. Calculate the total amount payable after 2 years. [3]

4004/1 N2019 Q13

(a) During a sale, all prices were reduced by 15%. Calculate the original price of a jacket that was bought for $55. [3]

(b) An extract from MS Neto's bank statement for the month of May is shown.

DATE	Details			
01.05.17	Balance Brought Forward			$10.00
29.05.17	Salary	$402.00		$412.00
30.05.17	Bank charges of 1% on Current Account Balance		*X*	*Y*
31.05.17	Withdrawal		*Z*	$292.88

Calculate the value of (i) *X*, [1]

(ii) *Y*, [1]

(iii) *Z*. [1]

(c) Omega decides to invest her pension of $600.

OPTION A: She can invest it in a bank that offers 4% per year **Simple** Interest.

OPTION B: She can invest it in a money market fund that offers 4% per year **Compound** Interest.

Calculate

(i) Omega's interest under Option A at the end of 3 years, [2]

(ii) Omega's interest under Option B at the end of 3 years. [3]

(iii) the difference between the amounts of interest from the two options. [1]

4004/2 N2019 Q7

By selling an article for $45, a shopkeeper made a loss of 10% on the cost price.

Calculate the cost price. [2]

4030/2 J2018 Q1(b)

(c) A television set has a marked price of $300. A 5% discount is given for cash payment. Calculate the cash price. [2]

(d) Jane invested a certain amount of money at a rate of 12% per annum simple interest. After 11 months the money had amounted to $555,00. Calculate the amount of money she received. [4]

4030/2 J2018 Q9

(a) The following is a price list from *Bright Link Chemical Company*.

Bright Link (Pvt) Ltd. Price List		
Item	Quantity	Price
Floor Polish	20*l*	$50
Toilet Dip	20*l*	$30
Sanitiser	20*l*	$28
Channel blocks	5*kg*	$50
Dish washer	20*l*	$28
All prices include 15% Value Added Tax (VAT). N.B. PROMOTION PROMOTION PROMOTION Place an order between 1 January and 28 February this year and get 10% **discount**		

Calculate

(i) the price of channel blocks per kilogram (kg). [2]

(ii) Value Added Tax on a twenty-litre bucket of floor polish. [2]

(iii) A school ordered the following on the fourth of January of the same promotional year:
Two 20 litre buckets of floor polish
One 20 litre container of toilet dip
Two 20 litre containers of dish washer
One 20 litre container of sanitizer
Three 5 kg boxes of channel blocks
Calculate the total discount the school got. [3]

(b) A man invested $400 in a bank that offers 3% p.a **compound interest**. Calculate the total amount he would get at the end of 3 years. [3]

4004/2 N2018 Q2

By selling an item for $529, a retailer makes a profit of 15% on the cost price. Calculate the cost price. [2]

4030/1 J2017 Q7(b)

Anesu changed 500 South African rands into United States dollars when the bank exchange rate was US$1 = R12,50. The bank charged 3% of the amount that had been changed as commission.

(i) Calculate the bank's commission in US$. [3]

(ii) Calculate the amount in United States dollars that Anesu received. [2]

4030/2 J2017 Q2(b)

Calculate the rate at which $500 earns $320 simple interest in 4 years. [2]

4030/1 N2017 Q11(b)

A trader made a profit of 16% on the cost price by selling a handset for $29,00.

(i) Calculate the cost price of the handset. [2]

(ii) Calculate the selling price of the handset if a loss of 30% was realized. [2]

4030/2 N2017 Q5(a)

A Zimbabwean motorist travels to Botswana on holiday. The motorist travels a total distance of 3 600 km in Botswana. The motorist's car consumes petrol at a rate of 9 km per litre of petrol.

(i) Calculate the amount of petrol used in Botswana. [2]

(ii) Petrol costs 6,5 pula per litre in Botswana. Calculate the total cost of petrol used in US dollars if the exchange rate was US$1 = 8 pula. [2]

4030/2 N2017 Q10(b)

A woman earning $275 had her salary increased by 5%. Calculate her new salary. [2]

4030/1 J2016 Q8(b)

On a certain day, US$100 was exchanged for R880. Calculate the equivalent value of R165 in US$ on that day. [2]

4030/1 J2016 Q24(a)

A salesman receives a basic salary of $200,00 a month. In addition, he is paid a commission of 5% on his sales. Calculate the gross salary in a month during which his sales amounted to $4 000,00. [2]

4030/1 N2016 Q20(a)

A trader sold a bicycle for $84 and made a profit of 40% on the cost price. Calculate the cost price of the bicycle. [2]

4030/2 N2016 Q1(d)

On a day when the exchange rate was R9,03 to 1 USD, a trader exchanged 600 USD for rands.
Find the amount, in rands, the trader received. [2]

4008/1 J2015 Q16(a)

A rural district council increases the value of land by 5% every year. If the value of a piece of land is $4 600, calculate its value in 2 years' time. [4]

4008/1 J2015 Q20

An advert in a shop read,

"VALENTINE SPECIAL 25% OFF ALL RED SHIRTS".

The red shirts were originally marked at $25,00 each.

(i) Joko bought a red shirt. Calculate the amount that Joko paid for the shirt.

(ii) Tindo bought 10 such shirts and sold them at $23,00 each. Calculate the total profit Tindo made. [6]

4028/2 J2015 Q3(b)

The table shows part of Ms. Dube's payslip for a particular month

Earnings	$	Deductions	$
transport allowance	100,00	pension contribution	6,00
housing allowance	129,00	union subscription	10,00
		medical aid	8,00
		Insurance	17,50
basic salary	275,00	total deductions	_____
net salary	_____		

(a) Calculate

(i) the total deductions, [1]

(ii) the net salary. [1]

(b) Express the pension contribution as a percentage of her basic salary. [2]

4028/1 N2015 Q15

A shop sells a refrigerator at $540. In the previous year the same type of a refrigerator cost 8% less. Calculate the cost price of the same type of refrigerator in the previous year. [2]

4028/2 N2015 Q2(c)

A holiday trip to South Africa costs R333. If the exchange rate was US$1 to R8, calculate the cost of the trip in US$, giving your answer to the nearest cent. [2]

4008/1 J2014 Q14(b)

On 1 March 2008 a farmer deposited $36 000 into a new bank account. On 30 June 2008 her account balance was $36 600.

(a) Calculate

(i) the time of investment as a fraction of a year in its simplest form, [1]

(ii) the interest rate percent per annum. [2]

(b) Given an exchange rate of $1 to R7,50, convert $210 to rands. [1]

4008/1 N2014 Q15

Jojo invests $7 500 at 3,5% per year simple interest. Calculate the simple interest he earns after 4 years. [2]

4008/1R N2014 Q24(b)

Mrs. Shoko decides to erect a durawall around her rectangular stand measuring 20 m by 11 m. Three metres are to be left for a gate.

(a) Find the perimeter of the durawall. [3]

She has two options, A or B, to consider for erecting the durawall.

Option A

She could engage a contractor who charges $12 per metre on a fix-and-supply basis.

(b) Calculate the total cost of erecting the durawall using option A. [2]

Option B

She could buy the following materials as shown in the table below and engage a builder who charges $100 for the job.

item	quantity	cost per unit
bricks	5 000	$80.00 for 1 000
cement	10 × 50 kg bag	$10 per bag
brick force	5 bundles	$5 per bundle
pit sand	2 loads	$30 per load

(c) Calculate the total cost of erecting the durawall using option B. [3]

(d) Mrs. Shoko decides to use the cheaper option. Calculate the amount she saves by using that option. [2]

4008/2 N2014 Q5

Jane sells airtime every day. During weekdays (Monday to Friday) her sales average is $22 per day and during weekends (Saturday and Sunday) her sales average is $29 per day.

Calculate her average daily sales for a week. [2]

4008/2R N2014 Q3(a)

A trader bought a tonne of goods worth $2 500.

(a) Calculate the cost price per kilogram. [1]

(b) If the goods were later sold at $2,10 per kilogram. Calculate the percentage loss. [2]

4028/1 J2013 Q21

Find the time in which \$20 000 will earn \$1 600 simple interest at 8% per annum. [2]

4028/2 J2013 Q2(b)

A piece of fleece material costs R20 in South Africa and Chido sells each piece at \$5 in Zimbabwe.

(a) If the price of a piece in South Africa is equivalent to \$2.50, calculate the exchange rate between the dollar and the rand. [2]

(b) Chido bought 20 pieces of fleece in South Africa and incurred \$30 in travelling costs. If she sells all 20, calculate her net profit in dollars. [3]

(c) Each piece of material is enough to make a morning gown. If Chido sews morning gowns and sells each at \$12, calculate her net profit from the sale of 20 gowns. [3]

(d) On another occasion, Chido buys the materials in Zimbabwe at \$5 a piece and makes 20 gowns. Calculate the profit she will make without travelling to South Africa. [2]

(e) If she settles on making gowns, find the difference in the profits realised. [2]

4028/2 J2013 Q7

A shopper spent $\$\frac{c}{d}$ on one item and half of that amount on each of three other items. Find how much she spent altogether. [3]

4008/1 N2013 Q5

A car loses 55% of its value after four years. If it cost \$8 500 when new, find its value after the four years. [2]

4008/1 N2013 Q7(b)

One litre of paraffin costs \$1,00. Calculate

(a) the cost of 750 millilitres of paraffin, [2]

(b) the number of 750-millilitre bottles of paraffin which can be obtained from a full 30-litre container. [2]

4008/1 J2012 Q13

By selling an article for \$11.40, a shop owner made a loss of 5%.

Calculate the cost price of the article. [3]

4008/2 J2012 Q1(c)

The statement below shows the telephone bill for Mr. Banda for the month of July 2009.

Date	Account details	Amount (USD)
	Balance B/F	529,74
	Interest at 2,5%	----------
	SUBTOTAL (1)	----------

	RENTAL FROM 01/07/09 TO 31/07/09	10,00
26/06/09	METERED UNITS PREVIOUS READING CURRENT READING 55 778 55 926	31,08
	SUBTOTAL (2)	41,08
	VAT AT 15%	6,16
	AMOUNT DUE	----------

Calculate

(i) the interest on the balance B/F,

(ii) the subtotal (1),

(iii) the number of units used,

(iv) the cost of one unit,

(v) the total amount due. [7]

4008/2 N2012 Q6(b)

The following is an extract from Mrs. Green's telephone Bill for the period 01/03/06 to 31/03/06.

	\$
Rental	2 000
177 units at X cents/unit	7 965
Sub-Total	9 965
VAT at 15%	Y
Amount due	Z

Calculate

(a) X, [2]

(b) Y, [2]

(c) Z. [1]

4008/4028/1 J2011 Q22

Mbudzi Investments borrowed \$6 000 from a bank to start a project. The bank charged them interest and expected the company to pay \$120 per month to service the loan. The following is an incomplete Loan Account Statement for Mbudzi Investments.

Date	Details	Debit \$	Credit \$	Balance \$
1-09-06				6 000
30-09-06	Interest	80		6 080
30-09-06	Repayment		120	5 960
30-10-06	Interest	79,47		6 039,47
30-10-06	Repayment		120	5 919,47
30-11-06	Interest	78,93		5 998,40
30-11-06	Repayment		120	5 878,40
30-12-06	Interest	w		x
30-12-06	Repayment		y	z

(i) Find the rate of simple interest per annum.

(ii) Calculate the values of

(a) w,

(b) x,
(c) y,
(d) z. [8]

4008/2 J2011 Q11(b)

Calculate the Principal that earns $300 Simple Interest at 5% per annum for 6 years. [2]

4008/2 N2011 Q1(d)

A company director went to Britain and America on business. Her company gave her an allowance of £2000.

(a) While in Britain she spent $\frac{1}{5}$ of her allowance. Calculate the amount she spent. [1]
(b) On arrival in America she converted all her remaining allowance into US$ at the rate of £1 to US$1,92. Calculate the amount she received in US$. [2]

4008/4028/1 J2010 Q10

(a) In a certain month £1 402 was equivalent to US$2 000. Calculate the exact value of the exchange rate in the form US$1 = £$n$. [1]
(b) In another month the exchange rate was US$1 = £0,69. Calculate the equivalent of £2 760 in US$. [2]

4008/4028/1 N2010 Q4

During a sale, the price of a camera was reduced from $160 to $148,80.
Calculate the percentage decrease in price. [3]

4008/2 N2010 Q1(b)

CO-ORDINATE GEOMETRY

A straight line has gradient -1 and passes through the point $(3;\ 0)$. Find the equation of the line in the form $y = mx + c$. [2]

4004/1 J2020 Q24(a)

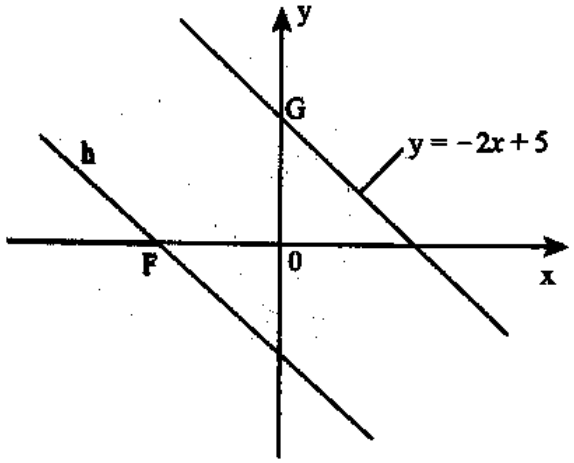
The equation of a straight line is $y + 3x = -4$.
Find the

(i) coordinates of the point where the line crosses the y-axis, [2]

(ii) gradient of the line, [1]

(iii) equation of a line parallel to the line $y + 3x = -4$ and passing through the point $(3;\ 5)$. [2]

4004/2 J2020 Q3(c)



In the diagram, line $y = -2x + 5$ is parallel to line h. **F** is 6 units from the origin.

(a) Write down the coordinates of point **F** and point **G**. [2]

(b) Find the equation of line h. [2]

4004/1 N2020 Q23

The diagram shows the straight line $3x + 4y = 12$ which cuts the x-axis at **P** and y-axis at **Q**.

(a) State the coordinates of point

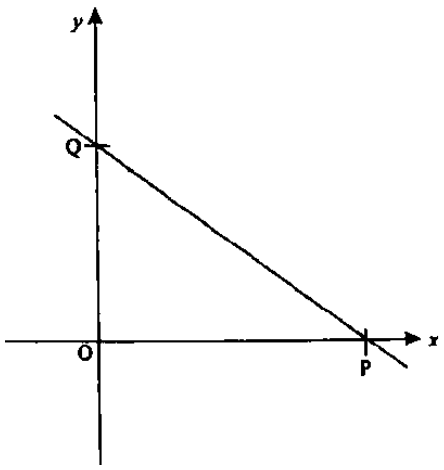
(i) **P**, [1]

(ii) **Q**. [1]

(b) Calculate the

(i) gradient of line $3x + 4y = 12$, [1]

(ii) length of line **PQ**. [2]



4004/1 N2019 Q21

It is given that $3x + 2y = 12$ is an equation of a straight line.

(a) Find the gradient of the straight line. [1]

(b) Find the coordinates of the point where the straight line crosses the y-axis. [2]

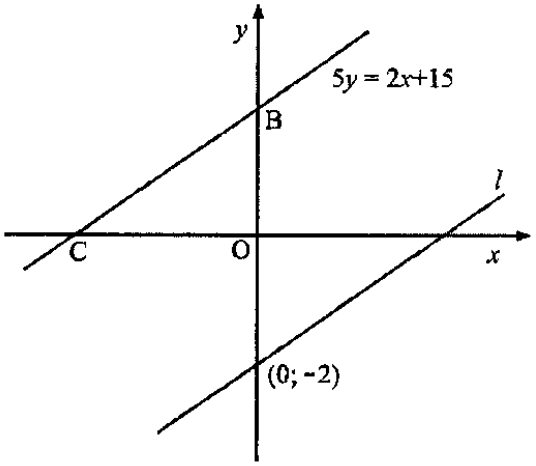
4030/1 J2018 Q12

The points A$(6;\ 2)$ and B$(8;\ 5)$ lie on a straight line.
Find the

(a) gradient of the line AB, [1]

(b) equation of the line AB, giving the answer in the form $y = mx + c$. [2]

4004/1 N2018 Q11



In the diagram, the line $5y = 2x + 15$ intersects with the x-axis at C and the y-axis at B. The line is also parallel to line l, which passes through the point $(0;\ -2)$.

(a) Find the

(i) coordinates of B, [1]

(ii) gradient of line l, [1]

(b) Write down the equation of line l in the form $y = mx + c$. [2]

4030/1 J2017 Q24

$4y - 3x = -8$ is an equation of a straight line.

(i) Find the gradient of the line. [1]

(ii) Find the coordinates of the point where the straight line crosses the y-axis. [2]

(iii) Find the equation of a line parallel to $4y - 3x = -8$ passing through the point $(0;\ 3)$. [2]

4030/2 N2017 Q4(b)

The equation of a straight line, l, is $3x - 5y = 30$.

Find

(a) the gradient of the line l, [1]

(b) the equation of a line parallel to line l passing through a point $(-5;\ 3)$, in the form $y = mx + c$. [2]

4030/1 J2016 Q16

The equation of a straight line is given as $3y - 2x - 6 = 0$.

Find the

(a) gradient of the line, [1]

(b) coordinates of the point where the line crosses the y-axis, [1]

(c) equation, in the form $ax + by = c$, of a straight line parallel to the line $3y - 2x - 6 = 0$ and passing through $(-5;\ 2)$. [2]

4030/1 N2016 Q18

AB is a line whose equation is $6y = 7x + 48$.

Find

(a) the gradient of line AB, [1]

(b) the equation of the line parallel to AB which passes through the point $(3;\ 1)$, giving your equation in the form $ay + bx + c = 0$. [2]

4008/1 J2014 Q13

The equation of a straight line is given as $5x + 4y - 30 = 0$

(a) Make y the subject of the equation. [2]

(b) Write down the gradient of the straight line. [1]

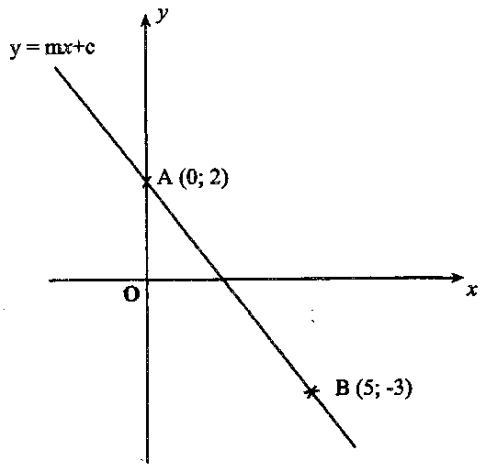
(c) Write down the coordinates of the point where the line crosses the x-axis. [1]

4008/1R N2014 Q16

(a) Write down the gradient of the line whose equation is $3x + 2y = 18$. [1]

(b) Find the equation of the straight line which is parallel to the line $3x + 2y = 18$ and passes through $(-2;\ 3)$. [2]

4028/1 J2013 Q13



The diagram shows the graph of $y = mx + c$, which passes through the points $A(0;\ 2)$ and $B(5;\ -3)$.

(a) Find the value of

(i) c, [1]

(ii) m. [2]

(b) Calculate the length of AB, leaving your answer in surd form. [2]

4008/1 N2013 Q24

A is the point $(0;\ 6)$ and B is the point $(4;\ 2)$.

Find

(a) $\overrightarrow{AB}$ in column form, [1]

(b) the gradient of the line AB, [1]

(c) the equation of the line AB. [1]

4008/1 J2012 Q6

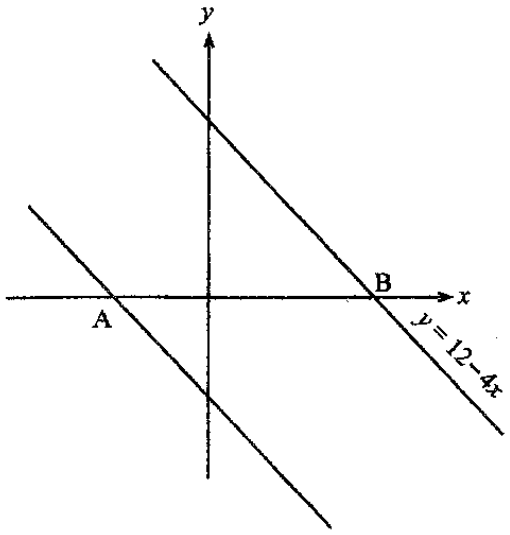
Find the equation of a straight line which passes through $P(3;\ -4)$ and $Q(-1;\ 2)$. [2]

4008/2 J2012 Q6(a)

In the diagram, the line through A is parallel to the line $y = 12 - 4x$ and the distance AB = 5 units.

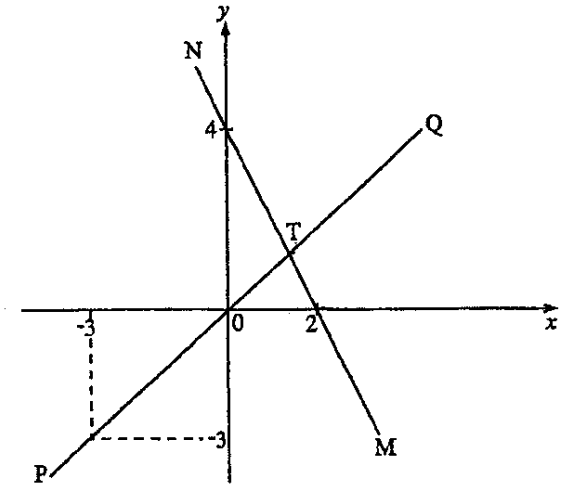
(a) Write down the x-coordinate of B. [1]

(b) Find the equation of the line through A parallel to the line $y = 12 - 4x$. [2]



4008/1 N2012 Q12

In the diagram, PQ and MN are two straight lines which intersect at T.



(a) Find the equation of the line
  (i) PQ, [1]
  (ii) MN. [2]

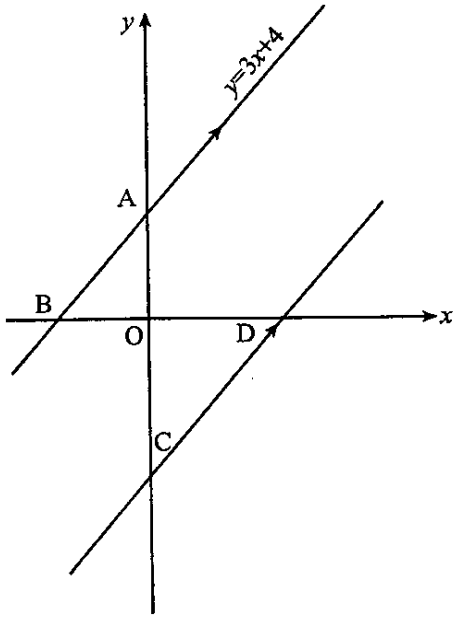
(b) Calculate the coordinates of the point T. [2]

4008/4028/1 J2011 Q21

In the diagram AC is 10 units and BA is parallel to CD. BA is the line $y = 3x + 4$.

(a) Write down
  (i) the value of y at C, [1]
  (ii) the equation of the line CD which is parallel to $y = 3x + 4$. [1]

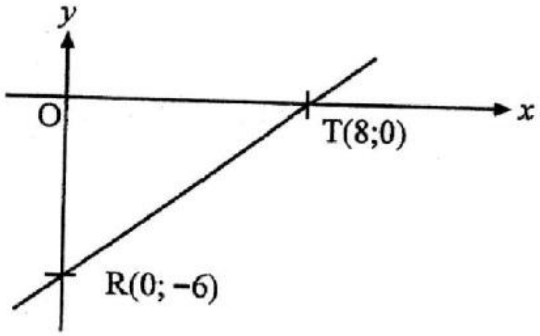
(b) Find the coordinates of the point D where the line in part **(a)(ii)** crosses the x-axis. [1]



4008/2 J2011 Q10

(a) A line passes through the points A$(2;\ 4)$ and B$(x;\ y)$ and has gradient $1\frac{1}{2}$. Given that B lies on y-axis, find the coordinates of B. [2]

(b)



In the diagram, O is the origin, T is the point $(8;\ 0)$ and R is the point $(0;\ -6)$. Calculate the area of triangle TOR. [2]

4008/4028/1 J2010 Q23

(a) Find the gradient of the line l which passes through $(6;\ 8)$ and $(0;\ 5)$. [1]

(b) Find the equation of the line which is parallel to line l in **(a)** and passes through $(4;\ -5)$. [2]

4008/4028/1 N2010 Q7

FACTORISATION, H.C.F & L.C.M

Factorise completely $x - y - xy + x^2$. [2]

4004/1 J2020 Q19(b)

(a) Factorise completely
(i) $4x^2 - 1$, [1]
(ii) $2x^2 + 2xa + x + a$. [2]
(b) Hence or otherwise, find the Highest Common Factor (H.C.F) of $4x^2 - 1$ *and* $2x^2 + 2xa + x + a$. [1]

4004/1 N2020 Q19

Find the Lowest Common Multiple (L.C.M) of 15, 20 and 25. [2]

4004/2 N2020 Q2(c)

(a) Factorise (i) $p^2 - 4$, [1]
(ii) $2p^2 + 7p + 6$. [2]
(b) Hence or otherwise, find the Highest Common Factor (H.C.F) of $p^2 - 4$ and $2p^2 + 7p + 6$. [1]

4004/1 J2019 Q17

Factorise completely
(a) $x^2 - \frac{1}{4}$, [1]
(b) $x(x - 2) - 2xy + 4y$. [2]

4004/1 N2019 Q8

Factorise completely
(i) $6y^2 - 10y + 4$, [2]
(ii) $ax + b + a + bx$. [2]

4004/2 N2019 Q6(b)

(a) Factorise completely
(i) $x^3 - x$, [2]
(ii) $x^2 + 2x + 1$. [1]
(b) Hence or otherwise, find the Highest Common Factor (HCF) of $x^3 - x$ and $x^2 + 2x + 1$. [1]

4030/1 J2018 Q16

Factorise completely
(i) $4a^2b - 20ab^2$, [1]
(ii) $3a^2 + 7a - 6$. [2]

4030/2 J2018 Q2(b)

(a) Factorise $3x^2 - 15x$ completely. [1]
(b) Find the Highest Common Factor (H.C.F) of $8kl^2m$, $28k^2l^3m$ and $36l^2mn$. [2]

4008/1 N2018 Q10

Factorise completely $2m^3n^2 + 3m^2n - 2m$. [2]

4004/2 N2018 Q3(c)

Factorise completely
(a) $9 - 36x^2$, [2]
(b) $a - bx + ax - b$. [2]

4030/1 J2017 Q1

(b) Find the Highest Common Factor (H.C.F) of
$2^3 \times 3^2 \times 5 \times 7^4$,
$2^3 \times 3^3 \times 5^2 \times 7^2$,
$2^4 \times 3 \times 5 \times 7^3$,
leaving the answer in index form. [2]
(c) Find the Lowest Common Multiple (L.C.M) of $3x^2y, 5x^3y^2$ and $8xy^3$. [2]

4030/2 J2017 Q1

Find the Highest Common Factor (H.C.F) of 9 and 12. [1]

4030/1 N2017 Q6(b)

Factorise completely the expression $4x^2 - y^2$. [2]

4030/1 N2017 Q23(a)

(i) Factorise completely $x^2 - 6x$. [1]
(ii) Factorise completely $(m - 1)^2 - 9$. [2]

4030/2 N2017 Q1(c)

Factorise completely $x^2 - \frac{1}{36}$. [1]

4030/1 J2016 Q4(a)

Find the Lowest Common Multiple (L.C.M) of 60 and 84. [1]

4030/2 J2016 Q1(b)

Factorise completely
(i) $4c^2 + 12cn$, [1]
(ii) $k^2 + kh - kp - hp$. [2]

4030/2 J2016 Q2(a)

Factorise completely $6mn - 3n$. [1]

4030/1 N2016 Q5(a)

Factorise completely
(a) $cg - dg - ch + dh$, [2]
(b) $5d^2 - d - 4$. [2]

4028/1 N2015 Q19

(i) Factorise completely $y^2 + 10y - 24$. [2]
(ii) Factorise completely $27 - 3x^2$. [2]

4028/2 N2015 Q1(b)

Factorise completely $3x^3y - 12xy^3$ [3]

4008/1 J2014 Q15

Factorise completely
$6m^2n^2 - mn - 15$. [2]

4028/2 J2014 Q2(b)

Find the Highest Common Factor (H.C.F) of 168 and 252. [2]

4008/1 N2014 Q2(b)

(a) The product of a number k and 15 is 105.
Find the number k. [1]
(b) Factorise completely $4x^2 + 12x - 7$. [2]

4008/1 N2014 Q6

Find the Lowest Common Multiple (L.C.M) of 72 and 96. [3]

4008/2 N2014 Q1(b)

Factorise completely
(i) $7x^3 - 28x$,
(ii) $3y^2 - 5y + 2$. [5]

4008/2 N2014 Q2(b)

Find the H.C.F (Highest Common Factor) of $3 \times 5^2 \times 7^2$ and $3^2 \times 5^2 \times 7^2 \times 11$, leaving the answer in index form. [1]

4008/2R N2014 Q1(c)

Factorise completely
(i) $9m^2 - 3m - 6$,
(ii) $(y + x)^2 - 4$. [4]

4008/2R N 2014 Q2(a)

Find the Lowest Common Multiple, (L.C.M), of 18 and 24. [2]

4028/1 J2013 Q18(c)

Factorise completely
(i) $12m - 2n^2 + 6mn - 4n$,
(ii) $2a^2 - 5a + 3$. [4]

4028/2 J2013 Q1(b)

Factorise completely
(i) $4y - 4$, [1]
(ii) $xy^2 - 4x + 2y^2 - 8$. [2]

4008/1 N2013 Q10

Factorise completely
(i) $2ax + 3ay + 4x + 6y$,
(ii) $8x^2 - 18$. [4]

4008/2 N2013 Q1(d)

Factorise $9x^2 - 12x + 4$. [2]

4008/1 J2012 Q10(b)

Factorise completely
(i) $2k^2 - 7k - 15$,
(ii) $2am^2 - 2an^2 - bm^2 + bn^2$. [5]

4008/2 J2012 Q2(a)

Factorise completely
(i) $7pq - 14q$, [1]
(ii) $x^2 - 7x + 10$. [2]

4008/1 N2012 Q9

Factorise completely
(i) $x^2 + 2x - 3$,
(ii) $x^2 - 1$.
Hence write down the lowest common multiple (L.C.M) of $x^2 + 2x - 3$ and $x^2 - 1$. [3]

4008/2 N2012 Q1(c)

Factorise completely $20x^2 - 5y^2$. [2]

4008/4028/1 J2011 Q19(b)

Find the Highest Common Factor (H.C.F) of
$27x^2yz$,
$72xy^3z^2$ and
$108xyz^3$. [2]

4008/2 J2011 Q1(d)

Factorise completely
(i) $3np - 6nq + ap - 2aq$,
(ii) $12 - 4g - g^2$. [4]

4008/2 J2011 Q4(a)

Factorise completely $3x^3 - 12x$. [2]

4008/1 N2011 Q5(b)

Factorise completely
(i) $2xy - x - z + 2yz$,
(ii) $2p^2q + pq^2$. [3]

4008/2 N2011 Q2(b)

For the expressions $12m^3n^2$ and $18m^2n^3$, find
(i) the H.C.F, [1]
(ii) the L.C.M. [1]

4008/4028/1 J2010 Q3(a)

Factorise completely $125p^3 - 5p$. [3]

4028/2 J2010 Q1(c)

Factorise completely

(i) $x^2 + 5x - 6$, [1]

(ii) $8m^3n - 2mn^3$. [2]

4008/4028/1 N2010 Q2

FRACTIONS, DECIMALS & PERCENTAGES

The difference between two fractions is $3\frac{2}{3}$. The smaller fraction is $2\frac{1}{4}$. Find the other fraction. [2]

4004/2 J2020 Q1(a)

(a) Find the exact value of
(i) $0{,}72 - 0{,}2 \times 0{,}7$, [1]
(ii) $6 \div 0{,}08$. [1]

(b) Calculate, $\frac{3}{8}$ of 2,2 km giving your answer in metres. [1]

4004/1 N2020 Q2

Express

(a) $\frac{12}{25}$ as a decimal fraction, [1]

(b) $\frac{2}{5}$ as a percentage, [1]

(c) 0.0375 as a fraction in its lowest terms. [1]

4004/1 J2019 Q1

Express 1 hectare as a percentage of 0,25 km^2. [2]

4004/2 J2019 Q1(b)

Calculate $\frac{2}{3}$ of 54 km. [1]

4004/1 N2019 Q6(a)

Simplify $4 - (1\frac{3}{4} + 1\frac{2}{3})$. [1]

4004/2 N2019 Q1(a)

(a) Find the exact value of
(i) $7{,}03 - 2{,}145$, [1]
(ii) $4{,}32 \times 0{,}11$, [1]

(b) Simplify $1\frac{7}{8} + 2\frac{1}{3}$, giving the answer as a mixed number. [1]

4030/1 J2018 Q2

Simplify $0{,}8 + 7{,}2 \div 0{,}24$ [2]

4030/2 J2018 Q1(a)

(a) Simplify $\frac{2^3}{5^2}$ giving the answer as a fraction. [1]

(b) Express $\frac{6}{25}$ as a decimal fraction. [1]

4004/1 N2018 Q1

Find the exact value of

(a) $0{,}04 \times 0{,}3$, [1]

(b) $1{,}44 \div 0{,}09$, [1]

(c) $0{,}89 - 1{,}72$. [1]

4030/1 J2017 Q2

Find $12\frac{1}{2}\%$ of 64,8 kg. [1]

4030/1 J2017 Q11(a)

Evaluate $\left(1\frac{1}{5} \div 3\frac{1}{5}\right) \times 2\frac{2}{3}$. [2]

4030/1 J2017 Q16(a)

Simplify $2 - \frac{1}{2} \times \frac{4}{5}$, giving the answer as a decimal number. [2]

4030/2 J2017 Q1(a)

Write 75% as a common fraction in its lowest terms. [1]

4030/1 N2017 Q5(b)

Evaluate, giving your answer in its lowest terms,

(a) $\frac{4}{5} - \frac{9}{10}$, [1]

(b) $\frac{7}{15} \times \frac{3}{8} \div \frac{7}{8}$. [2]

4030/1 N2017 Q7

Find the square of $\frac{1}{4}$. [1]

4030/1 N2017 Q11(a)

Evaluate $1{,}36 - \frac{7}{8}$, giving the answer as a decimal. [2]

4030/2 N2017 Q1(a)

Evaluate (a) $1{,}4 + 0{,}04$, [1]
(b) $5\frac{1}{4} \div 3\frac{1}{2}$. [2]

4030/1 J2016 Q1

Express $\frac{7}{30}$ as a recurring decimal fraction. [1]

4030/1 J2016 Q2(b)

Simplify $7\frac{1}{2} + \frac{1}{2} \times 8 - 2$ [2]

4030/2 J2016 Q1(a)

(a) Find the value of $0{,}4 \times 0{,}002$, giving the answer as a decimal fraction. [1]

(b) Simplify $\frac{2}{5} of 15x - 3x \times 1\frac{1}{3}$. [2]

4030/1 N2016 Q1

Express $2{,}54 \times 10^{-1}$
(b) as a fraction in its lowest terms, [1]
(c) as a percentage. [1]

4030/1 N2016 Q2

Given that $6\,782 \times 65 = 440\,830$, find the value of
(i) $6{,}782 \times 0{,}65$, [1]
(ii) $440\,830 \div 6{,}5$. [1]

4030/1 N2016 Q10(b)

Simplify $2\frac{1}{4} \div (1\frac{1}{4} + 3\frac{1}{3})$. [3]

4030/2 N2016 Q1(b)

(a) Evaluate $39.6 + 0.09$ [1]
(b) Simplify $\left(\frac{2}{3} - \frac{1}{2}\right) \times \frac{3}{4}$, giving the answer in its lowest terms. [2]

4008/1 J2015 Q2

(a) Express $\frac{5}{16}$ as a
(i) decimal fraction,
(ii) percentage. [3]
(b) Simplify
(i) $27^{\frac{2}{3}} - \left(\frac{1}{8}\right)^{\frac{1}{3}}$,
(ii) $3\frac{4}{5} - (1\frac{2}{3} + \frac{7}{15})$, giving the answer in its lowest terms. [5]

4028/2 J2015 Q1

(a) Find the value of $\frac{8}{0.04}$. [1]
(b) Simplify $1\frac{1}{2} - \frac{4}{7} \div \frac{2}{3}$ giving the answer as a fraction in its simplest form. [2]

4028/1 N2015 Q1

Find the value of $\left(1\frac{3}{4} + 2\frac{1}{3}\right) \div \frac{5}{6}$. [3]

4028/2 N2015 Q1(a)

Evaluate, giving your answers as common fractions in their lowest terms
(a) $\frac{3}{5} + \frac{1}{7}$, [1]
(b) $\frac{5}{8} \times \frac{32}{45}$, [1]
(c) $\frac{5}{24} \div \frac{1}{3}$. [1]

4008/1 J2014 Q2

Giving your answer as a decimal, find the exact value of
(a) $0.175 - 0.049$, [1]
(c) $(0.06)^2$ [1]

4008/1 J2014 Q3

Simplify
(i) $0.85 - 0.6$ giving your answer as a common fraction in its lowest terms,
(ii) $1\frac{3}{4} \div 1\frac{2}{5} + 1\frac{5}{8}$. [4]

4028/2 J2014 Q1(a)

Simplify (i) $1\frac{1}{2} - \frac{2}{3}$, [1]
(ii) $0.45 \times \frac{2}{9}$. [1]

4008/1 N2014 Q1(a)

Express 12,5% as a common fraction in its simplest form. [1]

4008/1 N2014 Q2(a)

Simplify $3{,}27 \times 0{,}59$ giving your answer correct to three significant figures. [2]

4008/2 N2014 Q1(a)

$2\frac{1}{4} \div (2\frac{1}{16} - \frac{3}{4})$, giving the answer as a mixed number in its simplest form. [3]

4008/2R N2014 Q1(a)(ii)

(a) Subtract -2 from 2. [1]
(b) Leaving your answer as a common fraction, find, in its lowest terms, the value of $\frac{8}{15} \div \frac{2}{3}$. [2]

4028/1 J2013 Q1

(a) Express $3\frac{4}{5}$ as a decimal number. [1]
(b) Find the exact value of $\frac{0{,}83+8{,}368}{0{,}42}$. [2]

4028/1 J2013 Q2

Find the exact value of $20{,}71 - 8{,}2 \times 1{,}1$. [2]

4028/2 J2013 Q1(a)

Evaluate, giving each answer as a fraction in its lowest terms.
(a) $\frac{1}{5} + \frac{1}{6}$, [1]
(b) $\frac{2}{5} \div 4$, [1]
(c) $\frac{3}{4} - \frac{1}{4} \times \frac{2}{3}$. [1]

4008/1 N2013 Q1

Evaluate $\frac{(0{,}3)^3 \times 0{,}02}{0{,}0008}$, giving your answer in standard form. [3]

4008/1 N2013 Q2

Express $\frac{7}{8}$ as a decimal fraction. [1]

4008/1 N2013 Q7(a)

Simplify $15{,}6 - 3 \times 4{,}6$. [2]

4008/2 N2013 Q1(a)

(a) Find 3% of \$70. [1]

(b) Evaluate $4{,}01 - 3{,}4 \times 1{,}08$. [2]

4008/1 J2012 Q1

A boy completes a 400−metre race in one minute. Express 400 metres as a percentage of a kilometre. [1]

4008/1 J2012 Q12(a)

Express $3\frac{3}{4} - 2\frac{1}{2}$ as a single fraction in its simplest form. [2]

4008/2 J2012 Q1(a)(i)

Simplify $3\frac{3}{4} - 3 \times \frac{1}{2}$. [1]

4008/1 N2012 Q4(a)

(a) Simplify $2\frac{1}{2} - 3\frac{5}{6} + 1\frac{2}{3}$, giving your answer as a fraction in its lowest terms. [2]

(b) At a certain Secondary School, 400 pupils sat for a Form 1 entrance test. If 150 of them passed the test, find the percentage that failed. [2]

4008/2 N2012 Q1

Simplify $\frac{\frac{2}{3}+\frac{3}{4}}{1\frac{1}{6}}$. [3]

4008/4028/1 J2011 Q1

Convert

(i) the fraction $\frac{3}{8}$ to a percentage, [1]

(ii) 9% to a decimal fraction. [1]

4008/4028/1 J2011 Q16(a)

(a) Simplify $\left(3\frac{1}{2} - 1\frac{3}{5}\right) \div 1\frac{2}{3}$. [3]

(b) Find the exact value of

(i) $10{,}03 \times 0{,}17$,

(ii) $7{,}2 \div 0{,}018$. [2]

4008/2 J2011 Q1

Express 150 g as a percentage of 3 kg. [2]

4008/2 J2011 Q2(c)

Giving your answer as a common fraction in its lowest terms, find the value of

(a) $\frac{3}{5} - \frac{5}{9}$, [1]

(b) $\frac{2}{3\frac{2}{5}}$. [2]

4008/1 N2011 Q1

Evaluate $3.25 \times 10^4 \times 10^{-6}$, giving the answer

(b) as a decimal fraction, [1]

(c) as a common fraction in its lowest terms. [1]

4008/1 N2011 Q4

Simplify $5\frac{1}{6} - 3\frac{2}{3} \div 1\frac{1}{4}$. [3]

4008/2 N2011 Q1(a)

(a) (ii) Express 0.096 as a common fraction, giving your answer in its lowest terms. [1]

(b) Express 36 minutes as a percentage of two hours. [1]

4008/4028/1 J2010 Q1

In a school with 1 050 pupils, $\frac{4}{7}$ of the pupils were boys. One quarter of the boys were suspended for misbehaviour.

(i) Find the number of boys suspended. [2]

(ii) Express the number of girls as a fraction of the remaining pupils. [2]

4008/2 J2010 Q5(a)

Find the value of $\frac{1}{3} + 1\frac{7}{9} \div 2\frac{2}{3}$. [3]

4008/2 N2010 Q1(a)

FUNCTIONAL NOTATION

Given that $f(x) = \frac{k+x}{3x-2}$ and that $f\left(-\frac{1}{3}\right) = \frac{1}{6}$, find the value of k. [3]

4004/01 J2020 Q11

It is given that $f(x) = 3x^2 - 2x - 8$.
Find
(a) $f(-4)$, [1]
(b) the values of x for which $f(x) = 0$. [3]

4004/1 J2019 Q19

It is given that the functions $f(x) = x^2 + 3x - 8$, $g(x) = 3x + 1$ and $h(x) = 2^x$, find the
(i) values of x for which $f(x) = g(x)$, [3]
(ii) value of x given that $h(x) = 0{,}25$. [3]

4004/2 J2019 Q4(b)

It is given that $f(k) = 2k^2 - 8$.
Calculate
(i) $f(-3)$, [2]
(ii) the values of k for which $f(k) = 0$. [2]

4030/2 J2018 Q1(c)

If a function $f(x) = (x + 4)(2x - 1)$, find $f(3)$. [2]

4004/1 N2018 Q16(a)

Given that $f(x) = 4 - x^2$, calculate $f(-1)$. [2]

4030/2 N2017 Q10(c)

If $f(x) = \frac{1}{x^2}$, $x \neq 0$, find
(a) $f(-3)$, [1]
(b) the values of x when $f(x) = 1$. [2]

4030/1 J2016 Q9

Find $f(-2)$ given that $f(x) = \frac{x^2}{4} - \frac{5}{4}$. [1]

4030/1 N2016 Q8(a)

Given that $f(x) = 3x^2 - 7x + 1$,
(i) evaluate $f(-1)$,
(ii) find the values of x where $f(x) = -1$. [6]

4028/2 J2015 Q5(a)

It is given that $f(x) = 10 + 3x - x^2$.
(i) Find, $f(2)$. [1]
(ii) Find the values of x when $f(x) = 0$. [3]

4028/2 N2015 Q1(c)

Given that $f(x) = (x - 1)(x + 6)$ and that $f(0) = p$, find the value of p. [1]

4008/1 J2014 Q9(a)

Given that $f(x) = 3 - 4x$, find
(i) $f(-2)$, [1]
(ii) x if $f(x) = 19$. [1]

4008/1 N2014 Q4(a)

Given that $f(x) = x^2 - 5x - 12$.
Find
(a) $f(-2)$, [2]
(b) the values of x for which $f(x) = 12$. [2]

4008/1R N2014 Q18

If $f(x) = x^2 - 2x + k$, where k is a constant, and $f(3) = -32$, find the value of k.
Hence, find the values of x for which $f(x) = 0$. [4]

4008/2 N2013 Q2(b)

It is given that $f(x) = x^2 + 3x + 2$.
(a) Find
(i) $f(0)$, [1]
(ii) the values of x for which $f(x) = 0$. [2]
(b) Given also that the line of symmetry of the graph of $f(x) = x^2 + 3x + 2$ is $x = -1\frac{1}{2}$, find the coordinates of the turning point of this graph. [2]

4008/1 N2012 Q25

Given that $f(x) = x^2 + x$, find
(i) $f(3)$, [2]
(ii) the values of x for which $f(x) = 0$. [2]

4008/4028/1 J2011 Q24(b)

Given that $f(x) = x^2 - 4x + 3$, find all the values of x for which $f(x) = 0$. [4]

4008/4028/2 N2010 Q1(c)

FUNCTIONAL GRAPHS

The following is a table of values for the function $y = x^3 - 3x^2$.

x	-2	-1	0	1	2	3	4
y	-20	m	0	-2	-4	0	16

(a) Find the value of m. [1]

Answer this part of the question on a grid. *Use a scale of 2 cm to 1 unit on the x-axis and 2 cm to 5 units on the y-axis.*

(b) Draw the graph of $y = x^3 - 3x^2$. [4]

(c) Use the graph to find an estimate, the

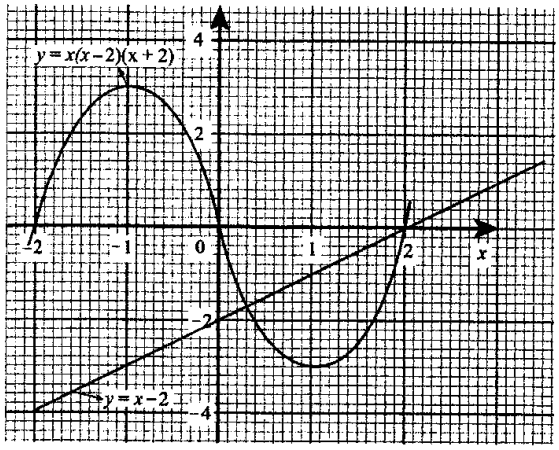
(i) gradient of the curve at the point where $x = 3$. [2]

(ii) area bounded by the curve, the y-axis and the line $y = -12$. [2]

(d) Write down, from the graph, the range of values of x when the curve has a negative gradient. [1]

(e) Use the graph to solve the equation $x^3 - 3x^2 = 2$ for positive values of x. [2]

4004/2 J2020 Q8



The diagram shows the graphs of $y = x(x-2)(x+2)$ and $y = x - 2$.

Use the graph to

(a) solve the equation $x(x-2)(x+2) = x - 2$. [2]

(b) estimate the area bounded by the straight line $y = x - 2$ and the curve $y = x(x-2)(x+2)$. [2]

4004/1 N2020 Q17

A particle is thrown vertically upwards and its height, h metres, above the ground after t seconds, is given by the equation $h = 10 + 25t - 5t^2$.

The following is an incomplete table of values for $h = 10 + 25t - 5t^2$.

Time (t) seconds	0	1	2	3	4	5	6
Height (h) metres	10	20	m	40	30	10	-20

(a) Find the value of m. [1]

(b) ***Answer the whole of this part of the question on sheet of graph paper.*** *Use a scale of 2 cm to 1 unit on the t-axis and 2 cm to 10 units on the h-axis.*

(i) Draw the graph of $h = 10 + 25t - 5t^2$. [4]

(ii) Write down the distance between the initial and final positions of the particle. [1]

(c) ***Use the graph to answer the following questions.***

(i) Find the greatest height reached by the particle. [2]

(ii) Estimate the velocity of the particle when $t = 5$. [2]

(iii) Find the times when the particle is 21 m above the ground. [2]

4004/2 N2020 Q8

The following is an incomplete table of values for the function $y = x^2 - 4x$.

x	-2	-1	0	1	2	3	4	5	6
y	12	5	0	p	-4	-3	0	q	12

(a) Find the values of (i) p, [1]

(ii) q. [1]

Answer parts (b) and (c) of the question on a grid.

(b) (i) Draw the graph of $y = x^2 - 4x$ on the grid using a scale of 2 cm to 1 unit on the x-axis and 2 cm to 2 units on the y-axis. [4]

(ii) On the same grid, draw the graph of $y = 3 - x$. [2]

(c) Use the graph to

(i) solve the equation $x^2 - 4x = 3 - x$, [2]

(ii) find the equation of the line of symmetry of the curve $y = x^2 - 4x$. [2]

4004/2 J2019 Q8

The following is a table of values for the function $f(x) = x^3 - 4x^2 + 4$.

x	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4
$f(x)$	-1	2.9	4	3.1	1	-1.6	-4	-5.4	p	-2.1	4

(a) Find the value of p. [1]

(b) Draw the graph of $f(x) = x^3 - 4x^2 + 4$ on a grid. *Use a scale of 2 cm to 1 unit on both axes.* [4]

(c) Use the graph to find the

(i) coordinates of the minimum turning point of the graph, [1]

(ii) roots of the equation $x^3 - 4x^2 + 4 = 0$, [3]

(iii) area bounded by the graph, x-axis and the lines $x = 2$ and $x = 3$, [2]

(iv) the range of values of x for which $f(x) < -4$. [1]

4004/2 N2019 Q10

The following is an incomplete table of values for $y = \frac{1}{2}(15 - x^2)$.

x	-4	-3	-2	-1	0	1	2	3	4
y	-0.5	m	5.5	7	7.5	7	n	3	-0.5

(a) Calculate the value of

(i) m, [1]

(ii) n. [1]

Answer this part of the question on a grid. *Use a scale of 2 cm to represent 2 units on both axes for* $-6 \leq x \leq 6$ *and* $-2 \leq y \leq 8$.

(b) (i) Draw the graph of $y = \frac{1}{2}(15 - x^2)$. [4]

(ii) Draw the line $y = 2$ to cut the graph at two points. [1]

(c) Use the graph to

(i) find the equation of the line of symmetry of the curve, [1]

(ii) estimate correct to one decimal place, the solution of the equation $\frac{1}{2}(15 - x^2) = 2$, [2]

(iii) find the gradient of the graph of $y = \frac{1}{2}(15 - x^2)$ at the point where $x = 2$. [2]

4030/2 J2018 Q8

The following is a table of values for the function $y = 2x + 3 - x^2$.

x	-2	-1	0	1	2	3	4
y	-5	p	3	q	3	0	-5

(a) Find the value of p and the value of q. [2]

(b) ***Answer this part of the question on a grid.*** *Use a scale of 2 cm to 1 unit on both axes for* $-3 \leq x \leq 5$ *and* $-6 \leq y \leq 7$.

(i) Draw the graph of $y = 2x + 3 - x^2$. [4]

(ii) On the same axes, draw the graph of the line $y = -x$. [1]

(c) Use the graph to find an estimate of the

(i) solution to the equation $-x^2 + 2x + 3 = -x$, [2]

(ii) area bounded by the curve, the lines $x = 0$, $x = 1$ and $y = -x$. [3]

4004/2 N2018 Q10

The following is an incomplete table of values for the function $y = \frac{1}{5}(3 - 2x - x^2)$.

x	-4	-3	-2	-1	0	1	2	3
y	-1	0	0.6	0.8	0.6	0	-1	p

(a) Calculate the value of p. [1]

Answer the following questions on a grid.

Use a scale of 2 cm to 1 unit on the x-axis and 2 cm to 0.5 units on the y-axis for $-4 \leq x \leq 4$ *and* $-2.5 \leq y \leq 1.5$.

(b) Draw the graph of $y = \frac{1}{5}(3 - 2x - x^2)$.[4]

(c) By drawing a suitable tangent, estimate the gradient of the curve at $x = 0$. [2]

(d) Use the graph to

(i) solve the equation $3 - 2x - x^2 = -0.5$ [3]

(ii) find an estimate of the area bounded by the x-axis and the curve. [2]

4030/1 J2017 Q10

The following is an incomplete table of values for the function $y = x(4 - x)$.

x	-1	0	1	2	3	4	5
y	p	0	3	4	q	0	-5

(a) (i) Calculate the value of p. [1]

(ii) Calculate the value of q. [1]

Answer the whole of this part of the question on a grid. *Use a scale of 2 cm to 1 unit on the x-axis and 2 cm to 2 units on the y-axis for* $-2 \leq x \leq 6$ *and* $-6 \leq y \leq 6$.

(b) (i) Draw the graph of $y = x(4 - x)$ on the grid. [3]

(ii) On the same axes, draw the graph of $y = x$. [1]

(c) Use the graph in **b(i)** to find the gradient of the curve when $x = 3$. [2]

(d) Use the graphs to solve the equation $x(4-x) = x$. [2]

(e) Estimate the area bounded by the curve and the line $y = x$. [2]

4030/2 J2016 Q11

The table of values is for the function $y = 5 - 3x - 2x^2$.

x	-3	-2	-1	0	1	2	3
y	p	3	6	5	0	-9	-22

(a) Find the value of p. [1]

Answer parts (b) and (c) on a grid. *Use a scale of 2 cm to 1 unit on the x-axis and 2 cm to 5 units on the y-axis for* $-3 \leq x \leq 3$ *and* $-25 \leq y \leq 10$.

(b) (i) Draw the graph of $y = 5 - 3x - 2x^2$. [4]

(ii) On the same axes, draw the graph of $y = 2x - 3$. [1]

(c) Use the graph to

(i) find the gradient of the curve when $x = -2$. [2]

(ii) Solve the equation $5 - 3x - 2x^2 = 0$. [2]

(iii) Solve the equation $5 - 3x - 2x^2 = 2x - 3$. [2]

4030/2 N2016 Q10

The table shows values for the function $y = \frac{1}{2}x(5-x)$.

x	-1	0	1	2	3	4	5	6
y	-3	0	2	3	p	2	0	-3

(a) Calculate the value of p. [1]

Answer this part of the question on a grid*. Use a scale of 2 cm to 1 unit on both axes for* $-1 \leq x \leq 6$ *and* $-3 \leq y \leq 4$.

(b) Draw the graph of $y = \frac{1}{2}x(5-x)$. [4]

(c) Use the graph to estimate

(i) the maximum value of y,

(ii) the range of values of x for which y is positive. [2]

(d) (i) Draw a suitable straight line, that can be used to solve the equation $\frac{1}{2}x(5-x) = x - 1$.

(ii) Use the graph to solve the equation $\frac{1}{2}x(5-x) = x - 1$. [3]

(e) Find the area bounded by the curve, the x-axis and the lines $x = 2$ and $x = 4$. [2]

4028/2 N2015 Q7

Answer the whole of this question on a sheet of graph paper.

The following is an incomplete table of values for $y = 12 + 2x - x^2$.

x	-3	-2	-1	0	1	2	3	4	5
y	-3	p	9	12	13	12	q	4	-3

(a) Find the value of p and the value of q. [2]

(b) *Using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 2 units on the y-axis,* draw the graph of $y = 12 + 2x - x^2$. [4]

(c) Use your graph to find

(i) the roots of the equation $12 + 2x - x^2 = 0$,

(ii) the gradient of $y = 12 + 2x - x^2$ at $x = 2$,

(iii) the equation whose roots are -1 and 3, giving your answer in the form $12 + 2x - x^2 = k$ where k is an integer. [6]

4028/2 J2014 Q8

Answer the whole of this question on a sheet of graph paper.

The following is an incomplete table of values for $y = 2x^2 + 5x - 3$.

x	$-3\frac{1}{2}$	-3	-2	-1	0	$\frac{1}{2}$	1
y	4	0	P	-6	-3	0	4

(a) Find the value of P. [1]

(b) Using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 2 units on the y-axis, draw the graph of $y = 2x^2 + 5x - 3$ for $-4 \leq x \leq 1$. [4]

(c) Use your graph to

(i) find the equation of the line of symmetry,

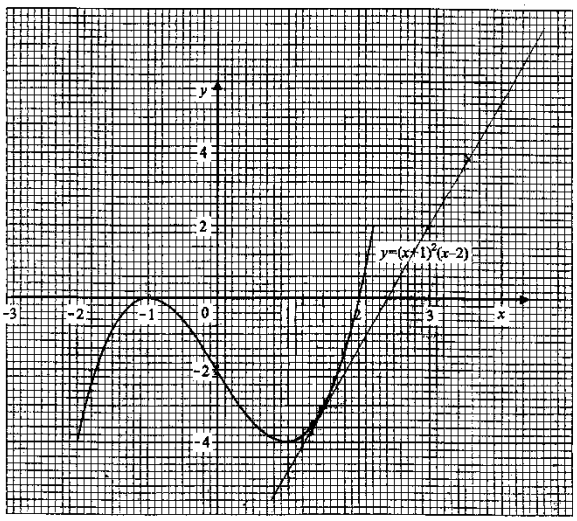
(ii) find the gradient of the curve when $x = 0$,

(iii) solve the equation $2x^2 + 5x - 3 = 2$,

(iv) estimate the area bounded by the curve, the axes and the line $x = -1$. [7]

4008/2R N2014 Q8

The diagram shows the graph of the function $y = (x+1)^2(x-2)$.



Use the graph to answer the following questions.

(a) Write down the roots of the equation $(x+1)^2(x-2)=0$. [2]

(b) Find the coordinates of the points where the gradient of the curve is zero. [2]

(c) State the range of values of x for which the function is positive. [1]

(d) Find the gradient of the curve at the point where $x = 1{,}5$. [2]

(e) Use the graph to solve the equation $(x+1)^2(x-2)=-2$. [3]

(f) Find the area bounded by the curve, the x-axis, the y-axis and the line $x=1$. [2]

4028/2 J2013 Q8

Answer the whole of this question on a sheet of graph paper.

The following is an incomplete table of values for the function $y = 2+\frac{5}{x}$.

x	1	2	3	4	5	6	7	8
y	7	p	3,7	3,3	3	q	2,7	2,6

(a) Calculate the value of p and the value of q. [2]

(b) Using a scale of 2 cm to represent 1 unit on each axis, draw the graph of $y=2+\frac{5}{x}$ for $1 \le x \le 8$. [4]

(c) Use the graph to estimate

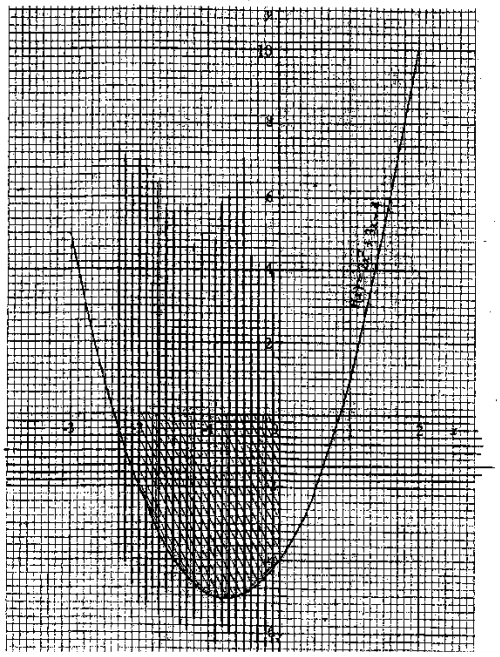
(i) the gradient of the graph of $y=2+\frac{5}{x}$ when $x=2$,

(ii) the area enclosed by the graphs $y=2+\frac{5}{x}$, $x=1$, $x=2$ and the x-axis. [4]

(d) On the same axes, draw the graph of $y=x$. Hence solve the equation $2+\frac{5}{x}=x$. [2]

4008/2 N2013 Q9

The diagram shows the graph of the function $f(x)=2x^2+3x-4$.



Use the graph to find

(a) the minimum value of the function $f(x)$, [1]

(b) the gradient of the curve at $x=1$, [1]

(c) the area between the curve, the x-axis, the y-axis and the line $x=-2$, [1]

(d) the roots of the equation $2x^2+3x=2$. [1]

4008/1 J2012 Q17

Answer the whole of this question on a sheet of graph paper.

Below is an incomplete table of values for $y=x^3-5x+3$

x	-3	-2	-1	0	1	2	3
y	-9	m	7	3	-1	1	n

(a) Find the value of $\boldsymbol{m}$ and the value of $\boldsymbol{n}$. [2]

(b) Using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 5 units on the y-axis, draw the graph of $y=x^3-5x+3$. [4]

(c) On the same axes, draw the line $y=x+3$. [1]

(d) Write down the roots of the equation $x^3-5x+3=x+3$. [3]

(e) Use your graph to estimate the gradient of the curve $y=x^3-5x+3$ at the point where $x=-2$. [2]

4008/2 J2012 Q11

Answer the whole of this question on a sheet of graph paper.

The following is an incomplete table of values for $y = 2x^2 - 5x - 3$.

x	-2	-1	$-\frac{1}{2}$	0	1	2	3	4
y	15	4	p	-3	-6	q	0	9

(a) Calculate the value of p and the value of q. [2]

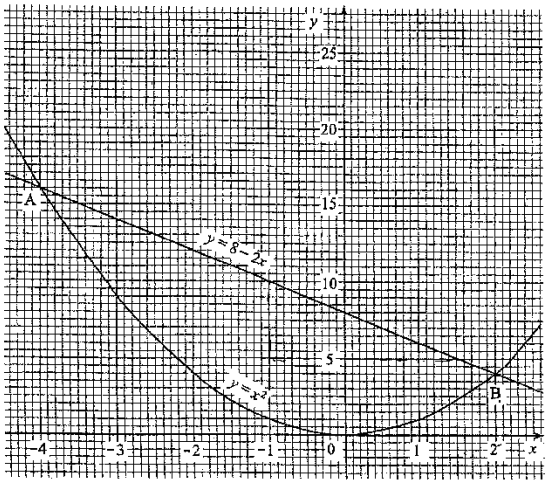
(b) Using a horizontal scale of 2 cm to represent 1 unit and a vertical scale of 2 cm to represent 2 units, draw the graph of $y = 2x^2 - 5x - 3$ for $-2 \leq x \leq 4$ and $-8 \leq y \leq 16$. [4]

(c) Find the gradient of the curve when $x = 1$. [2]

(d) Use your graph to solve the equation $2x^2 - 5x - 3 = -4$. [2]

(e) Find the area bounded by the curve and the x-axis from $x = 1$ to $x = 3$. [2]

4008/2 N2012 Q11



In the diagram, the curve $y = x^2$ and the line $y = 8 - 2x$ intersect at A and at B.

(a) Write down

(i) the gradient of the line $y = 8 - 2x$, [1]

(ii) the equation of the line passing through the origin and parallel to the line $y = 8 - 2x$. [1]

(b) Write down the x-coordinate of

(i) A, [1]

(ii) B. [1]

(c) Write down an equation in x whose roots are your answers in **(b)**. [1]

4008/4028/1 J2011 Q26

Answer the whole of this question on a sheet of graph paper.

The table shows values for the graph of $y = x^3$.

x	-3	-2	-1	0	1	2	3
y	-27	-8	-1	0	1	8	27

(a) Using a scale of 2 cm to represent one unit on the x-axis and 2 cm to represent 5 units on the y-axis, draw the graph of $y = x^3$ for $-3 \leq x \leq 3$. [4]

(b) Use your graph to find

(i) the gradient of the curve at $x = 1$,

(ii) the area enclosed between the graph and the line $y = 2x$ and the lines $x = 0$ and $x = 1{,}5$. [4]

(c) By drawing a suitable straight line, solve the equation $x^3 = 3x$. [4]

4008/2 N2011 Q8

Answer the whole of this question on a sheet of graph paper.

(a) The following is an incomplete table of values for the function $y = \frac{3}{x+2}$.

x	-6	-5	-4	-3	$-2{,}5$	-1	0	1	2
y	$-\frac{3}{4}$	-1	p	-3	-6	3	$1\frac{1}{2}$	1	$\frac{3}{4}$

(i) Calculate the value of p. [1]

(ii) Using a scale of 2 cm to represent 1 unit on both axes, draw the graph of $y = \frac{3}{x+2}$ for $-6 \leq x \leq 2$. [4]

(b) On the same axes, draw the graph of the function $y = 2x + 3$ to intersect with the graph of $y = \frac{3}{x+2}$. [2]

(c) Write down, in the form $ax^2 + bx + c = 0$ (where a, b and c are constants), the equation whose roots are the x coordinates of the points of intersection of the two graphs. [2]

(d) By drawing a suitable tangent, find the gradient of the graph $y = \frac{3}{x+2}$ at the point $(1;\ 1)$ [3]

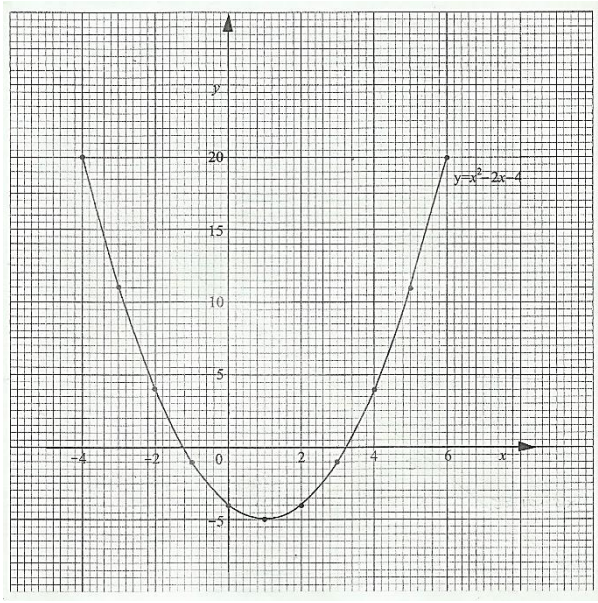
4028/2 J2010 Q12

The diagram shows the graph of $y = x^2 - 2x - 4$.

(a) On the diagram draw the graph of $y = 10 - 2x$. [1]

(b) Use the graph to estimate the solution of the equation $x^2 - 2x - 4 = 10 - 2x$. [2]

(c) State the range of values of x for which $x^2 - 2x - 4 \leq 14$. [2]



4008/4028/1 N2010 Q22

Answer the whole of this question on a sheet of graph paper.

The following is a table of values for the graph of the function $y = 7 - 5x - x^2$.

x	-7	-6	-5	-4	-3	-2	-1	0	1	2
y	-7	1	7	11	13	13	11	7	1	-7

(a) Using a scale of 2 cm to represent 1 unit on the horizontal axis and 2 cm to represent 5 units on the vertical axis, draw the graph of the function $y = 7 - 5x - x^2$. [4]

(b) Use your graph to answer the following questions.

(i) State the maximum value of the function $y = 7 - 5x - x^2$.

(ii) Solve the equation $7 - 5x - x^2 = 0$.

(iii) Solve the equation $-5x - x^2 = 2$.

(iv) Find the gradient of the curve at the point where $x = 0$. [8]

4008/2 N2010 Q8

INEQUALITIES

(a) Solve the inequality $2 - y < 3y - 10$. [2]
(b) The perfect square, y, satisfies both $2 - y < 3y - 10$ and $y \leq 9$. Find the possible values of y. [2]

4004/1 J2020 Q4

(a) Solve the inequality $7 \leq 2x + 3 < 11$. [3]
(b) Illustrate the solution to part **(a)** on a number line. [1]

4004/1 N2020 Q14

(i) Solve the following inequalities giving the answer in the form $a \leq x < b$ where a and b are constants to be found:
$5x - 13 \leq x - 6 < 9 + 4x$. [3]
(ii) Illustrate the solution on a number line. [1]
(iii) Write down the smallest integer value of x that satisfies the inequality. [1]

4004/2 J2019 Q7(a)

(a) Solve the inequality
$3x - 6 \leq 2x - 3 < 4x + 1$. [3]
(b) Illustrate the solution in **(a)** on a number line. [1]

4004/1 N2019 Q18

(i) Solve the inequality $2(x - 3) < 7$. [2]
(ii) Write down the largest perfect square that satisfies the inequality $2(x - 3) < 7$. [1]

4030/1 J2018 Q20(a)

(a) Solve the inequality $4 - 5x < 2x + 8$. [2]
(b) Write down the smallest integer that satisfies the inequality $4 - 5x < 2x + 8$. [1]

4004/1 N2018 Q14

(i) Solve the inequality
$4x - 2 \leq 5x + 2 < 2x + 8$, giving your answer in the form $a \leq x < b$, where a and b are integers. [3]
(ii) Illustrate the answer on a number line. [1]

4004/2 N2018 Q3(a)

(a) Solve the inequality $3x + 7 < 2x + 9$. [2]
(b) Illustrate the solution on a number line. [1]

4030/1 J2017 Q8

(a) Solve the inequality
$3x + 1 < 28 \leq 5x - 2$. [2]
(b) Show the solution in part **(a)** on a number line. [1]
(c) If x is an odd integer, write down its least value which satisfies the inequality in **(a)**. [1]

4030/1 N2017 Q19

(a) Solve the inequality, $-2(2x - 7) \geq 38$. [2]
(b) Illustrate the solution set in **(a)** on the number line. [1]

4030/1 J2016 Q12

(a) Given that x and y are integers such that $-4 \leq x \leq 1$ and $4 \leq y \leq 8$, find the greatest value of $\frac{2y}{3x}$. [2]
(b) Solve the inequality
$x - 2 \leq 4x + 1 < 2x + 4$, giving the answer in the form $a \leq x < b$, where a and b are constants. [3]

4030/1 N2016 Q25

Solve the inequality $2 - x \leq 2x - 1 < 11$, giving your answer in the form $a \leq x < b$, where a and b are integers. [3]

4028/1 N2015 Q12

(i) Solve the inequality
$x - 3 < 4 - 2x \leq x + 13$.
(ii) Illustrate your solution in part **b(i)** on a number line. [5]

4008/2R N2014 Q4(b)

If n is an integer, calculate the greatest possible value of n which satisfies the inequality
$3n - 25 < 2$. [2]

4028/1 J2013 Q24(a)

Solve the inequality
$5 - 3x \leq 7 < -2x + 19$. [3]

4028/2 J2013 Q3(c)

Given that x is an odd number, find the possible values of x, which satisfy the inequalities $x \geq 3$ **and** $5x - 10 < 35$. [2]

4008/2 N2013 Q2(a)

(a) Solve the inequality $3x + 17 < 5 - 3x$. [2]

(b) Write down the maximum possible integer value of x such that $3x - 17 \leq 5 - 3x$. [1]

4008/1 J2012 Q2

(a) Solve the inequality $4 - 5x < 19$. [2]
(b) Represent your solution to **(a)** on a Cartesian plane. [1]

4008/1 N2012 Q10

(i) Solve the inequality $5x - 6 < 2x - 3 \leq 3x + 1$, giving your answer in the form $a \leq x < b$, where a and b are integers.
(ii) Illustrate your solution on a number line. [5]

4008/2 N2012 Q4(b)

(a) Solve the inequality $x - 3 \leq 3x + 10$. [2]
(b) Given that x is an integer, write down the least value of x for which $x - 3 \leq 3x + 10$. [1]

4008/4028/1 J2011 Q5

Solve the inequality $15 - 3x < 2(x - 5)$. [2]

4008/2 N2011 Q2(a)

Integers x, y and z are such that
$x \leq 6$, $y \geq -2$ and $-6 \leq z \leq 4$.
Find (i) the **least** possible value of yz^2
(ii) the **greatest** possible value of $x - y$. [4]

4028/2 J2010 Q1(b)

(i) Solve the inequality $-3 < 2x - 7 \leq 7$.
(ii) Illustrate your solutions on the number line. [4]

4028/2 J2010 Q10(a)

Solve the inequality $y - 4 < 3y + 2 \leq 6 - y$.
Hence list the integral values of y that satisfy the inequality. [4]

4008/2 N2010 Q2(b)

INEQUALITIES & LINEAR PROGRAMMING

A group of youths wishes to make and paint chairs and tables for sale. Let x be the number of chairs and y the number of tables to be produced.

(a) The group wishes to produce at least 5 chairs and not less than 5 tables. Write down two inequalities, one in x and the other in y, that satisfy these conditions. [2]

(b) The group has 48 hours to make the chairs and tables. If it takes 4 hours to make a chair and 3 hours to make a table, write down an inequality in x and y that satisfies this condition. [1]

(c) The group hired a compressor for 14 hours to paint the chairs and tables. Given that it takes 1 hour to paint a chair and 1 hour to paint a table, form an inequality in x and y that satisfies this condition. [1]

(d) The point $(x\,;y)$ represents x chairs and y tables.

(i) Construct and show by shading the **unwanted regions**, the region in which $(x\,;y)$ must lie. Use a scale of 2 cm to 2 $units$ on both axes. [6]

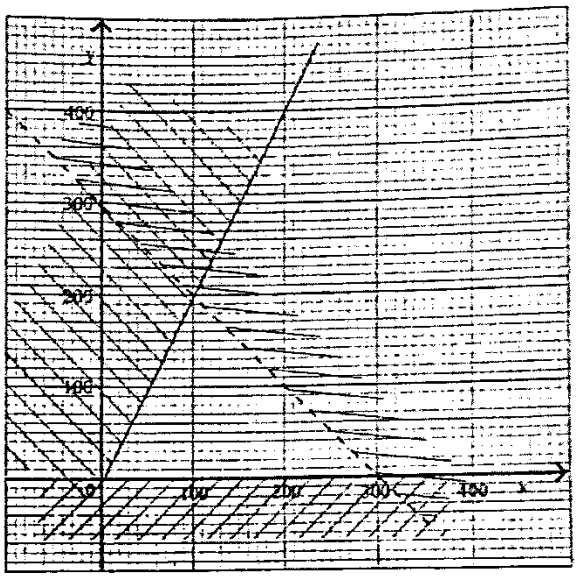
(ii) The profit on a chair is \$10 and the profit on a table is \$20. Use the graph to find the greatest possible profit that can be made. [2]

4004/2 J2020 Q11

The diagram shows a linear programming region which can best be described using three inequalities. One of the inequalities is $y \geq 0$.

(a) Find the other two inequalities shown in the graph. [2]

(b) Find the maximum value of $x + y$, given that x and y are integers that satisfy the three inequalities. [2]



4004/1 J2019 Q21

(a) A school's agriculture department intends to plant beans and peas in its 5-hectare field. Let x be the area in hectares required for beans and y the area in hectares under peas. Write down an inequality in x and y which satisfies this condition. [1]

(b) Beans require 2 bags of fertilizers per hectare while peas require 4 bags of fertilizers per hectare. The department has 16 bags of fertilizers for this project. Write down another inequality in x and y and show that it reduces to $x + 2y \leq 8$. [2]

(c) The department wishes to plant at least one hectare of each crop. Write down two inequalities, one in x and the other in y, that satisfy these conditions. [2]

(d) The point $(x\,;y)$ represents x hectares and y hectares under beans and peas respectively. Show by drawing the inequalities in **(a)**, **(b)**, **(c)** and shading the **unwanted** regions, the region in which $(x\,;y)$ must lie. Use a scale of 2 cm to 2 $units$ on both axes. [4]

(e) (i) The estimated profit is \$30.00 per hectare for beans and \$40.00 per hectare for peas. Find the area of each crop that should be planted for maximum profit to be realized. [2]

(ii) Find the expected maximum profit that may be realized. [1]

4004/2 N2019 Q11

(a) Draw the graphs of these inequalities by shading the **unwanted** region. Use a scale of 2 cm represent 10 $units$ on both axes.
  (i) $2x + y \leq 40$, [2]
  (ii) $x + 2y \leq 48$, [2]
  (iii) $x \geq 0$, [2]
  (iv) $y > 5$. [2]

(b) Mark R the region defined by the four inequalities in **(a)**. [1]

(c) For integral values of x and y,
  (i) find the coordinates of a point that gives a maximum value of $x + y$, [2]
  (ii) state the maximum value of $x + y$. [1]

4030/2 J2018 Q12

A luxury bus has 100 units of seating area. There are two types of seats, Ordinary and First Class.
Let the number of Ordinary seats be x and First Class seats be y.

(a) Ordinary seats take up 1 unit of seating area and First Class seats take up 1.5 units of seating area. Form an inequality which satisfies this condition and show that it reduces to $2x + 3y \leq 200$. [2]

(b) There must be at least 10 First Class seats. Write down an inequality which satisfies this condition. [1]

(c) There must also be at least twice as many Ordinary seats as First Class seats. Write down an inequality which satisfies this condition. [1]

(d) The point $(x\,;y)$ represents x Ordinary seats and y First Class seats. Use a scale of 2 cm to 10 $units$ on both axes and draw the graphs of the inequalities in
  (i) (a), [1]
  (ii) (b), [1]
  (iii) (c). [1]

(e) Show, by shading the **unwanted** regions, the region in which $(x\,;y)$ must lie. [2]

(f) A luxury bus company which uses this type of luxury bus charges \$15 for each ordinary seat and \$25 for each First Class seat for a certain trip. Use the graph to find the greatest possible amount of money that the company would receive from this trip. [3]

4030/2 J2017 Q7

Mr. Moyo wants to plant mango and guava trees in his plot. He wants at least 4 mango trees and at least 2 guava trees. Let x be the number of mango trees and y be the number of guava trees.

(a) Form two inequalities that satisfy the given conditions. [2]

(b) There is enough space in his plot for not more than 9 trees. Write down an inequality in x and y that satisfies the given condition. [1]

(c) Mango trees cost \$14.00 each and guava trees cost \$24.00 each. Mr. Moyo has \$168.00 for the purchase of trees. Form an inequality in x and y that satisfies this condition and show that it reduces to $7x + 12y \leq 84$. [2]

(d) The region $(x\,;y)$ satisfies the four inequalities. Use a scale of 2 cm to 10 $units$ on both axes and draw the graphs of the inequalities in
  (i) (a),
  (ii) (b),
  (iii) (c). [4]

(e) Indicate clearly by shading the **unwanted region**, the region in which $(x\,;y)$ should lie. [1]

(f) Use the graph to find the number of trees that will use the greatest amount of money. [2]

4030/2 N2017 Q8

Teachers at a certain school planned a trip with their pupils. They decide that the number of pupils should be greater than or equal to the number of teachers and that the number of pupils should not be greater than three times the number of teachers.

(a) If x teachers and y pupils go on the trip, form two inequalities to satisfy these conditions. [2]

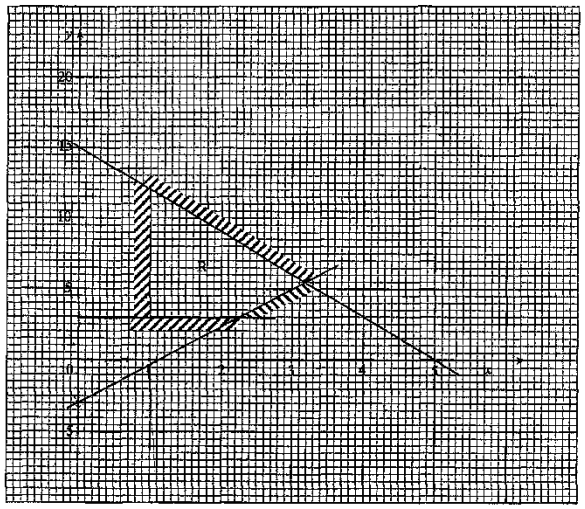
(b) The bus can take up to 60 passengers. Write down another inequality that satisfies this condition. [1]

(c) The transport cost is \$4.00 per teacher and \$2.00 per pupil. There must be sufficient passengers to cover the cost of \$120.00 for the hire of the bus. Write down an inequality that satisfies this condition. [1]

(d) Draw the inequalities in **(a)**, **(b)** and **(c)** to show, by shading the **unwanted** regions, the region in which $(x\,;y)$ must lie. Use a scale of 2 cm to 10 $units$ on both axes. [6]

(e) Use the graph to
  (i) find the least number of teachers, [1]
  (ii) find the greatest number of pupils that could go on the trip. [1]

4030/2 J2016 Q10



The diagram shows **unshaded region R** defined by four inequalities.

(i) Find the four inequalities which define the unshaded region **R**. [4]

(ii) Use the region **R** to find the greatest possible value of $x + y$ given that x and y are integers. [2]

4030/2 N2016 Q6(b)

A girl is given \$6.00 to buy fireworks for her birthday party. She buys x rockets at 60 c each and y crackers at 30 c each.

(a) Write down an inequality in x and y and show that it reduces to $2x + y \leq 20$. [2]

(b) She wants to buy at least 4 rockets and the number of crackers should be more than or equal to twice the number of rockets. Write down **two** inequalities that satisfy these conditions. [2]

(c) Using a scale of 2 cm to 2 units on both axes, show by shading the **UNWANTED** regions, the region in which $(x\,;y)$ must lie. [5]

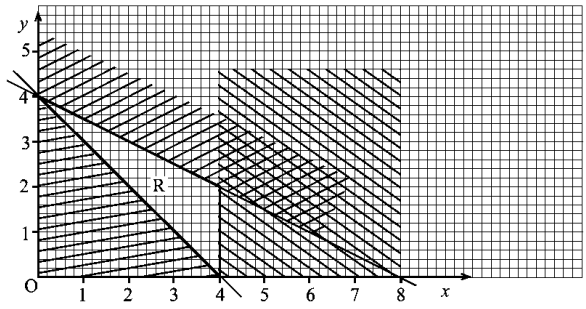
(d) Use your graph to find

(i) the combination that uses the maximum amount of money available,

(ii) 1. the combination that uses the minimum amount of money,

2. the change she would get in **(ii) 1**. [3]

4028/2 J2015 Q8



The diagram shows unshaded region R defined by three inequalities, one of which is $y \geq 4 - x$.

(i) Write down the other **two** inequalities. [2]

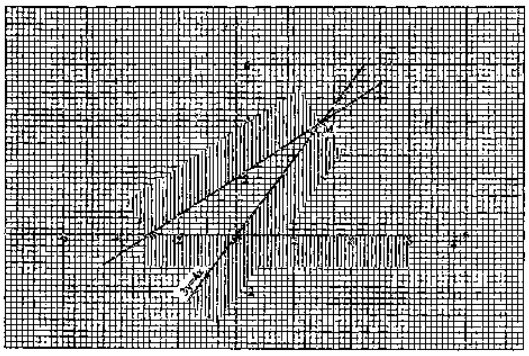
(ii) Find the maximum value of $3y + x$, given that x and y satisfy these three equalities. [2]

4028/2 N2015 Q8(b)

The cost of making a telephone call on Teneco is 25 cents per minute. Kuda has p cents and is able to make a call.

Xolani has q cents which is insufficient to make a call. Write down 3 inequalities in terms of p and/or q, other than $p > 0$ and $q > 0$, that satisfy the given conditions. [3]

4008/1 J2014 Q12



The diagram shows the region defined by three inequalities $3y \geq 4x$, $y \geq 0$ and a third inequality.

(a) Find

(i) the third inequality, [3]

(ii) the coordinates of point M, where the two lines intersect, shown on the diagram. [1]

(b) By considering integral values of x and y, calculate the least value of $x + y$. [2]

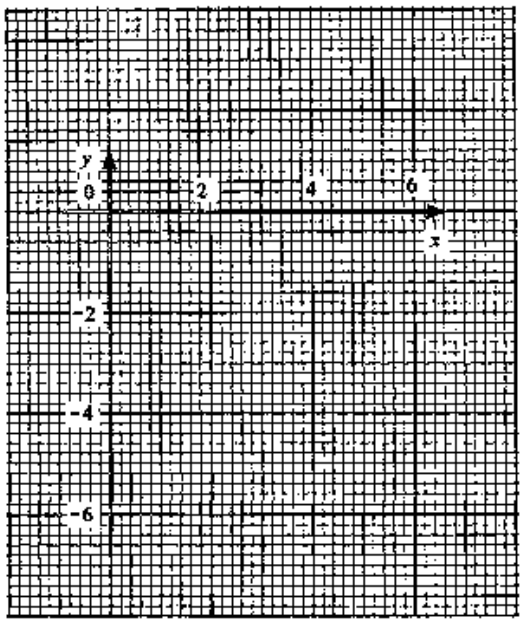
4008/1 N2014 Q24

Represent the following inequalities on the Cartesian plane in the answer space.

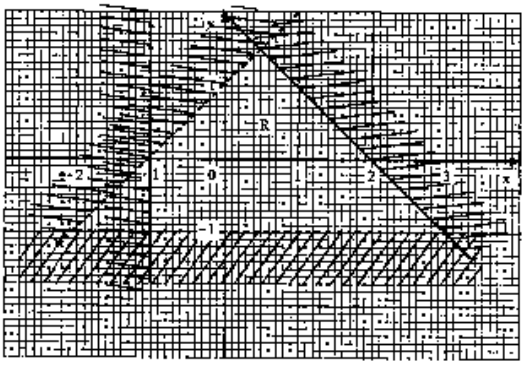
(a) $y > -6$ [1]

(b) $x \geq 2$ [1]

(c) $x + y \leq 0$ [2]



4008/1R N2014 Q19



The region, R, is defined by **four** inequalities, one of which is $y < x + 1$.

(i) Write down the other **three** inequalities.

(ii) Find the maximum value of $3x + 2y$ in R, where x and y are integers. [6]

4008/2R N2014 Q9(c)

Answer the whole of this question on a sheet of graph paper.

A green grocer offers a price reduction to customers who buy at least 1 kg of apples and more than 1 kg of grapes. The offer is limited to a total of 5 kg. Let x represent the mass of apples and y the mass of grapes.

(a) Write down three inequalities which represent the given information. [3]

(b) The point $(x\,;y)$ represents x kg of apples and y kg of grapes. Using a scale of 2 cm to represent 1 kg on both axes, construct and indicate clearly by shading the **unwanted** regions, the region in which $(x\,;y)$ must lie. [5]

(c) If the profit on apples is 40c per kg and that on grapes is 55c per kg, find the combination which gives the shop its greatest profit. [2]

(d) Calculate the maximum profit. [2]

4028/2 J2013 Q12

Nomsa, a newspaper vendor, orders and sells two types of newspapers, **The Messenger** and **The Arrival**.

(a) Nomsa always orders at most 100 newspapers for resale daily. If x represents the number of **The Messenger** and y the number of **The Arrival**, write down an inequality, in terms of x and/or y that satisfies the given condition. [1]

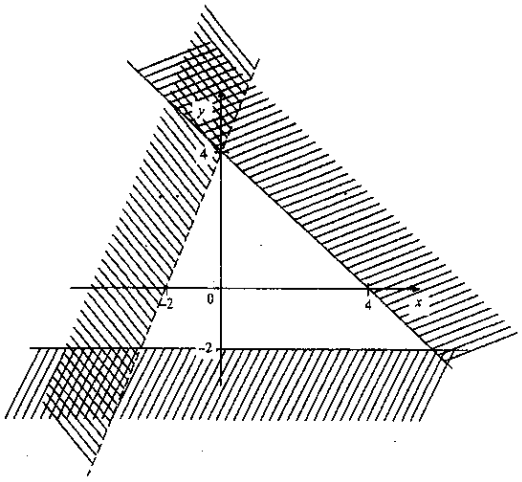
(b) She always sells more than 20 copies of **The Messenger** but the number of copies of **The Messenger** sold does **not** exceed double the number of copies of **The Arrival**. Write down 2 inequalities involving x and/or y that satisfy these restrictions. [2]

(c) By the end of each day she ends up having sold more copies of **The Messenger** than of **The Arrival**. Write down an inequality that satisfies this condition. [1]

(d) Using a scale of 2 cm to represent 20 newspapers on each axis, draw $x - axis$ and $y - axis$ each from 0 to 100. Illustrate, by shading the **unwanted** region, the region in which $(x\,;y)$ must lie. [5]

(e) It is given that **The Messenger** sells for \$1.20 and **The Arrival** sells for \$0.80 per copy. Nomsa is given $2\frac{1}{2}\%$ commission on her sales. Calculate the **highest** possible commission she could get. [3]

4008/2 N2013 Q12



Find the **three** inequalities which define the unshaded region in the diagram above. [5]

4008/1 J2012 Q21

Answer the whole of this question on a sheet of graph paper.

A newly constructed school wishes to buy desks and chairs for its pupils. Let x be the number of desks and y be the number of chairs.

(a) (i) The school wishes to buy at least 75 desks and at least 100 chairs. Write down **two** inequalities which satisfy these conditions.

(ii) The number of chairs should be more than the number of desks. Write down an inequality which satisfies this condition.

(iii) Desks cost \$25 each and chairs cost \$17.50 each. The school has only \$5 000 to spend on these items. Write down an inequality and show that it reduces to $10x + 7y \leq 2000$. [5]

(b) Using a scale of 2 cm to represent 25 desks and 2 cm to represent 50 chairs, show, by shading the **UNWANTED** regions, the region in which $(x\,;y)$ must lie. [5]

(c) Use your region to determine the number of desks and chairs that would use up the greatest possible amount. [2]

4008/2 N2012 Q8

Using a scale of 1 cm to represent 1 $unit$ on the $x-axis$ and 2 cm to represent 1 $unit$ on the $y-axis$, draw the x and y axes for $0 \leq x \leq 14$ and $-3 \leq y \leq 5$.

(i) Show by shading the **unwanted** regions, the region which is defined by:

$x \geq 3$,

$y \geq -2$,

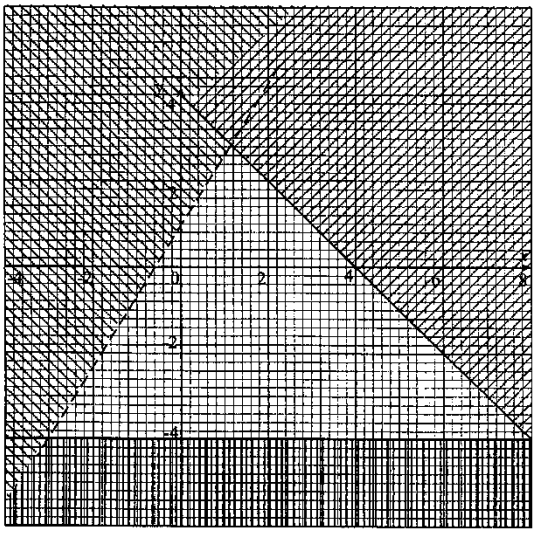
and $x + 2y \leq 8$.

(ii) From the region defined, find the coordinates of a point that gives a maximum value of $3x - 2y$.

(iii) State the maximum value of $3x - 2y$. [8]

4008/2 J2011 Q10(b)

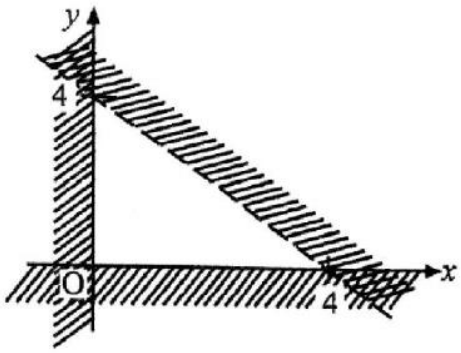
Find the three inequalities that define the unshaded region in the diagram above. [5]



4008/1 N2011 Q20

(a) Given that $x \geq 0.5$, state the **least** possible value of x if x is a prime number. [1]

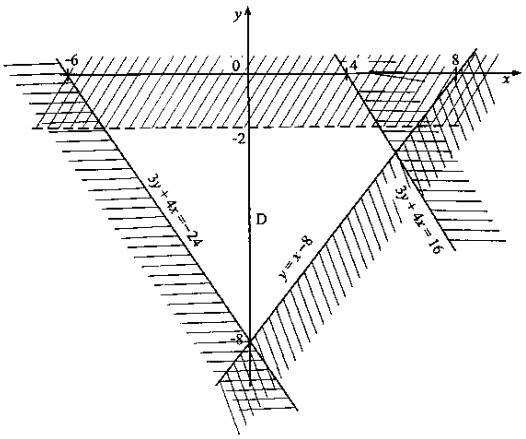
(b) The diagram shows the region defined by three inequalities, two of which are $x \geq 0$ and $y \geq 0$.



Find the third inequality. [2]

4008/4028/1 J2010 Q15

Write down 4 inequalities which define the unshaded region D. [4]



4008/4028/1 N2010 Q15

A builder wishes to build houses and flats on $6\,000\ m^2$ plot.

(a) The City Council insists that there must be more than 6 houses and that there must be more flats than houses.
Taking x to represent the number of houses and y to represent the number of flats, write down two inequalities, other than $x > 0$ and $y > 0$, which satisfy these conditions. [2]

(b) The builder allows $300\ m^2$ for each flat and $400\ m^2$ for each house. Write down another inequality which satisfies this condition and show that it reduces to $4x + 3y \leq 60$. [1]

(c) The point $(x\ ;y)$ represents x houses and y flats. Using a scale of 2 cm to represent 5 units on both axes, draw the x and y axes for $0 \leq x \leq 20\ and\ 0 \leq y \leq 20$.
Construct and show by shading the **unwanted** regions, the region in which $(x\ ;y)$ must lie. [5]

(d) Use your graph to find
(i) the maximum number of flats that can be built,
(ii) the maximum number of houses that can be built,
(iii) the values of x and y which give the maximum number of dwelling units. [4]

4008/2 N2010 Q11

LAWS OF INDICES

Evaluate (a) -10^0 [1]

(b) $\left(\frac{4}{9}\right)^{\frac{3}{2}}$ [2]

4004/1 J2020 Q2

(a) Find the square of $\sqrt{3}$. [1]

(b) Evaluate $0.3^{\frac{1}{3}} \times 0.3^{\frac{1}{3}} \times 0.3^{\frac{1}{3}}$ [2]

4004/1 N2020 Q5

Solve the equation $x^{\frac{2}{3}} = 4$ [2]

4004/1 J2019 Q20(a)

Evaluate $(-8)^{\frac{2}{3}}$ [1]

4004/1 N2019 Q2(a)

Solve the equation $3^k = \frac{81^2 \times 3^5}{3^{11}}$ [2]

4004/2 N2019 Q6(a)

Evaluate (a) $\sqrt[3]{0.027}$ [1]

(b) $\left(1\frac{7}{9}\right)^{\frac{1}{2}}$ [1]

(c) $3^0 \times 3^{-2}$ [1]

4030/1 J2018 Q4

Solve the equation $4^{2n-3} = 8$ [2]

4030/1 J2018 Q8(b)

Evaluate (a) $2^{1.6} \times 2^{0.4}$ [1]

(b) $\left(\frac{12}{27}\right)^{-\frac{3}{2}}$ [2]

4030/1 J2017 Q3

Simplify (a) $(2+x)^0$ [1]

(b) $\frac{3x^{-2}}{3x}$ [2]

4030/1 N2017 Q3

Find the square of $\frac{1}{4}$. [1]

4030/1 N2017 Q11(a)

Evaluate (a) $2^3 \times 2^0$ [1]

(b) $\sqrt{1.6 \times 10^2 + 9}$ [2]

4030/1 N2016 Q3

Find $\sqrt[3]{0.027}$. [1]

4028/1 J2015 Q5(a)

Simplify $(2a)^{-2} \times 3a^2$ [2]

4028/1 J2015 Q14(a)

(a) Evaluate $81^{\frac{3}{4}}$ [2]

(b) Find x if $9^{x-1} \times 3^{3x-2} = 3$ [2]

4028/1 N2015 Q16

Solve the equation $9^{m-1} = 27$ [2]

4028/2 N2015 Q4(b)

Giving your answer as a decimal, find the exact value of $\sqrt{0.0144}$. [1]

4008/1 J2014 Q3(b)

(a) Simplify $(32x^{10})^{\frac{1}{5}}$ [2]

(b) Given that $\frac{2^{-2} \times 2^c}{2^4} = 2^3$, find the value of c. [2]

4008/1 J2014 Q17

Solve the equation $3x = (-64)^{\frac{1}{3}}$ [2]

4028/2 J2014 Q2(a)(ii)

Solve $3^y = 9^{-2}$ [2]

4008/1 N2014 Q19(a)

(a) If $32 = 2^m$, find the value of m. [1]

(b) Simplify $\left(\frac{1}{27}\right)^{\frac{2}{3}}$ [2]

4008/1R N2014 Q7

(a) Write down the square of 4. [1]

(b) Evaluate $125^{\frac{1}{3}} \times \sqrt{144}$. [2]

4028/1 J2013 Q4

Evaluate (a) $(-3)^0$ [1]

(b) $\left(\frac{16}{81}\right)^{-\frac{3}{4}}$ [2]

4028/1 J2013 Q10

Simplify (a) $\frac{(3^3)^4}{27^3}$ [1]

(b) $(4x^2y^6)^{\frac{1}{2}}$ [1]

(c) $x^0 \div x^{-2}$ [1]

4008/1 N2013 Q6

Simplify $\sqrt{(5p+2)^2}$. [1]

4008/1 J2012 Q10(a)

Simplify the following, giving your answers in standard form.

(a) $\sqrt{6250000}$ [2]

(b) 5^{-2} [2]

4008/1 J2012 Q14

Express $(9^2 \times 9^3)$ as a power of 3. [2]

4008/1 J2012 Q22(b)

(a) Find the exact value of $\left(\frac{4}{3}\right)^{-2}$ [1]

(b) Simplify $3^{-\frac{1}{2}} \times 9^{\frac{1}{4}}$ [2]

4008/1 N2012 Q14

(i) Simplify $2m^3 \times 3m^0$

(ii) Evaluate $\sqrt{12\frac{1}{4}}$ [2]

4008/2 N2012 Q3(a)

Solve the equation $3^{2x-1} = \frac{1}{9}$ [2]

4008/2 N2012 Q3(c)(ii)

Evaluate (a) $3m^{-5} \times 2m^5$ [1]

(b) $\left(\frac{4}{9}\right)^{-\frac{1}{2}}$ [2]

4008/1 J2011 Q11

(a) Simplify $(27x^6)^{\frac{1}{3}}$ [1]

(b) If $32^{-\frac{2}{5}} = 2^p$, find p. [2]

4008/1 N2011 Q3

Given that $m = \frac{1}{2}$, $n = 0$ and $r = 3$, evaluate

(a) $(mr)^n$, [1]

(b) $(2\frac{1}{4})^m$, [1]

(c) $\sqrt[r]{-64}$. [1]

4008/4028/1 J2010 Q5

Evaluate (a) $\left(16^{\frac{1}{2}}\right)^{\frac{3}{2}}$ [1]

(b) $7^{-\frac{1}{4}} \times 7^{\frac{5}{4}} \times 7$ [1]

(c) $\left(\frac{1}{5}\right)^{-2}$ [1]

4008/1 N2010 Q1

LINEAR EQUATIONS

Solve the equation $\frac{2}{x-2} = \frac{3}{x+2}$. [2]

4004/1 J2019 Q20(b)

Solve the equation $\frac{1}{3}x - 1 = 7$. [1]

4030/1 J2018 Q8(a)

Solve the equation $\frac{3m}{4} - \frac{m}{3} = 2\frac{1}{2}$. [2]

4004/1 N2018 Q16(b)

Solve the equations

(i) $0{,}2n = 5$, [1]

(ii) $\frac{1}{3}m + 2 = 8$. [2]

4030/1 N2017 Q24(b)

Solve the equation $\frac{12-y}{3} = 5 - 2y$. [2]

4030/2 J2016 Q2(b)

Solve the equation $\frac{3}{x+7} - \frac{1}{x+2} = 0$. [3]

4030/2 N2016 Q4(a)

Solve the equation $3 - (2n - 5) = 32$. [2]

4008/1 J2015 Q22(a)

Solve the equation $\frac{3x+1}{3} - \frac{x-4}{5} = \frac{1}{2}$. [3]

4028/2 J2015 Q2(b)

Solve the equation $\frac{2y+5}{3y-2} = \frac{9}{4}$. [3]

4028/1 N2015 Q7

Solve the equation $0.3x - 1.7 = 1.8 - 0.4x$ [3]

4028/2 J2014 Q2(a)(i)

Solve the equation $\frac{2}{x} - \frac{1}{4} = \frac{3}{5x}$. [3]

4008/2 N2014 Q2(a)

(a) Express $\frac{2}{x+2} - \frac{1}{3}$ as a single fraction in its simplest form.

(b) Hence or otherwise solve the equation $\frac{2}{x+2} - \frac{1}{3} = -\frac{1}{5}$. [5]

4008/2R N2014 Q2(b)

Solve the equation $\frac{x+5}{7} = \frac{3}{2}$. [2]

4008/1 N2013 Q8(b)

Solve the equation $\frac{2}{3}(p + 1) = 2\frac{1}{5}$. [3]

4008/2 N2013 Q1(c)

Solve the equation $\frac{3}{2x-7} - \frac{4}{x-3} = 0$. [3]

4008/2 J2012 Q6(b)

Solve the equation $1\frac{1}{5} = x - 4$. [2]

4008/2 N2012 Q3(c)(i)

Solve the equation $\frac{2}{x+2} = \frac{1}{3}$. [1]

4008/4028/1 J2011 Q24(a)

(i) Express $\frac{x}{3} + \frac{x-4}{5}$ as a single fraction in its simplest form.

(ii) Hence or otherwise solve the equation $\frac{x}{3} + \frac{x-4}{5} = 4$. [4]

4008/4028/2 J2011 Q2(b)

Solve the equation $\frac{2y}{3} - 9 = 0$. [2]

4008/1 N2011 Q14(a)

Solve the equation

$x(x + 1) + 2x(x - 1) = 3(x^2 - 1)$. [3]

4008/2 N2011 Q3(a)

Solve the equation $\frac{3}{y} = \frac{12}{11}$. [1]

4008/4028/1 J2010 Q11(a)

In an Olympiad test, there were 26 questions. Eight points were given for each correct answer and five points were deducted for each wrong answer. Tamara answered all questions and scored zero. Find the number of questions she had got correct. [4]

4008/2 N2010 Q2(c)

LOGARITHMS

It is given that $log\ x = 6$ and $log\ y = -2$.
Evaluate (a) $log(xy)$ [2]
(b) $log\left(\frac{1}{\sqrt{x}}\right)$ [2]

4004/1 J2020 Q21

Evaluate (a) $log\ 16 \div log\ 4$, [2]
(b) $log\ 5 - log\ 0{,}5$. [2]

4004/1 N2020 Q16

It is given that $log\ 6 = 0.7781$ and $log\ 5 = 0.6990$.
Calculate (a) $log\ 30$ [2]
(b) $log\ 1\ 200\ 000$ [2]

4004/1 J2019 Q12

(a) Evaluate $log_3 \frac{1}{243}$ [2]
(b) Solve the equation
$log_3 81 = (2x - 1)$ [2]

4004/1 N2019 Q15

(a) Evaluate (i) $log_3 45 - log_3 5$ [2]
(ii) $\frac{log\ 0.2}{log\ 5}$ [2]
(b) Express as a logarithm of a single number,
$3log\ 2 + \frac{1}{2} log\ 81$ [2]

4030/1 J2018 Q24

If $log\ a = 3$ and $log\ b = 7$, calculate
(a) $log\ ab$ [1]
(b) $log\ \frac{1}{b}$ [1]
(c) $log\ \sqrt[3]{a}$ [2]

4004/1 N2018 Q15

(i) Show that $log(3x + 1) + log(x - 3) = 1$ reduces to $3x^2 - 8x - 13 = 0$. [3]
(ii) Hence solve the equation $3x^2 - 8x - 13 = 0$ giving your answers correct to one decimal place. [5]

4004/2 N2018 Q8(b)

Evaluate (a) $log_4 \frac{1}{4}$ [1]
(b) $3log5 + 3log2 - 1$ [2]

4030/1 J2017 Q6

Evaluate $log_7 7^{-2} - log_5 \frac{1}{5}$ [2]

4030/2 J2017 Q8(a)

Solve the equation $log_x 81 = 2$ [2]

4030/2 N2017 Q5(b)(i)

(a) Given that $log_b M = x$, express M in terms of b and x. [1]
(b) Evaluate (i) $log_4 \frac{1}{64}$ [1]
(ii) $\frac{log\ 81}{log\ 27}$ [2]

4030/1 J2016 Q22

If $log_x 27 = 1.5$, find x.

4030/2 J2016 Q5(b)

Given that $log\ P = 2.4$ and $log\ Q = 0.4$, evaluate
(a) $log\ \frac{1}{P}$ [2]
(b) $\frac{log\ P^2}{log\ Q}$ [2]

4030/1 N2016 Q19

Simplify $log\ 8 \div log\ 4$ [2]

4028/1 J2015 Q14(b)

(a) If $log_{10} 7 = 0.8451$, evaluate
(i) $log_{10} 0.07$ [1]
(ii) $log_{10} 49$ [1]
(b) Evaluate $log_2\left(\frac{1}{64}\right)$ [2]

4028/1 N2015 Q14

Evaluate (a) $\frac{log_5 64}{log_5 4}$ [2]
(b) $1 + log_3 9$ [2]

4008/1 J2014 Q21

Given that $log_x 81 = log_2 16$, find the value of x. [3]

4008/1 N2014 Q19(b)

If $log(2x + 21) - log\ 5x = 0$, find the value of x. [3]

4008/1R N2014 Q11

Given that $log_{10} 3 = 0.4771$ and $log_{10} 5 = 0.6991$, find
(a) $log_{10} 1\frac{2}{3}$ [2]
(b) $log_{10} 30$ [2]

4028/1 J2013 Q15

Express $2 - 2\,log\,50$ as a logarithm of a single number. [2]

4008/2 N2013 Q7(a)

Evaluate

(i) $log_{10} 1 - log_{10} 0.0001$ [2]

(ii) $log_2 \sqrt{2}$ [2]

4008/1 J2012 Q22(a)

Given that $log\,3 = 0.477$ and $log\,5 = 0.699$, find $log\,45$. [2]

4008/1 N2012 Q18(a)

(i) Express $log_5(x+1) - log_5(2x)$ as a single logarithm. [1]

(ii) Solve the equation $log_5(x+1) - log_5(2x) = 1$ [3]

4008/2 N2012 Q3(b)

Express $log_{10} x - 2log_{10} y = 1$ as an equation in index form. [3]

4008/1 J2011 Q14

(i) Show that $2\,log_5(3x+2) - log_5 2 = 1$ reduces to $3x^2 + 4x - 2 = 0$.

(ii) Solve the equation $3x^2 + 4x - 2 = 0$, giving your answers to two decimal places. [9]

4008/2 J2011 Q5(b)

Evaluate (a) $log_3 9$ [1]

(b) $log_5\left(\frac{1}{25}\right)$ [2]

(c) $log_{29} 1$ [1]

4008/1 N2011 Q17

Simplify as far as possible

(a) $log\,9 \div log\,3$, [1]

(b) $4\,log\,2 + log\,20 - log\,3{,}2$. [3]

4008/4028/1 J2010 Q22

Evaluate $\frac{log\,3 + log\,9}{log\,405 - log\,5}$ [3]

4008/4028/1 N2010 Q21(b)

MATRICES

The matrix $\begin{pmatrix}(x+2) & 4\\ 6 & x\end{pmatrix}$ is singular. Find the possible values of x. [3]

4004/1 J2020 Q10

(a) Find the value of y for which

$(y \quad 4)\begin{pmatrix}-2\\3\end{pmatrix} = (-2)$ [2]

(b) Find the matrix P such that

$P\begin{pmatrix}3 & -4\\2 & 0\end{pmatrix} = \begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}$ [3]

4004/2 J2020 Q3

It is given that matrix $A = \begin{pmatrix}2 & x\\4 & 3\end{pmatrix}$ and matrix $B = \begin{pmatrix}5\\-1\end{pmatrix}$.

(a) Simplify, leaving the answers in terms of x.

(i) A^2, [2]

(ii) AB, [2]

(b) If matrix A is singular, find the value of x. [2]

4004/2 N2020 Q4

(a) P is a 2×3 matrix, Q is a 3×1 matrix and PQ = H. State the order of matrix H. [1]

(b) Matrix $A = \begin{pmatrix}2 & 1\\3 & -3\end{pmatrix}$. Find A^2. [2]

4004/1 N2019 Q10

Matrix $A = \begin{pmatrix}x+2 & 14\\3 & 3\end{pmatrix}$. The determinant of Matrix A is less than 7.

(i) Find the largest integer value of x. [3]

(ii) Find A^{-1}, the inverse of matrix A using the value of x in (a)(i). [2]

4004/2 N2019 Q2(a)

It is given that

$$3\begin{pmatrix}p & -1\\0 & 4\end{pmatrix} - \begin{pmatrix}7 & q\\-2 & 2r\end{pmatrix} = \frac{1}{2}\begin{pmatrix}16 & 8\\4 & -12\end{pmatrix}$$

Find the value of (i) p [2]

(ii) q [2]

(iii) r [2]

4030/1 J2018 Q25

Matrix $A = \begin{pmatrix}4 & 2\\3 & 1\end{pmatrix}$ and matrix $B = \begin{pmatrix}2 & 0\\1 & -3\end{pmatrix}$.

Calculate

(i) $A - 2B$, [2]

(ii) AB, [2]

(iii) A^{-1}, the inverse of matrix A. [2]

4030/2 J2018 Q3(c)

The determinant of a matrix $\begin{pmatrix}a-1 & 9\\6 & 3\end{pmatrix}$ is 9. Find the value of a. [1]

4030/1 J2017 Q11(b)

(b) (i) State the order of the matrix $(3 \quad 1)$. [1]

(ii) Evaluate $(3 \quad 1)\begin{pmatrix}4\\3\end{pmatrix}$. [1]

(c) Matrix $G = \begin{pmatrix}-2 & 5\\0 & 6\end{pmatrix}$. Find G^{-1}, the inverse of matrix G. [2]

4030/2 J2017 Q5

Given that matrix $T = \begin{pmatrix}3 & -6\\4 & 1\end{pmatrix}$, find the determinant of matrix T. [1]

4030/1 N2017 Q16(a)

It is given that matrix $P = \begin{pmatrix}3 & -2 & 1\\0 & -1 & 4\end{pmatrix}$ and matrix $Q = \begin{pmatrix}-2 & 3\\-4 & 5\end{pmatrix}$.

(i) State the order of matrix P. [1]

(ii) 1. Calculate Q^2. [2]

2. Calculate Q^{-1}, the inverse of matrix Q. [2]

4030/2 N2017 Q3(a)

The matrix $A = \begin{pmatrix}-2 & 14\\2 & x\end{pmatrix}$ and $|A| = -2$.

(a) Find the value of x. [2]

(b) Hence find A^{-1}. [2]

4030/1 J2016 Q21

Given that $A = \begin{pmatrix}2 & 5\\-3 & y\end{pmatrix}$, and $B = (-4 \quad 3)$ and $C = \begin{pmatrix}5 & -4\\2 & -9\end{pmatrix}$,

(i) find the value of y for which A has no inverse, [2]

(ii) evaluate $A + C$, using the value of y in (i), [2]

(iii) evaluate C^{-1}, [2]

(iv) evaluate BC. [2]

4030/2 J2016 Q5(a)

It is given that $M = \begin{pmatrix}3 & 9\\2 & 7\end{pmatrix}$ and $N = \begin{pmatrix}5 & -1\\4 & -6\end{pmatrix}$.

(i) Find M^{-1}, the inverse of matrix M. [2]

(ii) Find matrix P such that

$2P + N = \begin{pmatrix}7 & 3\\4 & -4\end{pmatrix}$. [3]

4030/2 N2016 Q2(a)

Given that A = $\begin{pmatrix} x-1 & 2 \\ x+1 & -1 \end{pmatrix}$, and B = (3 4).
Find in terms of x

(a) the determinant of A in its simplest form. [2]

(b) BA in its simplest form. [2]

4028/1 J2015 Q15

If F = $\begin{pmatrix} 3 & x \\ -4 & -6 \end{pmatrix}$, G = $\begin{pmatrix} 3 & -2 \\ 2 & -1 \end{pmatrix}$ and H = $\begin{pmatrix} 7 \\ 1 \end{pmatrix}$, find

(a) F + 3G in terms of x. [2]

(b) the value of x if the determinant of F is -14. [2]

(b) GH. [2]

4028/1 N2015 Q27

It is given that M = $\begin{pmatrix} 8 & -4 \\ -5 & 3 \end{pmatrix}$ and N = $\begin{pmatrix} 1 \\ 3 \end{pmatrix}$.

(i) Find MN. [2]

(ii) Find the inverse of M. [2]

(iii) Find M^2. [2]

4028/2 N2015 Q3(a)

It is given that P = $\begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$ and Q = 2P − I where I is the identity matrix. Find

(a) P^{-1} [2]

(b) Q [2]

4008/1 J2014 Q18

Given that
$\begin{pmatrix} 10 & 3 \\ 4 & 2 \end{pmatrix} - 2\begin{pmatrix} -1 & -3 \\ u & -5 \end{pmatrix} = \begin{pmatrix} v & 9 \\ -18 & 12 \end{pmatrix}$,

(a) Find the value of (i) u [1]

(ii) v [1]

(b) Find the determinant of $\begin{pmatrix} 10 & 3 \\ 4 & 2 \end{pmatrix}$. [1]

4008/1 N2014 Q5

It is given that A = $\begin{pmatrix} 2 & 3 \\ -4 & -1 \end{pmatrix}$,
B = $\begin{pmatrix} x+1 & 2 \\ 2x-3 & 3 \end{pmatrix}$, C = $\begin{pmatrix} 4 & 3 & -2 \\ -1 & -2 & 0 \end{pmatrix}$ and
D = $\begin{pmatrix} 7 \\ -3 \end{pmatrix}$.

(a) Write down the order of matrix C, [1]

(b) Express AD as a single matrix, [2]

(c) Find x such that B has no inverse. [2]

4008/1R N2014 Q21

It is given that P = $\begin{pmatrix} 3 & 5 \\ 4 & x \end{pmatrix}$ and Q = $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$.

(a) Find PQ in terms of x. [2]

(b) Find the value of x that makes |P| = 7. [2]

(c) Hence write down P^{-1}. [2]

4028/2R N2014 Q7(a)

Given that M = $\begin{pmatrix} 5 & 5 \\ 3 & x \end{pmatrix}$ and N= $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$. Find

(a) the determinant of M in terms of x, [1]

(b) the modulus of the vector N, [1]

(c) the value of x given that det M = |N| [1]

4028/1 J2013 Q12

Simplify $\frac{1}{3}\begin{pmatrix} -5 & -10 \\ 1 & -1 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}$. [3]

4028/2 J2013 Q2(a)

Given that A = $\begin{pmatrix} -2 & -1 \\ 6 & 2 \end{pmatrix}$ and B = $\begin{pmatrix} 0 & -1 \\ 4 & 3 \end{pmatrix}$.

Find (a) 3A−B, [2]

(b) B^2. [2]

4008/1 N2013 Q15

Given that P = $\begin{pmatrix} 3 & -4 \\ 5 & 1 \end{pmatrix}$ and Q = $\begin{pmatrix} 2 \\ 8 \end{pmatrix}$, find

(a) the value of n if PQ = $\begin{pmatrix} 4n \\ 18 \end{pmatrix}$, [2]

(b) P^{-1}. [2]

4008/2 N2013 Q5(a)

(a) State the reason why the matrix $\begin{pmatrix} 6 & -3 \\ -2 & 1 \end{pmatrix}$ has no inverse. [1]

(b) Find the 2 × 2 matrix M such that
$\begin{pmatrix} 2 & -3 \\ -1 & 6 \end{pmatrix} - \begin{pmatrix} 2 & -6 \\ 5 & 0 \end{pmatrix} = 3M$. [2]

4008/1 J2012 Q7

It is given that P = $\begin{pmatrix} 4 & -3 \\ 5 & 2 \end{pmatrix}$ and Q = $\begin{pmatrix} 7 & 3 \\ 4 & 6 \end{pmatrix}$.

Find

(i) the inverse of Q. [2]

(ii) the matrix R such that P + R = Q. [2]

4028/2 J2012 Q3(c)

Given that **C** = $\begin{pmatrix} 2 & -3 \\ 0 & 4 \end{pmatrix}$ and **D** = $\begin{pmatrix} 5 & -2 \\ -7 & 1 \end{pmatrix}$,
express as a single matrix

(a) **C**−2**D**, [2]

(b) $\mathbf{D^2}$. [2]

4008/1 N2012 Q17

Given that A = $\begin{pmatrix} 3 & -4 \\ 1 & -2 \end{pmatrix}$,

(i) find the inverse of matrix A,

(ii) hence or otherwise solve the equations
$3x - 4y = -3$
$x - 2y = -2$ [5]

4008/2 J2011 Q7(a)

(a) If A is a non-singular matrix, simplify AA^{-1}. [1]

(b) If $B = \begin{pmatrix} 1 & 3 \\ 5 & 5 \end{pmatrix}\begin{pmatrix} 2 \\ 6 \end{pmatrix}$, write down the order of matrix B. [2]

4008/1 N2011 Q9

Given that $A = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 3 & 1 \\ 2 & 0 \end{pmatrix}$, find

(i) 2A+B, [2]

(ii) BA, [2]

(iii) B^{-1}. [2]

4008/2 N2011 Q5(b)

It is given that D is a 2 by 2 matrix such that

$D + \begin{pmatrix} -6 & -8 \\ 3 & 4 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$

(a) Find D. [2]

(b) Write down the determinant of $\begin{pmatrix} -6 & -8 \\ 3 & 4 \end{pmatrix}$. [1]

4008/1 4028/1 J2010 Q16

Given that $M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$, $N = \begin{pmatrix} 4 & -2 \\ 3 & 0 \end{pmatrix}$ and $3M + N = M$, find

(i) the matrix M, [3]

(ii) N^2. [2]

4028/2 J2010 Q3(b)

M and N are 2×2 matrices such that $M = \begin{pmatrix} 2 & -2 \\ -1 & 3 \end{pmatrix}$ and $N = \begin{pmatrix} 4 & -2 \\ 0 & 7 \end{pmatrix}$.

Find (a) M^{-1}, [2]

(b) N. [2]

4008/4028/1 N2010 Q18

Given that $M = \begin{pmatrix} 3 & -2 \\ -1 & 4 \end{pmatrix}$, $N = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ and $R = (3 \quad -1)$, find

(i) MN [2]

(ii) M^{-1} [2]

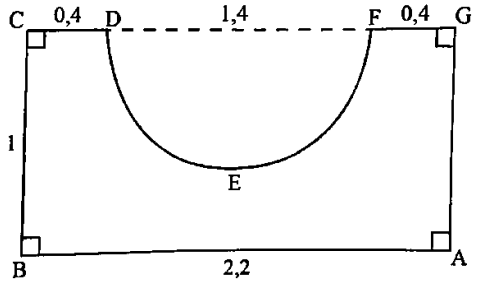
(iii) RN. [2]

4008/2 N2010 Q4(b)

MEASURES & MENSURATION

The diagram shows the cross-section of a concrete drinking trough which is 3 m long. $AB = 2.2\ m$, $BC = AG = 1\ m$ and $CD = FG = 0.4\ m$. DF, the diameter of the drinking trough is $1.4\ m$.

Take π to be $\frac{22}{7}$.



Calculate the

(a) perimeter of the cross-section, [3]

(b) area of the cross-section, [3]

(c) volume of the concrete used to make the drinking trough. [2]

4004/1 J2020 Q27

A wooden block is in the form of a prism whose cross-section is a parallelogram with base 35 cm, perpendicular height 20 cm and length 1,2 m. Calculate the

(i) surface area of the cross-section of the block. [2]

(ii) volume of the block. [2]

(iii) mass of the block if 3 cm^3 of the block weigh 2,5 g. [2]

4004/2 J2020 Q2(b)

A motorist travelled from Mutare to Harare, a distance of 300 km, at an average speed of 120 km/h.

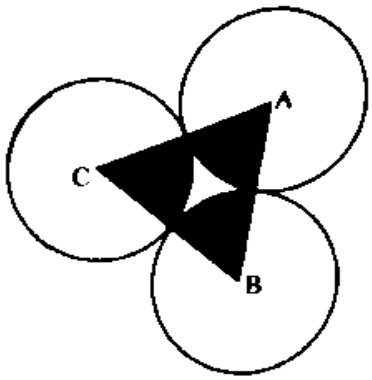
(a) Calculate the time in hours and minutes taken by the motorist to reach Harare. [2]

(b) On the return journey the motorist increased its average speed to 132 km/h. Calculate percentage increase in average speed. [2]

4004/1 N2020 Q15

The diagram shows three identical circles with centres at **A**, **B** and **C** each of radii 3.5 cm. The centres of the circles are joined by straight lines **AB, BC** and **CA**.

In this question take π to be $\frac{22}{7}$.



(a) State the special name of triangle **ABC**. [1]

(b) **Using as much of the information given below as is necessary.**

$[\boldsymbol{sin\ 60° = 0.90;\ cos\ 60° = 0.5;\ tan\ 60° = 1.70}]$

Calculate the area of the

(i) triangle ABC, [2]

(ii) shaded parts. [2]

4004/1 N2020 Q25

The following is an incomplete table of distances, in kilometres, between capital cities, A, B, C and D, of four countries.

A			
14 520	**B**		
23 490	8 970	**C**	
33 260	18 740		**D**

(i) Write down the distance from A to D, giving the answer in standard form. [1]

(ii) Calculate the distance between C and D.[2]

4004/2 N2020 Q2(a)

(a) A rectangle with a width of $(x + 2)\ cm$ has a perimeter of $(8x + 2)\ cm$. Find an expression for the length of the rectangle. [2]

(b) Given that the area of the rectangle is 16 cm^2, form an equation in x and show that it reduces to $3x^2 + 5x - 18 = 0$. [3]

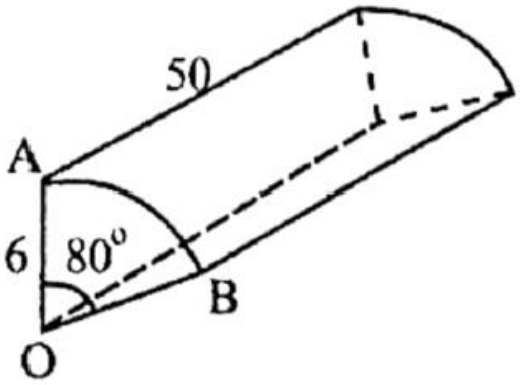
(c) Solve the equation $3x^2 + 5x - 18 = 0$, giving the answers correct to **three** significant figures. [5]

(d) Hence, find the perimeter of the rectangle. [2]

4004/2 N2020 Q7

In this question, take π to be 3,142.

In this diagram, sector OAB is the cross-section of a solid prism that is 50 cm long.



The radius of the sector is 6 cm and $A\hat{O}B = 80°$. Calculate the

(i) length of arc AB, [2]

(ii) total surface area of the prism. [3]

4004/2 N2020 Q9(a)

The sides of a parallelogram are of lengths $10\ cm$ and $8\ cm$. One of the interior angles of the parallelogram is 150°. Calculate the area of the parallelogram.

Use as much of the information given below as is necessary.

$[tan\ 30° = 0.577;\ cos\ 30° = 0.866;\ sin\ 30° = 0.5]$

[3]

4004/1 J2019 Q9

A right circular cone has a base diameter of 24 cm and a slant height of 15 cm. Calculate the

(a) vertical height of the cone, [2]

(b) volume of the cone in terms of π. [2]

$[volume\ of\ cone\ = \frac{1}{3}\pi r^2 h]$

4004/1 J2019 Q18

The diagram shows the cross-section of a garden shed. The cross-section ABCDE is made up of a rectangle measuring $2\ m$ by $2{,}2\ m$ and an isosceles triangle with a perpendicular height of $0{,}6\ m$ and a base of $2\ m$.

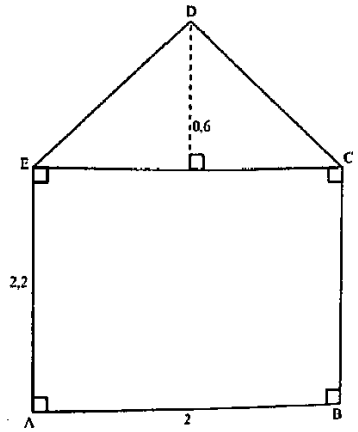
(a) Calculate the area of the cross-section. [3]

(b) If the shed is $3\ m$ long, calculate the volume of the shed. [2]

(c) It is given that $23\ m^2$, of the surface area of the shed need to be painted and that one tin of paint covers an area of $4{,}5\ m^2$. Calculate the number of tins of paint that have to be bought to cover the $23\ m^2$. [2]

(d) (i) Calculate the length of the edge DE. [2]

(ii) The sloping roof is to be covered by roofing material which costs \$6.40 per



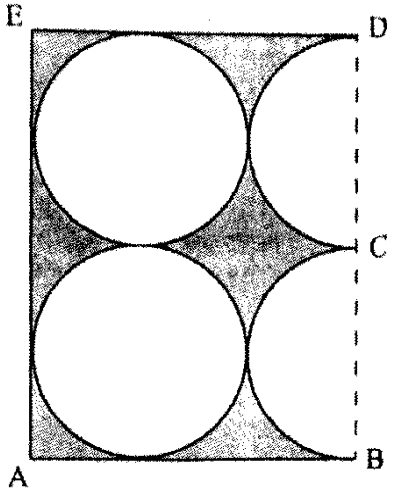
square metre. Calculate the cost of roofing material needed to cover the sloping roof. [3]

4004/2 J2019 Q11

[In this question take π to be $\frac{22}{7}$]

Two identical circular and 2 semi-circular discs of radii 3,5 cm were cut off from a rectangular sheet of metal as shown in the diagram.

AE = 14 cm and **ED** = 10,5 cm.



Calculate the

(a) circumference of one of the circular discs, [2]

(b) perimeter of **ABCDE**, [2]

(c) area of the shaded part. [3]

4004/1 N2019 Q25

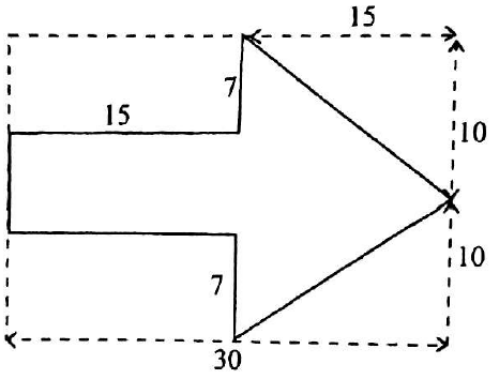
(a) A sweet shop sells cylindrical sweets each of diameter 3,8 cm and length 4,9 cm.

In this question take $\pi$to be $\frac{22}{7}$

(i) Calculate the volume of one sweet. [2]

(ii) If the mass of 1 cm^3 of the sweet is 0,63g, calculate the mass of a sweet, giving the answer to the nearest gramme. [2]

(b) The diagram shows an arrow for a signpost cut from a rectangular sheet of metal measuring 30 cm by 20 cm.



Calculate the

(i) area of the arrow, [3]

(ii) perimeter of the arrow. [4]

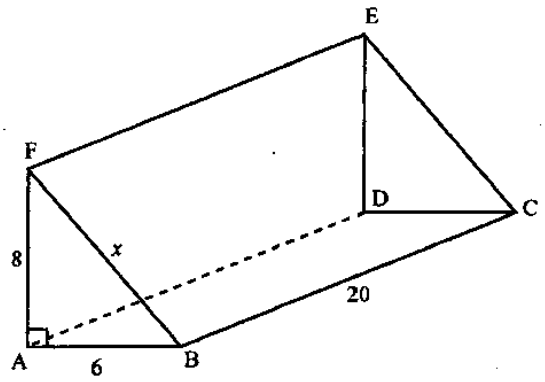
4004/2 N2019 Q4

A goods train left Johannesburg at 2030 on a Wednesday and arrived in Beitbridge after travelling for 27 hours 45 minutes.

(i) State the day on which the train arrived at Beitbridge. [1]

(ii) Find the time at which the train arrived at Beitbridge. [1]

4030/1 J2018 Q3(b)



In the diagram, ABCDEF is solid triangular prism. AB = 6 cm, BC = 20 cm, AF = 8 cm, FB = x cm and $\widehat{BAF} = 90°$.

(a) Find x. [2]

(b) Calculate the total surface area of the prism. [3]

4030/1 J2018 Q23

An open cylindrical water container has an internal height of 1,5 m and internal diameter of 0,75 m. Calculate the

(i) volume of the container, in litres, [3]

(ii) total internal curved surface area of the container. [3]

Take $\pi = \frac{22}{7}$.

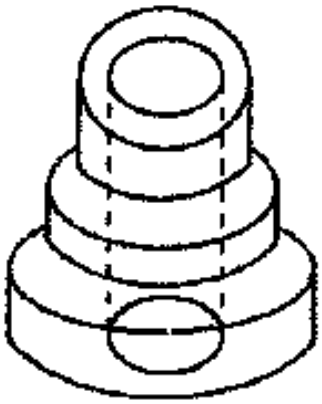
4030/2 J2018 Q7(a)

(a) Convert 00 45 in 12−hour notation. [1]

(b) Gortha's local time is 3 hours 45 minutes ahead of Harare's local time. Find the time in Harare when the time in Gortha is 21 23. [1]

4004/1 N2018 Q4

(a) The diagram shows a solid aluminum alloy casting for a pully which consists of 3 discs each $1\frac{1}{2}$ cm thick, of diameters 4 cm, 6 cm and 8 cm, with a central hole 2 cm in diameter.



Calculate the

(i) volume of aluminum used to make the casting, [4]

(ii) mass, in grammes, of the casting if the density of the alloy is 2,8 g/cm^3, [2]

(iii) total price of the casting if the alloy costs \$7,50 per gramme. [2]

(b) A triangular plot has two of its boundaries measuring 400 m and 440 m with an included angle of 46°. Calculate the area of the plot, giving the answer in hectares. [4]

4004/2 N2018 Q11

A solid cone has a base radius of 7 cm and a perpendicular height of 24 cm. Find the

(a) slant height, [2]

(b) volume of the cone. [2]

(Volume of Cone $= \frac{1}{3}\pi r^2 h$)

Take π to be $\frac{22}{7}$.

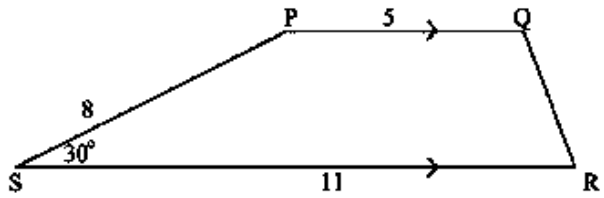
4030/1 J2017 Q17

The length of each side of an equilateral triangle is 8 cm.

(i) Calculate the area of the triangle. [2]

(ii) Express the area of the triangle in square metres. [2]

4030/2 J2017 Q3(c)



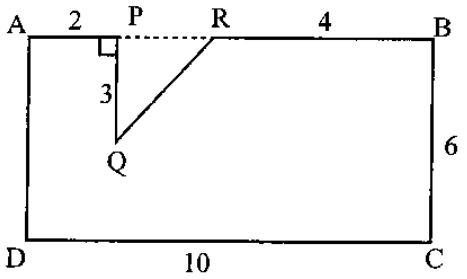
In the diagram, PQRS is a trapezium with PQ parallel to SR, PQ = 5 cm, PS = 8 cm, SR = 11 cm and $P\hat{S}R = 30°$.

Calculate the area of the trapezium. [3]

[Use as much of the information given below as is necessary].

[sin 30° = 0.500; cos 30° = 0.866; tan 30° = 0.577]

4030/1 N2017 Q14



The diagram shows a rectangle ABCD with DC = 10 cm and BC = 6 cm. Right-angled triangle PQR has been cut off, such that AP = 2 cm, PQ = 3 cm and BR = 4 cm. Calculate the perimeter of the shape APQRBCD. [2]

4030/2 N2017 Q1(b)

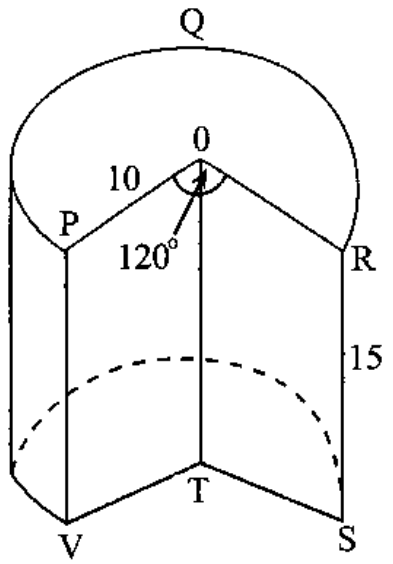
The diagram shows the cross-section OPQR of a cylindrical wooden block centre O that was cut with PORSTV removed, such that $P\hat{O}R = 120°$. The radius, OP, is 10 cm and the block is 15 cm high.

[Take π to be $\frac{22}{7}$.]

(i) Calculate the area of the cross-section OPQR. [2]

(ii) Calculate the volume of the block. [2]

(iii) Calculate the curved surface area of the block. [2]



4030/2 N2017 Q10(a)

A motorist left Masvingo for Beitbridge at 2102. The motorist spent 1 hour 30 minutes mending a puncture and 3 hours driving. The motorist's average speed for the journey was 64 km/h.

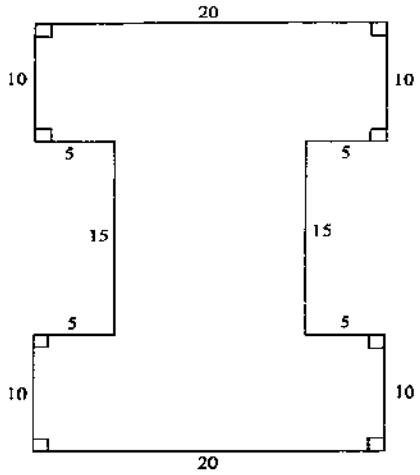
(a) Express 2102 as a time on the 12-hour notation. [1]

(b) Find the arrival time in Beitbridge in 24-hour notation. [1]

(c) Calculate the distance between Masvingo and Beitbridge. [1]

4030/1 J2016 Q20

The diagram shows the transverse cross-section of a steel bar which is 2 m long. The measurements are in centimetres.



(a) (i) Calculate the area of the cross-section. [3]

(ii) Calculate the volume of the bar. [2]

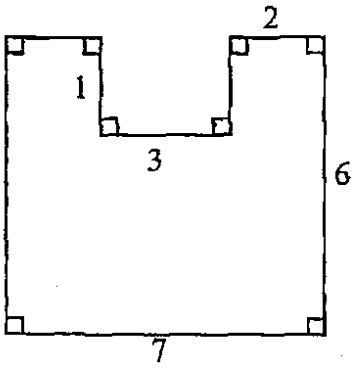
(iii) Given that the bar has a density of 7 800 kg/m^3, find the mass of the bar. [2]

(b) Calculate the total surface area of the bar, in cm^2. [3]

(c) The bar is to be coated with zinc at a cost of \$10,00 per square metre.
Calculate the cost of coating the bar. [2]

4030/2 J2016 Q12

The diagram represents the plan of a floor of a room. All dimensions are in metres and all marked angles are right angles.



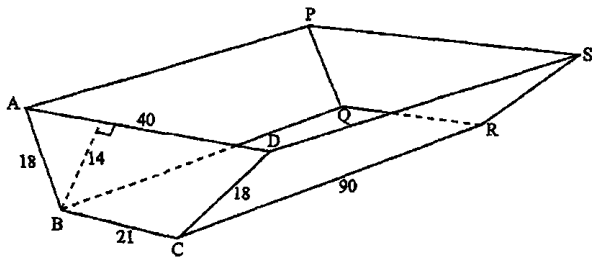
Calculate the

(a) perimeter of the floor, [2]

(b) area of the floor, [2]

(c) number of tiles to be fitted on the floor if the area of each tile is 625 cm^2. [2]

4030/1 N2016 Q27



The diagram shows a trough in the form of a prism whose cross section ABCD is a trapezium with AD parallel to BC and the measurements are in centimetres.

(a) (i) Calculate the area of the cross-section ABCD of the trough. [3]

(ii) Calculate the capacity of the trough when full. [2]

(b) The inside of the trough is to be painted. One litre of the paint covers an area of 1 496 cm^2.

(i) Calculate the area of the trough to be painted. [3]

(ii) Calculate the number of litres of paint needed to paint the inside of the trough to the nearest litre. [2]

(iii) Calculate the cost of the paint if one litre of the paint costs \$6,30. [2]

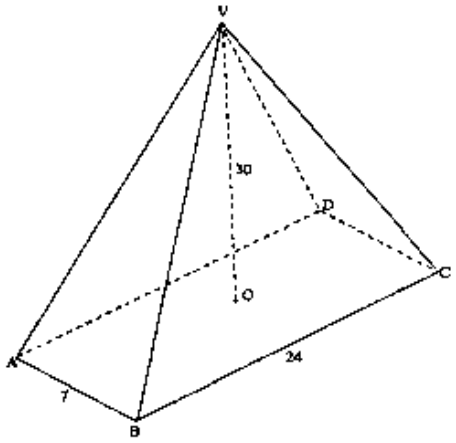
4030/2 N2016 Q7

In the diagram, VABCD is a right pyramid on a rectangular base ABCD. O is the centre of the rectangle ABCD with AB = 7 cm, BC = 24 cm and VO = 30 cm.

(i) Calculate the length of the diagonal AC, [2]

(ii) Calculate the length of the edge VA, [3]

(iii) Calculate the angle which the edge VA makes with the horizontal plane ABCD. [2]



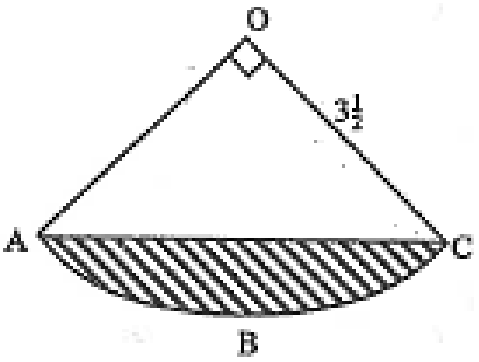
4030/2 N2016 Q9(a)

A jet plane leaves Harare for Praira at 2323. The journey takes 5 hours 33 minutes and Praira's time is 2 hours behind Harare's time.

(a) Express 2323 in 12 – hour notation. [1]

(b) Find the time in Praira when the jet arrives. [2]

4008/1 J2015 Q3



Take π to be $\frac{22}{7}$.

In the diagram OABC is a sector of a circle centre O and radius $3\frac{1}{2}$ cm.

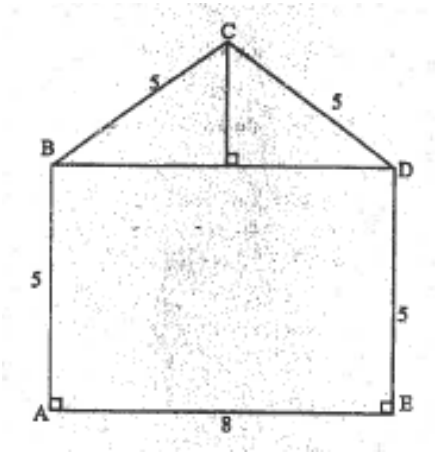
(a) State the name given to the shaded region. [1]

(b) Calculate the area of the shaded region. [2]

4008/1 J2015 Q19

The diagram ABCDE is a cross-section of a tobacco shed that is 20 m long. AB = BC = CD = DE = 5 m and AE = 8 m. Calculate the

(i) perpendicular height of C above the side BD,
(ii) area of the cross-section ABCDE,
(iii) volume of the shed,
(iv) number of bales of tobacco that can be stored in the shed up to BD, given that each bale has a volume of 4 m^3. [9]



4028/2 J2015 Q7(b)

In an athletics competition, under 20 boys compete in a 5 000 m race, while under 16 boys compete in a 3 000 m race.

(a) Calculate the difference in the distances they run giving the answer in standard form. [2]
(b) A lap is 400 m long. Find the number of laps in the 5 000 m race. [1]

4028/1 N2015 Q3

A luxury coach leaves Bulawayo for Harare every morning at 7.30 am and arrives in Harare at 1.00 pm.

(a) Express the departure time as a time in the 24-hour notation. [1]
(b) Calculate the total time taken to travel from Bulawayo to Harare. [1]
(c) Calculate the average speed of the bus to the nearest whole number if the distance from Bulawayo to Harare is 439 km. [2]

4028/1 N2015 Q18

The area of a trapezium is 63 cm^2 and the sum of the lengths of its two parallel sides is 22,5 cm. Calculate the perpendicular distance between the two parallel sides. [2]

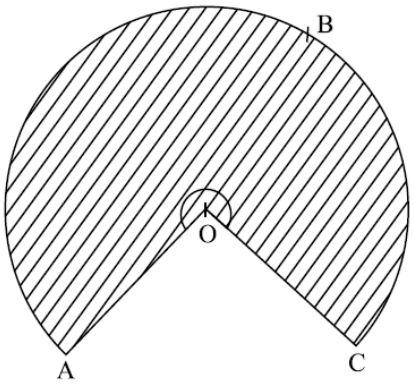
4028/2 N2015 Q3(c)

In this question take π to be $\frac{22}{7}$.

$$\begin{bmatrix}\text{curved surface area} = \pi rl \\ \text{volume of cone} = \frac{1}{3}\pi r^2 h\end{bmatrix}$$

(a) A right cone, made of paper, has a base radius of 8 cm and a slant height of 10 cm.
(i) Calculate for the cone, the perpendicular height, [2]
(ii) Calculate for the cone, the curved surface area, [2]
(iii) Calculate for the cone, the volume. [2]

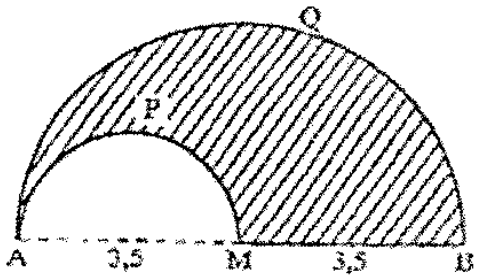
(b) The cone is cut open to make a sector ABC of a circle centre O as shown in the diagram.



Calculate reflex A$\hat{O}$C. [3]

(c) Another cone, PQR, which is similar to the right cone in (a) has a slant height of 18 cm. Calculate the base area of the cone PQR. [3]

4028/2 N2015 Q12



The diagram shows two semi circles APM and AQB. AM = MB = 3.5 cm.
Take π to be $\frac{22}{7}$, calculate the perimeter of the shaded region. [3]

4028/1 J2014 Q23(b)

(a) Calculate the volume of a copper ball of radius 3 cm. [2]
(b) The copper ball in **(a)** is melted and recast into cylindrical rods each of diameter 0,3 cm and length 15 cm.
(i) Calculate the volume of each rod.[2]
(ii) Find the number of copper rods that

can be made from the copper ball. [2]

(c) Each of the copper rods in **(b)** is bent to form a circular bangle.
Calculate the radius of the bangle. [2]

(d) If each bangle is to be coated with silver paint at a cost of $5c \ per \ cm^2$, calculate the total cost of coating all the bangles so formed, giving
your answer correct to the nearest cent. [4]

$$\left[\text{Volume of a sphere} = \frac{4\pi r^3}{3}, \quad \pi = \frac{22}{7}\right]$$

4028/2 J2014 Q7

The density of a certain stone is known to be $2{,}5 \ g/cm^3$. Calculate the volume, in cm^3, of a piece of the stone with a mass of 7,5 kg. [3]

4008/1 N2014 Q10

(a) Below is a list of some of the units used in measuring quantities.

hour ; hectare ; kilometre ; kilogramme ; degree

Write down the unit of area from the given list. [1]

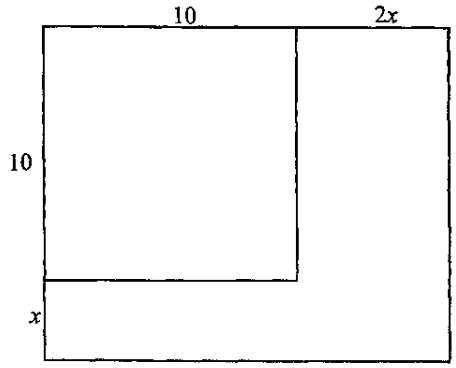
(b) Find the capacity, in litres, of a cylindrical tank of height 3,5 m and diameter 4 m. [3]
[Take π to be $\frac{22}{7}$]

4008/1R N2014 Q17

A train that is scheduled to arrive in Bulawayo at 0027 is delayed by 3 hours 47 minutes. Find the time at which it arrives in Bulawayo. [2]

4008/2 N2014 Q1(d)

A farmer has a square orchard of side $10 \ m$. He decides to extend it by increasing the length of one side by x metres and the other by $2x$ metres as shown in the diagram below.



(a) Write down an expression for the total area of the extended orchard and show that it simplifies to $2x^2 + 30x + 100$. [2]

(b) Write down and simplify an expression for the area of the extension. [2]

(c) Given that the area has increased by $87{,}5 \ m^2$, form an equation in x and show that it reduces to $2x^2 + 30x - 87{,}5 = 0$. [2]

(d) Solve the equation
$2x^2 + 30x - 87{,}5 = 0$. [4]

(e) Write down the actual length of the extended orchard. [2]

4008/2 N2014 Q7

Simplify

	hrs	min	sec
	10	25	42
+	8	41	30

[2]

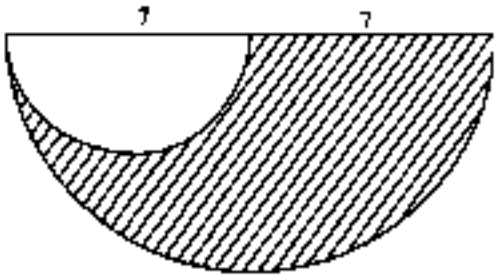
4008/2R N2014 Q1(a)(i)

A car tank holds $22\frac{1}{2}$ litres of fuel when it is $\frac{3}{8}$ full. Calculate the amount of fuel when it is full. [2]

4008/2R N2014 Q1(b)

The trapezium PQRS, in which QR is parallel to PS, is such that $PS = 11$ cm, $PQ = 5$ cm and $Q\hat{P}S = 90°$. If the area of the trapezium is $45 cm^2$, find the length of QR. [2]

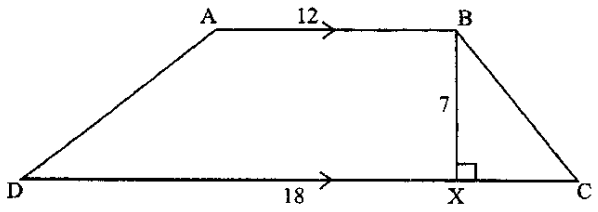
4008/2R N2014 Q9(a)



Use $\frac{22}{7}$ for π

The diagram shows two semi-circles with diameters 7 cm and 14 cm.
Calculate
(i) the area of the shaded part,
(ii) the perimeter of the shaded part. [4]

4008/2R N2014 Q10(a)



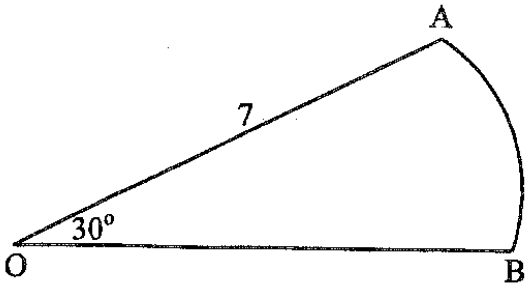
In the diagram, ABCD is a quadrilateral in which AB is parallel to DC, AB = 12 cm, CD = 18 cm, BX = 7 cm and $B\hat{X}C = 90°$.

(a) State the special name given to the quadrilateral ABCD. [1]

(b) Calculate the area of the quadrilateral. [2]

4028/1 J2013 Q6

In the diagram, OAB is a sector of a circle of radius 7 cm and $A\hat{O}B = 30°$.



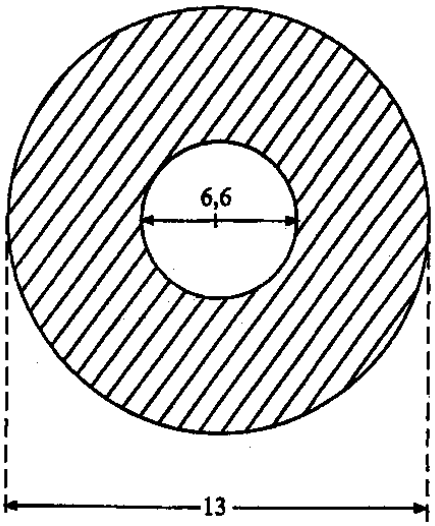
Calculate

(a) the length of the arc AB, [2]

(b) the area of the sector AOB. [2]

Use $\pi = \frac{22}{7}$

4028/1 J2013 Q16



Take π to be $\frac{22}{7}$

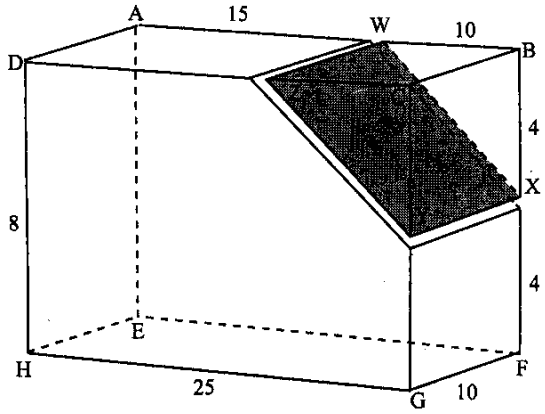
The diagram shows a Compact Disc (CD) for information storage. The useful part is shaded. The inside and outside diameters are 6.6 cm and 13 cm respectively.

Find (i) the shaded area,

(ii) the percentage area of the disc that is useful. [6]

4028/2 J2013 Q2(c)

In the diagram, ABCDEFGH is a rectangular block of wood 25 cm long, 10 cm wide and 8 cm high. The block is sawn along the plane WXYZ to form a wedge WBXYCZ.



Calculate

(a) the area of the plane WXYZ, [2]

(b) the area of triangle ZCY, [2]

(c) angle CZY, [2]

(d) the surface area of the wedge, [3]

(e) the percentage volume of wood removed. [3]

4028/2 J2013 Q10

The temperature inside a freezer is −8°C. During a power cut the temperature rose by 12°C. Find the temperature after the rise. [1]

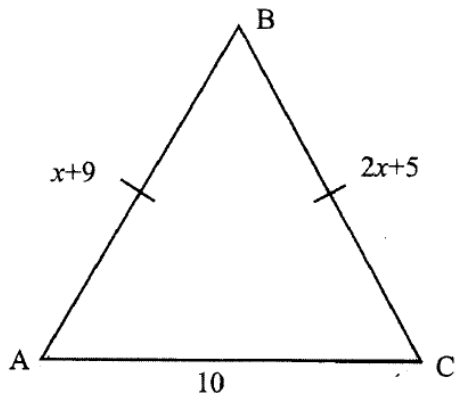
4008/1 N2013 Q3(a)

(a) Express 200 km/h as a speed in km/min. [1]

(b) Find the time taken for a racing driver to cover a 120 km race if he travels at a speed of 200 km/h, giving your answer in minutes. [2]

4008/1 N2013 Q9

In the diagram, ABC is an isosceles triangle with AB = BC. AB = $(x + 9)$ cm, BC = $(2x + 5)$ cm and the base, AC = 10 cm.

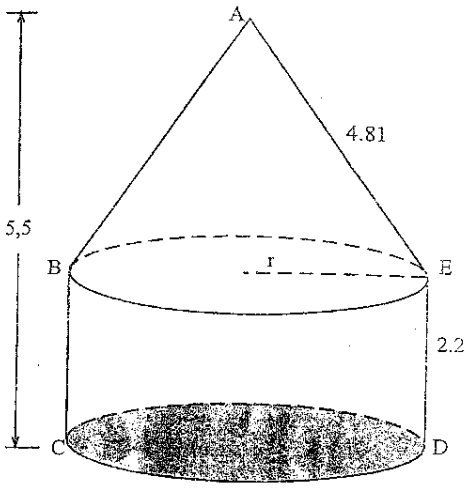


(i) Form an equation in terms of x and solve it.
(ii) Write down the length of BC.
(iii) Calculate the area of triangle ABC.
(iv) Given that all the lengths of the sides of ΔABC were given to the nearest centimetre, calculate the **least** possible perimeter of the triangle. [9]

4008/2 N2013 Q3(b)

A rectangle measures $(5x - 2)$ cm and $(x + 1)$ cm.
(a) Write down an expression for the area of the rectangle in terms of x. [1]
(b) Given that the area of the rectangle is $12\ cm^2$, form an equation and show that it reduces to $5x^2 + 3x - 14 = 0$. [2]
(c) Solve the equation $5x^2 + 3x - 14 = 0$. [2]
(d) Hence find the length of the rectangle. [1]

4008/1 J2012 Q12



Use $\pi = \frac{22}{7}$

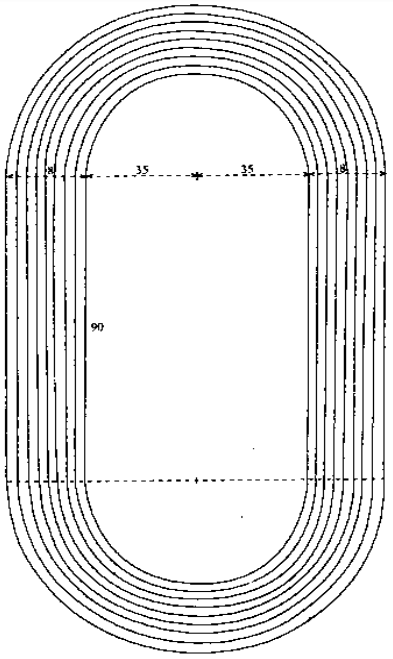
In the diagram, ABCDE is a composite solid which is made up of a cylinder and a cone with a common radius r metres. AE = 4,81 m and DE = 2,2 m.
Calculate
(i) the common radius of the solid,
(ii) the surface area of the solid excluding the shaded base,
(iii) the volume of the solid. [7]
[Curved surface area of a cone $= \pi rl$]
[Volume of a cone $= \frac{1}{3}\pi r^2 h$]

4008/2 J2012 Q10(b)

The diagram shows an athletics running track enclosing a rectangular field 90 m by 70 m, with semi-circular ends. The track is made up of 8 lanes each 1 m wide.

Use $\frac{22}{7}$ for π

(a) Calculate
(i) the length of the inner boundary of the first lane,
(ii) 1. the length of the inner boundary of the second lane,
2. the distance between the starting points of lane 1 and lane 2 if competitors in lanes 1 and 2 are to run the same distance in one lap,



(iii) the area covered by the 8-lane running track. [10]
(b) The track is to be covered by an artificial grass costing $200 per square metre.
Calculate the cost of covering the track. [2]

4008/2 N2012 Q9

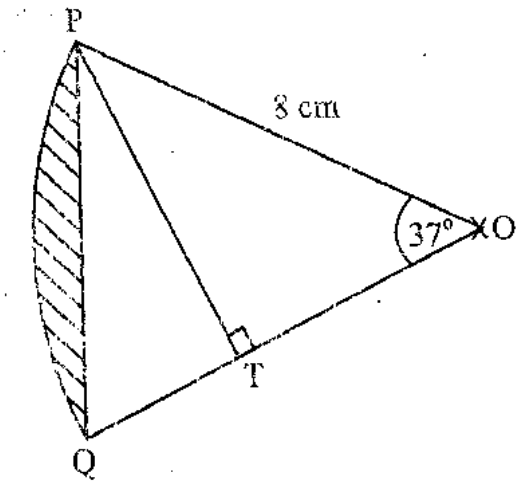
In this question take π to be 3,14.
A spherical ball is 20 centimetres in diameter.
Calculate
(a) the surface area of the ball, [2]

(b) the volume of the ball, correct to the nearest whole number. [3]

$$\left[\begin{array}{c}\text{Surface area} = 4\pi r^2 \\ \text{Volume} = \frac{4}{3}\pi r^3\end{array}\right]$$

4008/4028/1 J2011 Q27

The diagram shows a sector of a circle centre O. $P\hat{O}Q = 37°$, PO = 8 cm and PT is perpendicular to QO.



Calculate

(i) PT,

(ii) area of the sector,

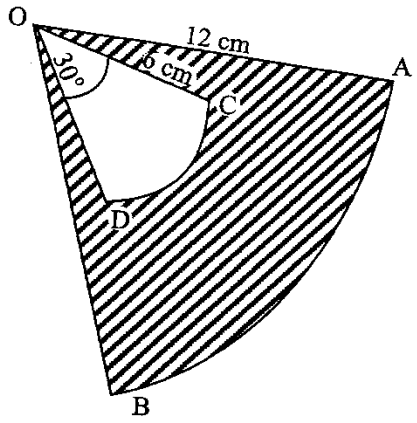
(iii) area of triangle PQO,

(iv) the area of the shaded segment. [7]

Take π to be 3,142.

4008/2 J2011 Q3(b)

In the diagram, OAB is a sector of a circle centre O and radius 12 cm and angle AOB = 50°. OCD is a sector of a circle centre O and radius 6 cm and angle COD = 30°.



Calculate, in terms of π,

(a) the area of the shaded part, [3]

(b) the perimeter of the shaded area AOCDOBA. [3]

4008/1 N2011 Q22

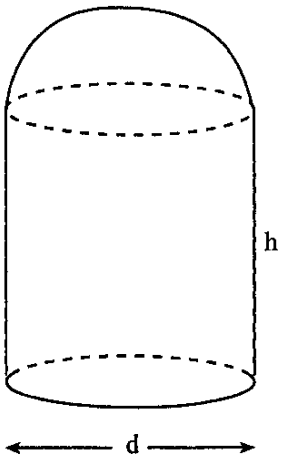
An office is 4,35 m long and 3,62 m wide.
Its floor is to be carpeted at a cost of $15,99 per square metre. Calculate

(i) the area of the floor,

(ii) the cost of carpeting the floor. [4]

4028/2 N2011 Q2(d)

A salt shaker is made up of a cylinder of height h and a hemisphere of internal diameter d as shown below.



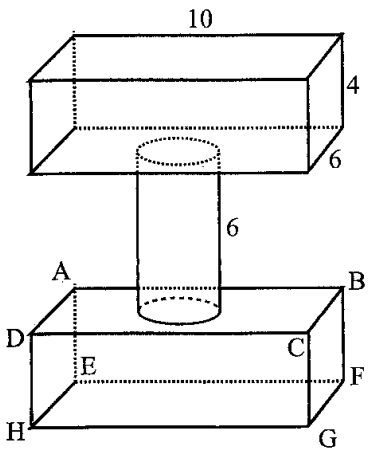
(i) Write down an expression for the volume of the salt shaker in terms of π, d and h.

(ii) Find the internal volume of the salt shaker if $h = 11$ cm and $d = 3{,}5$ cm, leaving the answer in terms of π. [5]

[Volume of sphere $= \frac{4\pi r^3}{3}$]

4028/2 N2011 Q3(c)

The diagram shows a metal object made up of two identical cuboids and a cylinder riveted together. The cuboids have dimensions 10 cm by 6 cm by 4 cm. the cylinder has a height of 6 cm and a diameter of 4 cm.

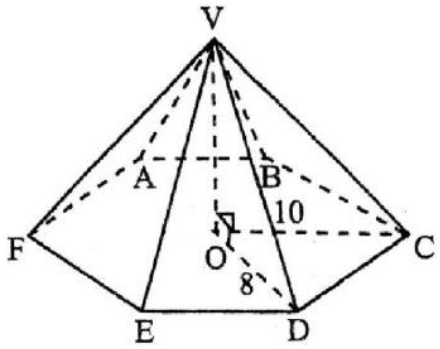


Take π to be $\frac{22}{7}$

(a) Calculate
(i) the exposed area of ABCD,
(ii) the surface area of cuboid ABCDEFGH,
(iii) the curved surface area of the cylinder,
(iv) the total surface area of the object. [9]

(b) Given that the volume of the metal used is 555,4 cm^3 and that the density of the metal is 9 000 kg/m^3, calculate, giving your answer correct to the nearest kg, the mass of the object. [3]

4028/2 N2011 Q7



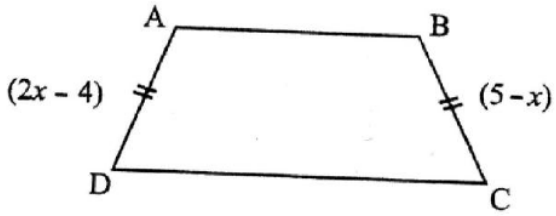
The diagram shows a right pyramid whose base ABCDEF is a regular hexagon of centre O.
$OD = 8\,m$, $VD = 10\,m$ and the area of triangle $DOC = 15{,}6\,m^2$.

(a) Show that the height (VO) of the pyramid is $6\,m$. [1]

(b) Find the volume of the pyramid. [2]

[Volume of pyramid $= \frac{1}{3}$ base area $\times$ height]

4008/4028/1 J2010 Q18



ABCD is an isosceles trapezium with AD = BC.

(a) Given that AD $= (2x - 4)cm$ and BC $= (5 - x)cm$, form an equation in x and solve it. [1]

(b) Given also that AB $= (2x + 6)cm$ and DC $= 14\ cm$, find the numerical value of the perimeter of the trapezium. [2]

4008/4028/1 J2010 Q25

---

120 kg of a certain metal has a volume of 0,4 m^3. Find the density of the metal, giving your answer in g/cm^3. [2]

4028/2 J2010 Q2(b)

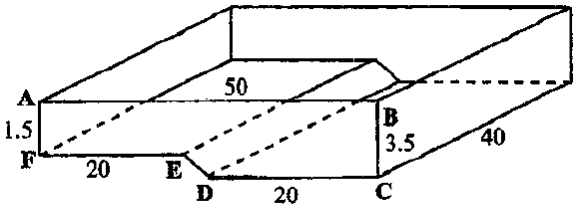
Triangle ABC is such that BC = x metres and the perpendicular distance of A from BC is $(3x - 5)$ metres. Given that the area of the triangle ABC is $4\ m^2$,

(i) form an equation in x and show that it reduces to $3x^2 - 5x - 8 = 0$, [2]

(ii) solve this equation for x, giving your answers correct to 2 decimal places, [5]

(iii) **hence** write down the distance of A from BC. [1]

4028/2 J2010 Q10(b)

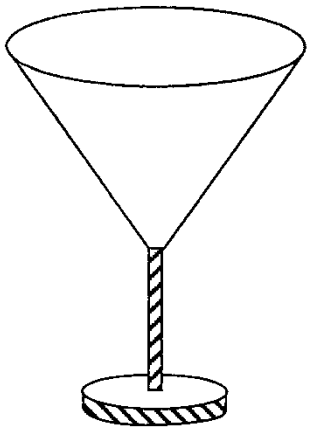


The diagram shows a swimming pool of uniform cross-section ABCDEF, of length 50 m and breath 40 m. AB = 50 m, BC = 3,5 m, DC = FE = 20 m, AF = 1,5 m and $B\hat{A}F = A\hat{F}E = B\hat{C}D = A\hat{B}C = 90°$.

(a) Calculate
(i) the cross-sectional area ABCDEF, [3]
(ii) the capacity of the swimming pool, giving your answer in kilolitres, [1]
(iii) the length of DE. [2]

(b) The vertical walls of the pool are to be painted. Given that 7 litres of paint is needed to cover 10 m^2 of wall surface and that the paint is sold in 5 litre tins at a cost of $27 000 per tin. Calculate
(i) the total area to be painted, [2]
(ii) the number of tins of paint to be bought, [3]
(iii) the amount of money needed to buy the paint. [1]

4028/2 J2010 Q11



(a) The diagram shows a wine glass in the shape of a cone mounted on a stand. The depth of the cone is equal to its diameter at the top.

(i) Write down an expression for the volume of the cone in terms of its radius r and π.

(ii) If the wine glass can hold 20 ml of wine when full, calculate the radius of the wine glass at the top.

(iii) Wine is bought in bottles of volume 750 ml. Calculate the number of wine glasses that can be filled from one bottle. [5]

$[\text{Volume of cone} = \frac{1}{3} \text{ base area } \times \text{height}. \pi = \frac{22}{7}]$

(b) The base of triangle is x cm and its height is $(x - 7)$ cm.

(i) Write down an expression for the area of the triangle.

(ii) If the area of the triangle is $6\ \text{cm}^2$, form an equation in x and show that it reduces to $x^2 - 7x - 12$. [3]

4008/2 N2010 Q7

NUMBER$_{BASES}$

(a) Convert 301_4 to a number in *base* 10. [1]
(b) Evaluate
(i) $1101_2 + 111_2$, giving the answer in *base* 2, [1]
(ii) $131_5 - 42_5$, giving the answer in *base* 5. [1]

4004/1 J2020 Q6

Simplify $11011_2 + 243_5$, giving your answer in *base* 5. [3]

4004/2 J2020 Q1(e)

(a) Express $2^4 + 2^3 + 1$ as a number in *base* 2. [1]
(b) Evaluate
(i) $343_5 + 44_5$, giving the answer in *base* 5, [1]
(ii) $674_8 - 75_8$, giving the answer in *base* 8. [1]

4004/1 N2020 Q3

A three-digit number in base n is given as 147_n.
(i) Write down the least possible value of n. [1]
(ii) If $147_n = 324_6$, find the possible value of n. [4]

4004/2 N2020 Q2(b)

(a) Convert
(i) 434_5 to *base ten*, [1]
(ii) 75_{10} to *base two*. [1]
(b) Evaluate $377_8 + 411_8$, leaving the answer in *base* 8. [1]

4004/1 J2019 Q4

(a) Express 2214_5 in powers of 5. [1]
(b) Find n given that $101_n = 37_{10}$. [2]

4004/1 N2019 Q9

(a) Simplify $1044_8 - 175_8$, giving the answer in *base* 8. [1]
(b) Convert 10111_2 to a number in *base* 6. [2]

4030/1 J2018 Q6

Find the value of n given that $111_n = 7_{10}$. [3]

4030/2 J2018 Q5(c)

(a) Express $4 \times 5^3 + 3 \times 5^2 + 2$ as a number in *base* 5. [1]
(b) Evaluate
(i) $10111_2 + 1010_2$, giving the answer in *base* 2, [1]
(ii) $512_7 - 435_7$, giving the answer in *base* 7. [1]

4004/1 N2018 Q3

It is given that $244_n + 32_n = 331_n$. Find the value of n. [2]

4030/2 J2017 Q3(a)

(a) Convert 1001_2 to a number in *base* 6. [2]
(b) Given that $111_n = 73_{10}$, find the value of n. [2]

4030/1 N2017 Q20

(a) Expand 1234_5 in powers of 5. [1]
(b) Evaluate $1011_2 + 111_2$, giving the answer in *base* 2. [2]

4030/1 J2016 Q7

(a) Evaluate $413_5 - 34_5$, giving the answer in *base* 5. [1]
(b) Express 78_9 as a number in *base* 6. [2]

4030/1 N2016 Q4

Write down $1 \times 2^4 + 1 \times 2^3 + 1 \times 2^1$ as a number in *base* 2. [1]

4028/1 J2015 Q4(a)

(i) Convert 65_{10} to a number in *base* 3.
(ii) Simplify $3102_4 + 11101_2$, giving the answer in *base* 4. [4]

4028/2 J2015 Q4(b)

(a) Express $1 \times 3^5 + 2 \times 3^3 + 3$ as a number in *base* 3. [1]
(b) Convert 101_{10} to a number in *base* 9. [1]
(c) Evaluate $203_7 - 154_7$, giving the answer in *base* 7. [1]

4028/1 N2015 Q5

(a) Express $3^4 + 3^2 + 3$ as a number in *base* 3. [1]
(b) Evaluate
(i) $143_8 - 57_8$, giving your answer in *base* 8, [1]
(ii) $4_5 - 2_3 + 1_2$, giving your answer in *base* 10. [1]

4008/1 J2014 Q10

Evaluate $212_3 + 122_3$ giving your answer in *base three*. [1]

4008/1 N2014 Q20(a)

Express 10111_2 as a number in *base* 5. [3]

4008/2 N2014 Q1(c)

Convert 372_8 to a number in *base* 10. [1]

4008/1R N2014 Q13(a)

(a) Write down the greatest possible digit of a number in *base* 8. [1]
(b) Convert 111_5 to a number in *base* 2. [2]

4038/1 J2013 Q18

(a) Write down the largest four-digit number in *base eight*. [1]
(b) Convert 111_8 to a number in *base two*. [2]
(c) Find the sum of 444_5 and 21_5 giving your answer in *base five*. [1]

4008/1 N2013 Q16

Find p in *base eight* such that $p_8 + 234_5 = 421_5$. [3]

4008/1 J2012 Q5

If $120_3 = 13_n + 10_n$, find the value of n. [3]

4008/1 N2012 Q13

Express $5^2 + 3 \times 5 + 4$ as a number in
(a) *base* 5, [1]
(b) *base* 8. [2]

4008/4028/1 J2011 Q7

(i) Convert 112_3, to a number in *base* 5.
(ii) Evaluate $1101_2 + 1011_2$, giving your answer in *base* 2. [3]

4008/2 J2011 Q5(a)

(a) Evaluate $765_8 - 567_8$, giving your answer in *base eight*.
(b) Express $5^3 + 4$ as a number in *base five*.
(c) Convert 13_{10} to a number in *base two*. [3]

4008/1 N2011 Q11

(a) Convert 408 to a number in *base* 6. [1]
(b) Write down $2 \times 3^4 + 1 \times 3^2 + 2 \times 3^1$ as a number in *base* 3. [1]
(c) Given that $42_x + 53_x = 125_x$, find the value of x. [1]

4008/4028/1 J2010 Q4

Simplify, giving your answer in *base* 8,
$503_8 - (226_8 + 167_8)$ [2]

4008/1 N2010 Q21(a)

ORDINARY & STANDARD FORM

The population of a certain country is 24.9 million. Express this population in standard form. [2]

4004/2 J2020 Q1(b)

(a) Express in standard form
(i) 618 000, [1]
(ii) 0.000 423. [1]
(b) Evaluate $(8.76 \times 10^{-2}) + (7.89 \times 10^{-2})$, leaving the answer in standard form. [2]

4004/1 J2019 Q22

(i) Express 3598 as a number in standard form. [1]

4030/1 J2018 Q1(a)

(a) Express 6.07×10^4 in ordinary form. [1]
(b) Evaluate $2.53 \times 10^1 + 6.1 \times 10^{-1}$, giving the answer in standard form. [2]

4004/1 N2018 Q5

It is given that $p = 3.6 \times 10^4$ and $q = 9 \times 10^{-4}$. Find, giving the answer in standard form,
(a) pq, [2]
(b) $\frac{p}{q}$. [2]

4030/1 J2017 Q14

Express 99,987 in standard form. [1]

4030/1 N2017 Q1(c)

Find the exact value of $4mn$ when $m = 4 \times 10^4$ and $n = 5 \times 10^{-9}$, giving the answer as a decimal. [2]

4030/1 N2017 Q15(b)

Simplify $(3 \times 10^2) - (2 \times 10^{-1})$, giving the answer in standard form. [2]

4030/2 N2017 Q5(b)(ii)

Given that $r = 9 \times 10^6$, evaluate, leaving the answers in standard form,
(a) $2r$, [1]
(b) r^2, [1]
(c) $\sqrt{r}$. [1]

4030/1 J2016 Q14

Express 2.54×10^{-1} in ordinary form. [1]

4030/1 N2016 Q2(a)

Express 0.098 in standard form. [1]

4008/1 J2015 Q1(c)

Given that $p = 0.045$ and $r = 2.513 \times 10^{-4}$,
(i) express p in standard form,
(ii) evaluate pr giving the answer in standard form. [2]

4028/2 J2015 Q1(c)

In an athletics competition, under 20 boys compete in a 5 000 m race, while under 16 boys compete in a 3 000 m race. Calculate the difference in the distances they run giving the answer in standard form. [2]

4028/1 N2015 Q3(a)

In 1998, the population of a village was 2.8×10^2. In 2004, the population was 3.5×10^2. Calculate the percentage increase of the population from 1998 to 2004. [2]

4008/1 J2014 Q7(b)

Giving your answer in standard form, find 25% of 3.168×10^{-4}. [2]

4028/2 J2014 Q1(c)

Simplify $1.11 \times 10^5 \div 3.7 \times 10^{-3}$, expressing your answer in standard form. [2]

4008/1 N2014 Q13(b)

Express 0.07649 in standard form. [1]

4008/1R N2014 Q1(a)

The population of town A is 4.5×10^4 and that of town B is 3.9×10^4.
(a) Calculate the difference between the two populations. [1]
(b) The population of town A is 125% greater than what it was forty years ago. Calculate the population of town A forty years ago. Give the answer in standard form. [2]

4008/1R N2014 Q6

Given that $x = 2.25 \times 10^6$ and $y = 4 \times 10^{-20}$, find the numerical value of $\sqrt{\frac{x}{y}}$, giving the answer in standard form. [3]

4008/2R N2014 Q1(d)

Find n such that $0.0075 = 7.5 \times 10^n$. [1]

4028/1 J2013 Q3(a)

Evaluate $\frac{(0.3)^3 \times 0.02}{0.0008}$, giving your answer in standard form. [3]

4008/1 N2013 Q2

Simplify the following, giving your answers in standard form.

(a) $\sqrt{6250000}$ [2]

(b) 5^{-2} [2]

4008/1 J2012 Q14

Express 754.96 in standard form. [1]

4008/1 N2012 Q1(b)

If $m = 2{,}6 \times 10^{-3}$ and $n = 4{,}0 \times 10^{7}$, calculate mn, giving your answer in standard form. [2]

4008/2 N2012 Q1(d)

Evaluate $3.25 \times 10^4 \times 10^{-6}$, giving the answer in standard form. [1]

4008/1 N2011 Q4(a)

The virus that causes the common cold is $5 \times 10^{-7}\ m$ long. Giving the answer in standard form, find the total length of 12 000 such viruses. [3]

4008/2 N2011 Q1(b)

(a) Write down, in ordinary form, the value of 4.32×10^4. [1]

(b) Given that $M = 3.6 \times 10^2$ and $N = 8 \times 10^{-1}$, find in standard form, the value of

(i) MN, [1]

(ii) $M + N$. [1]

4008/4028/1 J2010 Q2

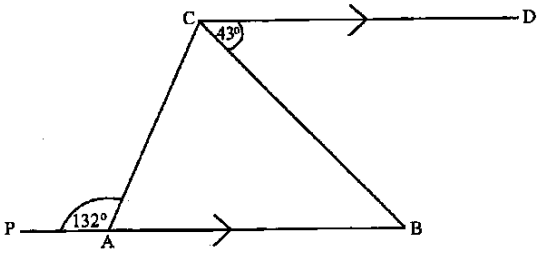
Given that $m = 2 \times 10^3$ and $n = 5 \times 10$, evaluate, giving your answer in standard form.

(a) $m + n$, [1]

(b) $\frac{n}{m}$. [2]

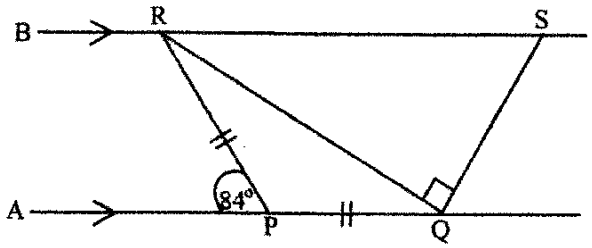
4008/4028/1 N2010 Q3

POINTS, LINES & ANGLES



In the diagram, PAB is a straight line and is parallel to CD. $P\hat{A}C = 132°$ and $B\hat{C}D = 43°$.
Calculate $A\hat{C}B$. [2]

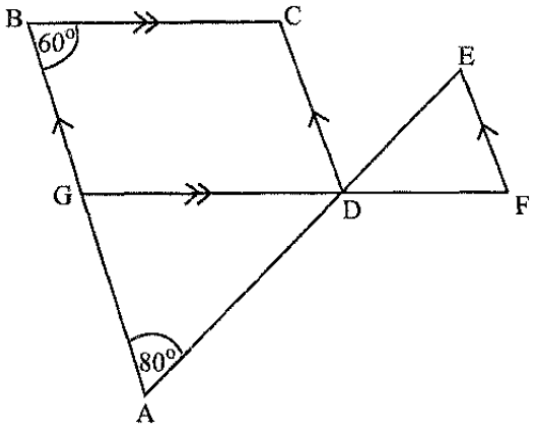
4030/2 J2018 Q2(a)



In the diagram AQ and BS are parallel lines such that PQ = PR, $A\hat{P}R = 84°$ and $R\hat{Q}S = 90°$.

Find (a) $P\hat{R}Q$, [1]
(b) $Q\hat{R}B$, [1]
(c) $Q\hat{S}R$. [1]

4004/1 N2018 Q6

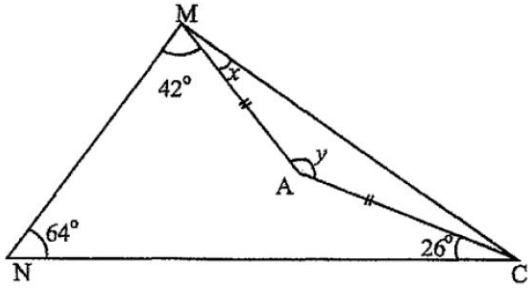


In the diagram AB, DC and FE are parallel. BC is parallel to GF. $G\hat{B}C = 60°$ and $B\hat{A}D = 80°$. Find

(a) $B\hat{G}D$, [1]
(b) $A\hat{D}G$, [1]
(c) $D\hat{E}F$. [1]

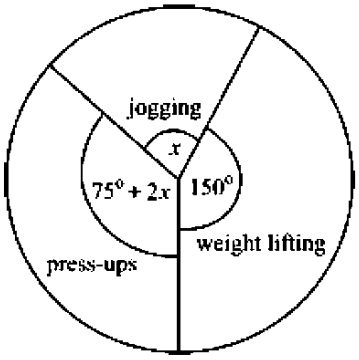
4030/1 J2016 Q13

In the diagram, MNC is a triangle in which $M\hat{N}C = 64°$. A is a point inside the triangle such that AM = AC, $A\hat{M}N = 42°$, $A\hat{C}N = 26°$, $A\hat{M}C = x°$ and $C\hat{A}M = y°$.



(i) Find the value of y, [2]
(ii) Find the value of x. [2]

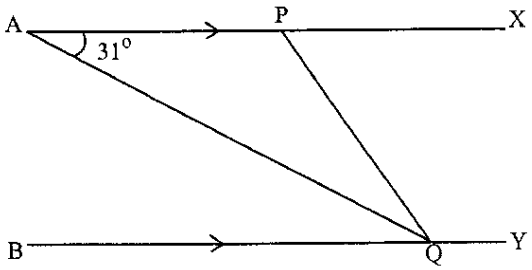
4030/2 N2016 Q3(a)



The pie chart shows the distribution of an athlete's daily exercise programme.

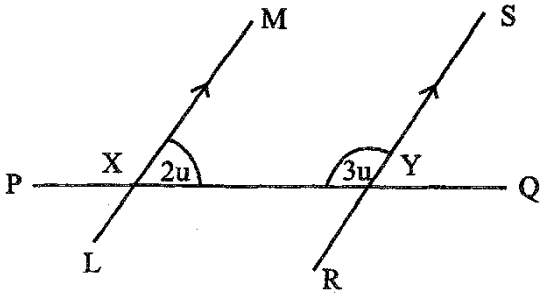
(a) Calculate the value of x. [1]
(b) If the athlete spent 18 minutes jogging, calculate
  (i) the time the athlete spent on weight lifting, [1]
  (ii) the total time spent exercising. [2]

4028/1 N2015 Q20



In the diagram, APX and BQY are parallel straight lines and AQ is the bisector of $P\hat{Q}B$.
Given that $P\hat{A}Q = 31°$, calculate $A\hat{P}Q$. [2]

4028/2 J2014 Q1(d)



In the diagram, LM and RS are two parallel straight lines and PQ cuts LM and RS at X and Y respectively.

Given that $M\hat{X}Y = 2u°$ and $X\hat{Y}S = 3u°$, calculate

(i) the value of u, [2]

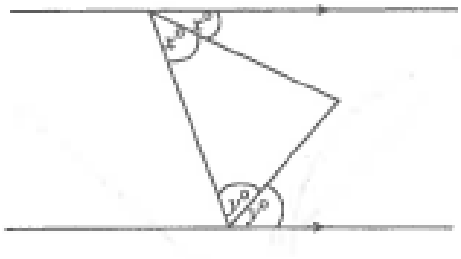
(ii) $X\hat{Y}S$, [1]

(iii) $P\hat{X}L$ [1]

4008/1 N2014 Q20(b)

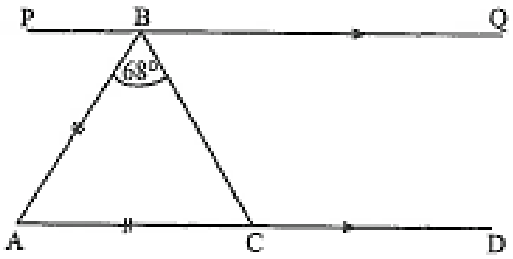
(i) Write down the special name given to two angles that add up to 180°. [1]

(ii) The diagram shows a triangle between two parallel lines.



Find the value of $x + y$. [2]

4008/1R N2014 Q24(a)



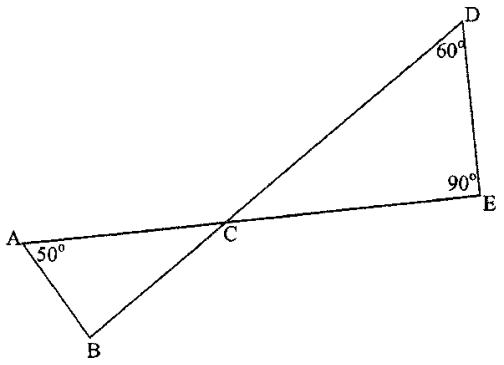
In the diagram, ABC is an isosceles triangle with AB = AC and $A\hat{B}C = 68°$. ACD is parallel to PBQ.

Calculate (i) $B\hat{C}D$,

(ii) $P\hat{B}A$. [4]

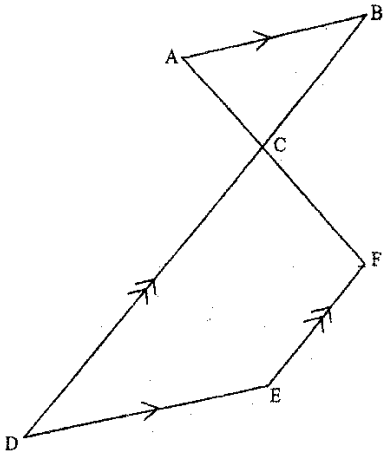
4008/2R N2014 Q3(c)

In the diagram ACE and BCD are straight lines intersecting at C. Given that $C\hat{E}D = 90°$, calculate $A\hat{B}C$. [2]



4028/1 J2013 Q3(b)

In the diagram, AB is parallel to DE. DB is parallel to EF. ACF and DCB are straight lines.



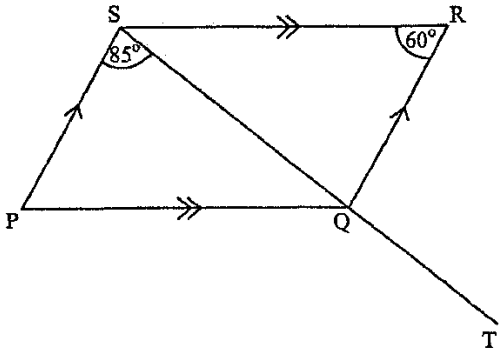
Given that $D\hat{E}F = 140°$, calculate

(a) $C\hat{D}E$, [1]

(b) $A\hat{B}C$, [1]

(c) the size of $D\hat{C}F$ which makes CDEF a cyclic quadrilateral. [1]

4008/1 J2012 Q11



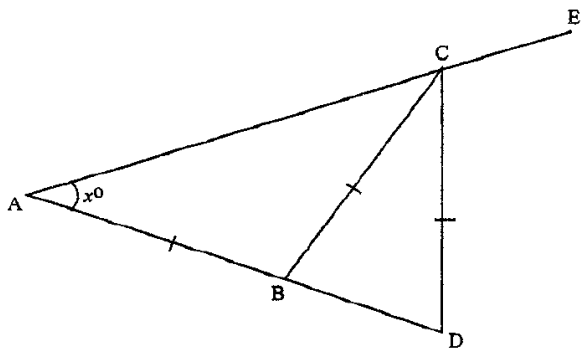
In the diagram, PQRS is a parallelogram. $P\hat{S}Q = 85°$, $S\hat{R}Q = 60°$ and SQT is a straight line. Find

(a) $P\hat{Q}R$, [1]

(b) $R\hat{S}Q$, [1]

(c) $R\hat{Q}T$. [1]

4008/4028/1 J2011 Q3



In the diagram, ACE and ABD are straight lines, AB = BC = CD and $B\hat{A}C = x°$.

(i) Express in terms of x

(a) $C\hat{B}D$,

(b) $D\hat{C}E$,

(c) $B\hat{C}D$. [3]

(ii) If AC = AD, find the numerical value of x. [2]

4028/2 J2010 Q3(a)

POLYGONS, SYMMETRY & CIRCLES

(a) Name the regular polygon which has rotational symmetry of order 5. [1]

(b) The sum of the interior angles of a hexagon is 720°. Three of its interior angles are 140°, 120° and 160°. The remaining angles are in the ratio 2 : 3 : 5. Calculate the size of the largest of the remaining angles. [3]

4004/1 J2020 Q20

The size of each interior angle of a regular polygon is 135°.

(a) Find the number of sides of the polygon. [2]

(b) State the order of rotational symmetry of the regular polygon. [1]

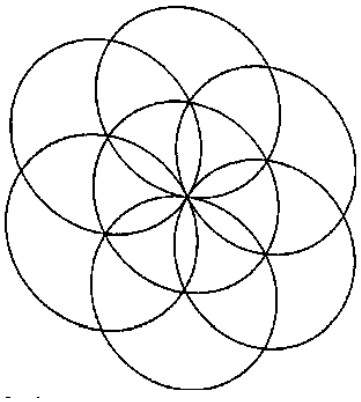
4004/1 N2020 Q10

(i) Write down the number of degrees in 4 compete revolutions. [1]

(ii) Find the number of sides of a polygon whose interior angles add up to 4 complete revolutions. [3]

4004/2 N2020 Q3(a)

In the diagram, all the circles are of equal radii.



State the

(a) total number of circles, [1]

(b) number of lines of symmetry, [1]

(c) order of rotational symmetry. [1]

4004/1 J2019 Q11

(a) Calculate the size of one exterior angle of an 18-sided regular polygon. [2]

(b) Calculate the sum of the interior angles of a heptagon (7-sided polygon). [2]

4004/1 J2019 Q13

(a) State the order of rotational symmetry of a rhombus. [1]

(b) Four of the interior angles of a 12-sided polygon are each $x°$. The other angles are $2x°$ each. Calculate the value of x. [2]

4004/1 N2019 Q5

(a) State the number of lines symmetry of a regular nonagon. [1]

(b) The sum of interior angles of a regular polygon is 3 960°. Find the number of sides of the regular polygon. [2]

4030/1 J2018 Q5

A polygon has n sides. The sum of the interior angles is equal to the sum of the exterior angles.

(i) Find the value of n. [2]

(ii) State the name of the polygon. [1]

4030/2 J2018 Q4(b)

(a) State the special name given to a **regular** polygon with 4 sides. [1]

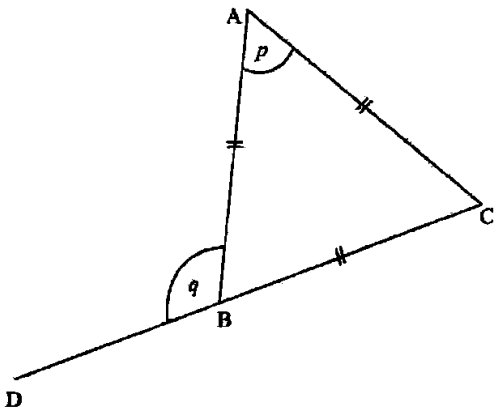
(b) The angles of a hexagon are 115°, 89°, $x°$, $x°$, $x°$ and $x°$. Find the value of x. [3]

4004/1 N2018 Q18

(a) State the order of rotational symmetry of a regular pentagon. [1]

(b) Three angles of a pentagon are 110°, 80° and 140°. The remaining two angles are such that one is twice the other. Find the size of the remaining two angles. [3]

4030/1 J2017 Q13



(a) Write down the special name given to triangle ABC. [1]

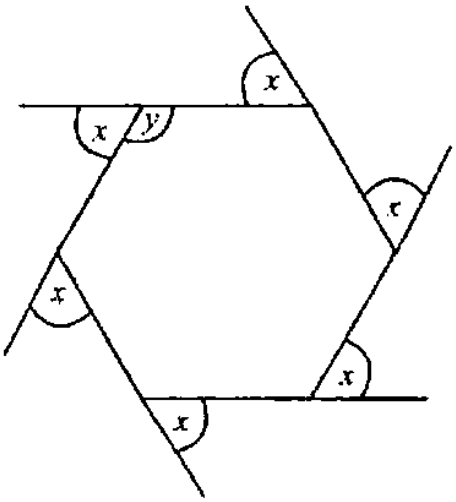
(b) Calculate the angles marked
(i) p, [1]
(ii) q. [1]

4030/1 N2017 Q4

What is the number of lines of symmetry on a general parallelogram? [1]

4030/1 N2017 Q15(a)

The diagram shows a regular polygon with angles marked x and y.



Calculate the value of (i) x, [2]
(ii) y. [1]

4030/1 N2017 Q18(b)

(i) Three interior angles of a hexagon are each $x°$ and the remaining three interior angles are each $y°$. Form an equation in x and y that satisfies this condition. [2]
(ii) Given also that $5x = 7y$, use this equation and the equation in **(i)** to find the values of x and y. [3]

4030/2 N2017 Q2(a)

The size of each interior angle of a regular polygon is 135°.
(a) Find
(i) the size of each exterior angle, [1]
(ii) the order of rotational symmetry of the regular polygon. [1]
(b) State the special name of the regular polygon. [1]

4030/1 J2016 Q18

The interior angles of a regular polygon are 144° each.
(a) Find the number of sides of the polygon. [2]
(b) State the number of lines of symmetry of the polygon. [1]

4030/1 N2016 Q9

The size of each interior angle of a regular polygon is 168°.
Find the number of sides of the polygon. [2]

4008/1 J2015 Q5(b)

(a) Write down the **special** name given to a polygon with five sides. [1]
(b) State, for a regular five-sided polygon,
(i) the number of lines of symmetry, [1]
(ii) the order of rotational symmetry. [1]

4028/2 J2015 Q11

Four interior angles of a nonagon have a sum of 460°. The remaining interior angles are equal. Find the size of each of the equal angles. [2]

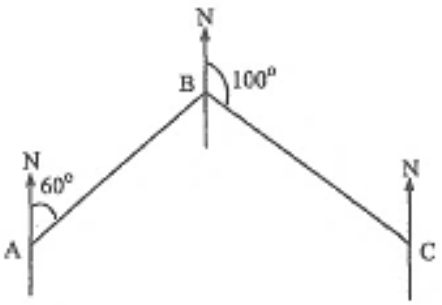
4028/2 N2015 Q2(b)

(a) State the special type of a triangle which has one line of symmetry. [1]
(b) A polygon has n sides. Two of its exterior angles are 55° and 45°. The remaining $(n - 2)$ exterior angles are each 20°.
Calculate the value of n. [2]

4008/1 J2014 Q6

State the name of a polygon with rotational symmetry of order 2. [1]

4008/1 N2014 Q9(b)



In the diagram, the bearing of B from A is 060° and the bearing of C from B is 100°. If AB and BC are adjacent sides of a regular polygon, find the number of sides of the polygon. [2]

4008/1R N2014 Q8(b)

A quadrilateral has a rotational symmetry of order 1 and one line of symmetry.
State the name of the quadrilateral. [1]

4008/1R N2014 Q13(b)

A regular polygon has an interior angle that is twice the exterior angle.
Find
(i) the number of sides of the polygon,
(ii) the sum of the interior angles of the polygon. [4]

4008/2 N2014 Q11(a)

(b) the sum of the interior angles of an n-sided polygon is 6 120°. Find the value of n. [2]

(c) If three of the angles of a heptagon are 162°, 150° and 132° and the rest of the angles are equal, calculate the size of each of the equal angles. [2]

4008/2R N2014 Q11

Given the capital letters M, N, Z, E and H, write down the letters with
(a) line symmetry, [2]
(b) rotational symmetry of order two. [2]

4028/1 J2013 Q17

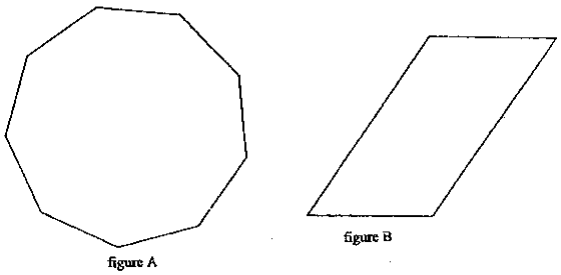
Find the order of rotational symmetry of a right-angled isosceles triangle. [1]

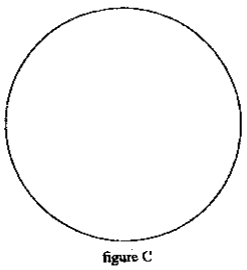
4008/1 N2013 Q13(b)

The sum of interior angles of a polygon is 3 240°. Three of its interior angles are 140°, 110° and 100°. The rest are all equal.
Find the size of each of the equal angles. [4]

4008/2 N2013 Q11(a)

Below are three shapes labelled figure A, figure B and figure C.





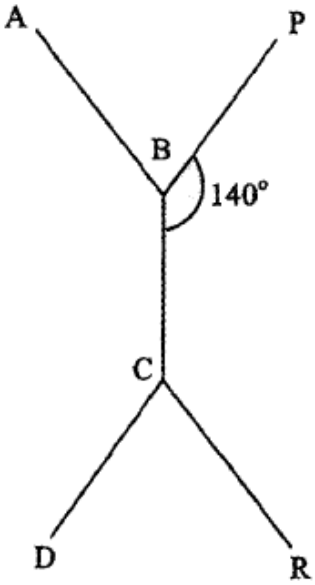
(a) State the order of rotational symmetry of the shape labelled
(i) figure A, [1]
(ii) figure B. [1]

(b) State the number of lines of symmetry of the shape labelled
(i) figure A, [1]
(ii) figure B, [1]
(iii) figure C. [1]

4008/1 J2012 Q18

(a) Write down the special name of the regular polygon which has three lines of symmetry. [1]

(b)



AB, BC and CD are sides of a 12-sided polygon.
PB, BC and CR are sides of a regular n-sided polygon and angle $P\hat{B}C = 140°$.
Find
(i) the value of n, [2]
(ii) the size of angle DCR. [2]

4008/1 N2012 Q24

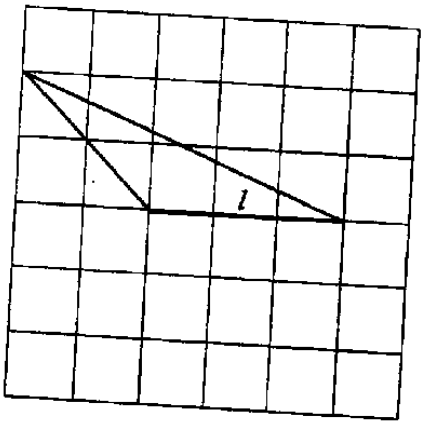
State the order of rotational symmetry of a parallelogram. [1]

4008/4028/1 J2011 Q8(a)

State the number of lines of symmetry of an equilateral triangle. [1]

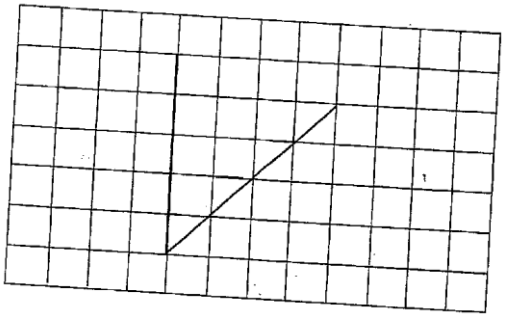
4008/1 N2011 Q5(a)

(a) In the diagram, l is a line of symmetry of a quadrilateral.

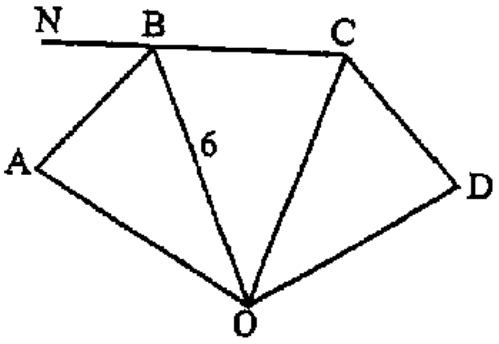


On the diagram, complete the quadrilateral. [1]

(b) In the diagram, add **one** line so that the completed diagram has rotational symmetry of order 2. [2]



4008/4028/1 J2010 Q14



AB, BC and CD are adjacent sides of a regular octagon with centre O. OB = 6 cm and BC is produced to N.

Using as much of the information given below as is necessary, calculate

(a) $N\hat{B}A$, [1]

(b) $A\hat{O}B$, [1]

(c) the area of ΔAOB. [2]

$[\sin 45° = \cos 45° = 0{,}7;\ \tan 45° = 1]$

4008/4028/1 J2010 Q27

PRIME NUMBERS, SEQUENCES & TYPES OF NUMBERS

(i) Express 252 as a product of its prime factors in index form. [2]
(ii) Find the smallest number by which 252 must be multiplied by to make the product a perfect square. [1]

4004/2 N2020 Q2(d)

Write down the next term in each of the following sequences.
(a) $1\,;4\,;9\,;16\,;25\,;36\,;\_\_\_$ [1]
(b) $\sqrt{2}\,;\sqrt{3}\,;\sqrt{5}\,;\sqrt{7}\,;\sqrt{11}\,;\_\_\_$ [1]
(c) $16\,;8\,;4\,;2\,;1\,;\_\_\_$ [1]

4004/1 J2019 Q2

(a) Write down the next term in the sequence below.
$\frac{1}{3}\,;\frac{2}{4}\,;\frac{3}{5}\,;\frac{4}{6}\,;\_\_\_$ [1]
(b) Express 10 as a **sum of two** different prime numbers. [1]

4004/2 J2019 Q1

Write down the next two terms of the pattern
$16\ ;\ 8\ ;\ 4\ ;\ 2\ ;\ \_\_\_\ ;\ \_\_\_$. [1]

4030/1 J2017 Q7(a)

(i) Express 248 as a product of its prime factors. [2]
(ii) Find the number by which 248 must be multiplied to make it a perfect square. [1]

4030/2 J2017 Q1(d)

Study the number pattern.

First row	0	0	2	2
Second row	1	3	2	5
Third row	2	6	2	8
Fourth row	3	9	2	11
Fifth row	---	---	---	---
:	:	:	:	:
n th	---	---	---	x

(i) Complete the fifth row. [2]
(ii) Express x in terms of n. [2]

4030/2 N2017 Q5(c)

It is given that $0\,;1\,;8\,;27\,;\ \_\_\_\ ;$ ... is a pattern.
State the next term of the pattern. [1]

4030/1 J2016 Q3(a)

Write down the next term of the sequence
$\frac{81}{625}\,;\frac{27}{125}\,;\frac{9}{25}\,;$ [1]

4008/1 N2014 Q13(a)

Write down the next term in the sequence
$-2\ ;\ 1\ ;\ 6\ ;\ 13\ ;\ 22\ ;\ \ldots$ [1]

4008/1R N2014 Q2(a)

(a) Write down the smallest prime number. [1]
(b) Express 5 292 as a product of its prime factors in index form. [2]

4008/1R N2014 Q5

Study the number pattern below:
$2\ ;\ 3\ ;\ 5\ ;\ 9\ ;\ 17\ ;\ \ldots$
Write down
(i) the next two numbers,
(ii) the formula that is used to get the next number, (r^{th} term) in terms of r. [3]

4008/2R N2014 Q11(a)

Write down the next two terms in the following sequence; $1\,;\frac{1}{2}\,;\frac{1}{4}\,;\frac{1}{8}\,;\ldots;\ldots$ [2]

4008/1 N2013 Q3(b)

Write down the prime numbers between 20 and 30. [1]

4008/1 N2013 Q12(b)

The pattern below refers to the number of elements in a set and the number of subsets of that set. Study the pattern and answer the questions that follow.

Number of elements in a set	Number of subsets
1	2
2	4
3	8
4	16
5	p
.	.
.	.
.	.
q	128
.	.
.	.
.	.
n	r

(i) Find the value of p and the value of q.

(ii) Express r in terms of n. [4]

4008/2 J2011 Q11(a)

Study the pattern below.

$$3^2 - 1^2 = 8 = 4 \times 2$$
$$4^2 - 2^2 = 12 = 4 \times 3$$
$$5^2 - 3^2 = 16 = 4 \times 4$$
$$6^2 - p^2 = q = 4 \times 5$$

(a) Write down the value of

(i) p, [1]

(ii) q. [1]

(b) Write down the 10^{th} line of this pattern. [3]

4008/1 N2011 Q19

Express 252 as a product of its prime factors. [2]

4028/2 J2010 Q2(a)

PROBABILITY

The table shows grades obtained by 150 candidates in Mathematics test.

Grade	A	B	C	D	E	U
Frequency	5	25	30	29	21	40

Calculate the probability that two candidates chosen at random from the 150 obtained grade A or B. [2]

4004/1 J2020 Q15(b)

In a form four class with 36 students, the probability of picking a boy is $\frac{7}{12}$.

(a) Find the number of boys in the class. [1]

(b) (i) One student is selected at random from the class, find the probability of selecting a girl. [1]

(ii) Two students are selected at random from the class, find the probability of selecting a boy and a girl. [2]

4004/1 N2020 Q21

A box contains 20 sweets which are identical in shape and size except for colour. Eight of the sweets are yellow and twelve are green.

(a) Calculate the probability of picking a yellow sweet. [1]

(b) Two sweets are picked at random from the box. Calculate the probability that the sweets are of the same colour. [2]

4004/1 J2019 Q10

In a test the probability that a learner gets the first question correct is $\frac{3}{5}$.

If a learner gets it correct the probability of getting the second one correct becomes $\frac{4}{5}$.

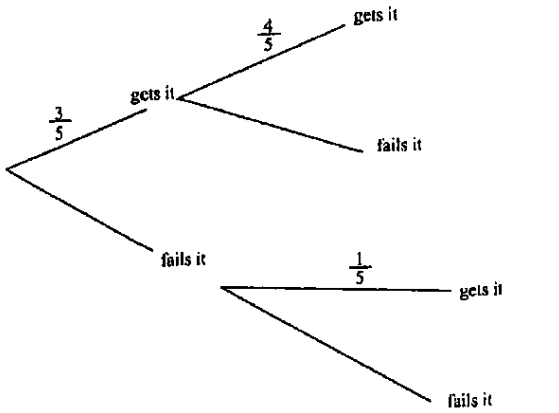
If the learner fails the first question, the probability of getting the second one correct becomes $\frac{1}{5}$.

(i) Complete the probability tree diagram. [3]

(ii) Hence or otherwise find the probability that the learner who answers two questions, gets both questions correct. [2]

(iii) Hence or otherwise find the probability that the learner, who answers two questions, gets none of the two questions correct. [2]

(iv) Hence or otherwise find the probability that the learner, who answers two questions, gets only one of the questions correct. [3]



4004/2 J2019 Q6(b)

It is given that set

$P = \{-11;\ -2;\ 0;\ 1;\ 2;\ 3;\ \sqrt{11};\ 9;\ 17;\ 21\}$

(a) A number is chosen at random from set P. Find the probability that the number is either a negative number or a prime number. [2]

(b) Two numbers are chosen at random from set P one after the other, without replacement. Find the probability that one is a perfect square and the other is a factor of 21. [2]

4030/1 J2018 Q19

The probability that Themba will score in a match is $\frac{1}{3}$. The probability that Allan will score in the same match is $\frac{3}{4}$.

Calculate the probability that in the same match

(a) both score, [2]

(b) neither of them scores, [2]

(c) only one of them scores. [2]

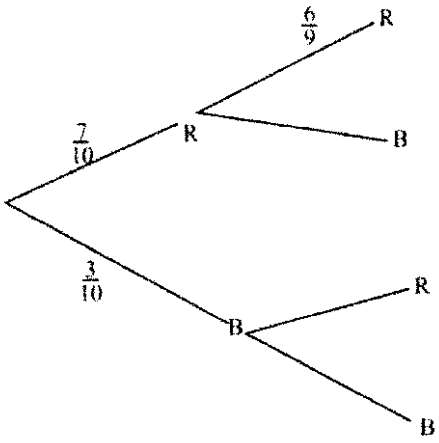
4004/1 N2018 Q21

A bag contains 10 buttons that are identical except for colour. 7 of the buttons are red and 3 are blue. Two buttons are drawn at random, one after the other without replacement.

(i) Complete the tree diagram. [2]

(ii) Find the probability that both buttons are red. [2]

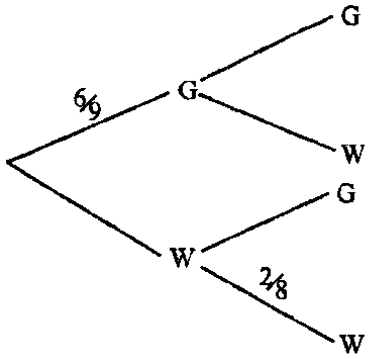
(iii) Find the probability that at least one of the buttons is red. [2]



4004/2 N2018 Q5(c)

A bag contains 6 green (G) buttons and 3 white (W) buttons which are identical except for colour. Two buttons are picked at random from the bag one at a time without replacement.

(a) Complete the tree-diagram by indicating the probability of each event. [2]



(b) Find the probability of picking at least one white button. [2]

4030/1 J2017 Q22

Two unbiased coins, coin 1 and coin 2 are tossed and the outcomes recorded in a table.

(a) Complete the outcome table given, where H is a head and T is a tail.

		Coin 1	
		H	T
Coin 2	H	HH	
	T		TT

(b) Using the table or otherwise, find the probability of getting

(i) 2 heads, [1]

(ii) different outcomes, [1]

(iii) at least one tail. [1]

4030/1 J2016 Q23

9 white and 6 yellow identical tennis balls are placed in a box. Kuda picks balls at random one at a time. Find the probability that the first and second balls picked are

(a) both white, [2]

(b) of different colours. [2]

4008/1 J2015 Q18

The probability that Sihle will bring a calculator is $\frac{5}{6}$ while the probability that Yemurai will bring a calculator is $\frac{3}{5}$. Giving the answer as a fraction in its simplest form, find the probability that,

(a) Sihle will **not** bring a calculator for the lesson, [1]

(b) only one of them will bring a calculator for the lesson. [2]

4028/1 N2015 Q10

The probability that John passes a driving test is $\frac{3}{4}$ and that of Peter passing is $\frac{2}{x}$.

(a) If the probability that they both pass the test is $\frac{3}{28}$, find x. [2]

(b) Calculate the probability that

(i) Peter **fails** the test, [1]

(ii) either John or Peter passes the test. [2]

4008/1 N2014 Q22

A bag has green, red and blue balls. The balls are identical except for colour. Anna picks a ball at random and puts it back.

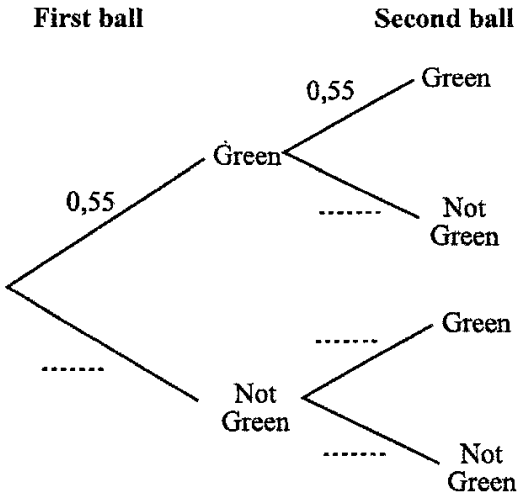
The table shows the probabilities that Anna picks any of the balls.

colour	green	red	blue
probability	0,55	0,25	x

(a) Find x. [1]

(b) If there are 20 red balls in the bag, find the number of the green balls in the bag. [2]

(c) Complete the probability tree diagram in the answer space. [2]



4008/1R N2014 Q22

John had four $1 notes and five $2 notes in his pocket. He wanted to buy an item costing $2. He just pulled out two notes, one after another, without first checking.
Find the probability that he pulled out notes that
(i) were worth the same value,
(ii) added up to more than the price of the item. [5]

4008/2R N2014 Q11(d)

A teacher gave ball-point pens as prizes to pupils who passed his test. He had 2 boxes of pens. Box A had 6 blue, 4 green and 3 red pens while Box B had 6 blue and 4 green pens. Ben was asked to pick a pen from Box A and Laiza from Box B.
Find the probability that
(a) Ben picked a blue pen, [1]
(b) both Ben and Laiza picked blue pens. [2]
(c) both Ben and Laiza picked pens of the same colour. [3]

4028/1 J2013 Q23

Tendai and Vimbai take a driving test. The probability that Tendai will pass is $\frac{3}{5}$ and the probability that Vimbai will pass is $\frac{2}{3}$.
(a) State which one of them is more likely to pass. [1]
(b) Calculate the probability that
(i) they both fail, [2]
(ii) only one of them will pass. [2]

4008/1 N2013 Q22

A box contains twelve tennis balls which are identical except for colour. Three of the tennis balls are **yellow**, four are **green** and five are **white**.
(a) Find the probability that a ball picked at random from the box is
(i) white, [1]
(ii) black. [1]
(b) Two balls are at random from the box. Find the probability that they are
(a) of the same colour, [2]
(b) of different colours. [2]

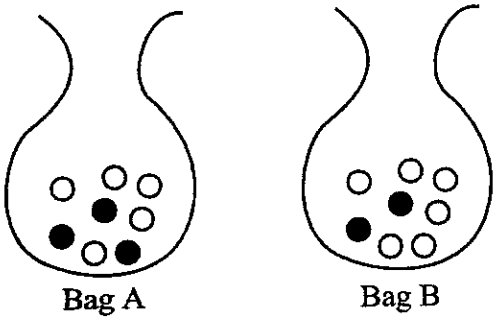
4008/1 J2012 Q24

In this question give all probabilities as common fractions.
Eight identical cards are numbered
2 ; 3 ; 5 ; 6 ; 7 ; 8 ; 8 and 9
(a) One of the cards is chosen at random.
(i) Write down the number whose probability of being chosen is $\frac{1}{4}$. [1]
(ii) Find the probability of choosing a card with a prime number. [1]
(b) Two of the eight cards are taken at random. Find the probability that the sum of the two numbers is 5. [2]

4008/1 N2012 Q20

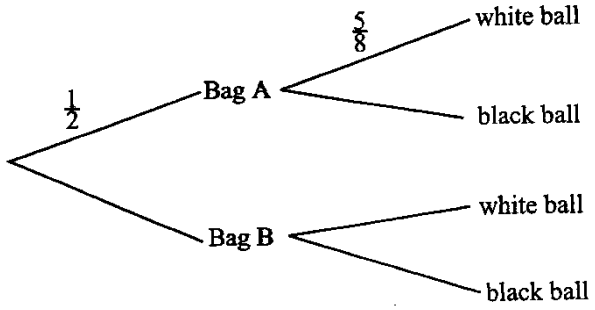
When a biased coin is tossed, the probability of getting a head is 0,6. For this coin, find
(a) the probability of getting a tail if it is tossed once, [1]
(b) the probability of getting at least one head if it is tossed twice, [2]
(c) the expected number of heads if it is tossed 50 times. [2]

4008/4028/1 J2011 Q25



Denis must choose a bag from which he should pick a ball. The probability that he chooses Bag A is $\frac{1}{2}$.
Bag A contains 5 white and 3 black balls.
Bag B contains 6 white and 2 black balls.

The tree diagram below shows some of this information.



(a) Complete the probability tree diagram shown above. [2]
(b) Find the probability that Dennis chooses Bag A and then a white ball. [2]
(c) Find the probability that Dennis picks a white ball. [3]

4008/1 N2011 Q25

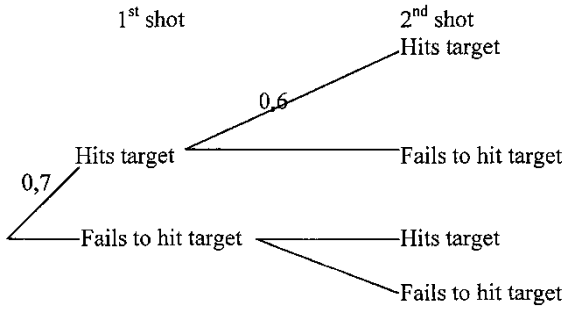
Assuming there is an equal chance of being born a boy or a girl, find the probability that
(i) a child is born a boy,
(ii) in a family of three children, there are two boys and one girl. [3]

4008/2 N2011 Q2(c)

In a school with 1 050 pupils, $\frac{4}{7}$ of the pupils were boys. One quarter of the boys were suspended for misbehaviour.
(i) Find the number of boys suspended. [2]
(ii) Express the number of girls as a fraction of the remaining pupils. [2]
(iii) If two pupils were chosen at random from the remaining pupils to testify, find the probability that the two pupils were of the same sex. [3]

4028/1 J2010 Q5(a)

In a shooting game Nyarai is allowed two shots. The probability that she hits the target first time is 0,7. If she hits the target first time, the probability that she hits the target second time is 0,6 otherwise it is 0,3.
(a) Complete the tree diagram below to represent all this information. [3]



(b) Calculate the probability that she hits the target
(i) twice, [2]
(ii) once. [2]

4008/4028/1 N2010 Q26

Two cards were picked at random from a pack of 52 playing cards **with** replacement. Find the probability that one was a Court card (i.e. J, K or Q) and the other was an Ace (A). [3]

4008/2 N2010 Q9(b)

QUADRATIC EQUATIONS

The solutions of a quadratic equation are $x = -1$ and $x = 3$. Write down the quadratic equation in the form $ax^2 + bx + c = 0$ where a, b and c are integers. [3]

4004/1 J2020 Q24(b)

(a) Show that the equation $x - 3 = \frac{5}{3x}$ reduces to $3x^2 - 9x - 5 = 0$. [2]

(b) Solve the equation $3x^2 - 9x - 5 = 0$. Give the answers correct to 2 decimal places. [5]

4004/2 J2020 Q5

Solve the equation $(2x - 1)^2 = 1$ [3]

4004/1 N2020 Q9

Solve the equation $3x^2 + 5x - 18 = 0$, giving the answers correct to **three** significant figures. [5]

4004/2 N2020 Q7(c)

(ii) Solve the equation $3x^2 - 4x - 16 = 0$, giving the answers correct to 3 significant figures. [5]

4004/2 N2019 Q8(b)

(i) Show that the equation $\frac{1}{x} - \frac{1}{x+2} = \frac{1}{3}$ reduces to $x^2 + 2x - 6 = 0$. [2]

(ii) Solve the equation $x^2 + 2x - 6 = 0$, giving the answers correct to 2 decimal places. [4]

4030/2 J2018 Q7(b)

Solve the equation $x(x - 3) - x + 3 = 0$. [3]

4030/1 J2017 Q4

Solve the equation $3x^2 - 4x - 11 = 0$, giving the answers correct to 2 significant figures. [5]

4030/2 J2017 Q5(d)

Solve the equation $3x^2 - 5x - 2 = 0$. [3]

4030/1 N2017 Q10

Given that $2x + y = 10$, solve the equations

$4x^2 - y^2 = 40$

$2x + y = 10$ [3]

4030/1 N2017 Q23(b)

Solve the equation $\frac{3}{x} = x - 2$. [3]

4008/1 J2015 Q8

(i) Show that $\frac{2}{1-x} - \frac{4}{x} = 3$ reduces to $3x^2 + 3x - 4 = 0$. [3]

(ii) Solve the equation $3x^2 + 3x - 4 = 0$, giving answers correct to 3 significant figures. [5]

4028/2 N2015 Q8(a)

Solve the equation $\left(y + \frac{1}{4}\right)^2 = \frac{9}{16}$. [3]

4008/1 J2014 Q16

Solve the equation $3x^2 - 5x - 15 = 0$, giving your answers correct to 2 decimal places. [5]

4028/2 J2014 Q10(a)

Solve the equation $2x^2 + 3x - 84 = 0$, giving the answers correct to 2 decimal places. [5]

4008/2R N2014 Q4(c)

Solve the equation $\frac{2}{x+2} + \frac{1}{x} = 1$. [4]

4028/2 J2013 Q3(a)

Solve the equation $(x + 3)^2 = 49$. [3]

4008/1 N2013 Q12(a)

Solve the equation $2x^2 - 4x - 3 = 0$, giving your answers correct to 1 decimal place. [5]

4008/2 N2013 Q10(a)

Solve the equation $3q^2 - 5q - 5 = 0$, giving the answers correct to two decimal places. [5]

4008/2 J2012 Q10(a)

Solve the equation $3x^2 - 5x - 7 = 0$, giving your answers correct to 2 decimal places. [5]

4008/2 N2012 Q6(a)

Solve the equation $3x^2 + 4x - 2 = 0$, giving your answers to two decimal places. [5]

4008/2 J2011 Q5(b)(ii)

Solve the equation $x^2 - 5x - 6 = 0$. [2]

4008/1 N2011 Q4(b)

Solve the equation $2x^2 - 3x - 7 = 0$, giving your answers correct to 2 decimal places. [5]

4008/2 N2011 Q4(b)

Solve the equation $x^2 + 5x = 24$. [2]

4008/4028/1 J2010 Q11(b)

Solve the equation $x^2 - 7x - 12 = 0$, giving your answers correct to 2 decimal places. [5]

4008/2 N2010 Q7(c)

RATIONAL, IRRATIONAL NUMBERS & SURDS

Evaluate $(7\sqrt{5})^2$. [1]

4004/2 J2020 Q1(d)

Simplify $(\sqrt{10}-\sqrt{5})^2$, leaving your answer in surd form. [2]

4004/2 N2020 Q1(b)

Simplify $\sqrt{147}+\sqrt{108}$. Leave the answer in the form $m\sqrt{n}$ where m and n are integers. [2]

4004/1 N2019 Q2(b)

The following is a list of real numbers:

$$\frac{3}{7}\ ;\ 11\ ;\ \sqrt{\frac{3}{2}}\ ;\ 121\ ;\ -19\ ;\ \pi\ ;\ \sqrt{64}$$

Choose from the list

(a) a square number, [1]

(b) irrational number. [1]

4004/1 N2018 Q2

Simplify $2\sqrt{75}+3\sqrt{75}-\sqrt{48}$, giving the answer in the form $a\sqrt{b}$, where a and b are integers. [2]

4030/1 J2017 Q16(b)

From the following list of numbers write down the rational numbers:

$$3.1\ ;\ \sqrt{3}\ ;\ \pi\ ;\ 0.3\ ;\ \sqrt{169}\ ;\ \frac{17}{19}$$

[3]

4030/1 N2017 Q2

Find the value of $3\sqrt{2}\times 5\sqrt{2}$. [1]

4030/1 N2016 Q10(a)

Simplify the expression $\sqrt{3}+\sqrt{12}$. [2]

4008/4028/1 J2011 Q16(b)

Simplify $\sqrt{50}$, leaving your answer in the form $a\sqrt{b}$. [1]

4008/4028/1 J2010 Q8(a)

From the list of numbers below, choose the rational numbers.

$$\frac{22}{7}\ ;\ \pi\ ;\ 2{,}3\ ;\ \sqrt{48}\ ;\ \sqrt[3]{-8}$$

[2]

4008/4028/1 N2010 Q11(b)

RATIOS, RATES & PROPORTIONS

Increase \$40.00 in the ratio 8:5. [2]

4004/2 J2020 Q1(c)

Three girls aged 12 years, 13 years and 15 years share \$100.00 in the ratio of their ages. Calculate the amount of money that each girl receives. [3]

4004/1 J2019 Q3

(i) Increase \$105 by 12%. [2]

(ii) Tendai and Chipo share \$105.00 in the ratio 4 : 3 in that order. Find Tendai's share and Chipo's share. [3]

4004/2 J2019 Q1(c)

Kin, Munashe and Chipo shared sweets in the ratio 5 : 3 : 7. Calculate the total number of sweets shared if Chipo got 35 sweets. [2]

4004/1 N2019 Q6(b)

A hotel has Executive rooms and General rooms in the ratio 3 : 5 respectively. A General room costs \$19.00 per day. On a certain day, all the 2 928 rooms were occupied by both Executive and General customers and the total takings from the rooms amounted to \$66 612.00.

(i) Find the number of General rooms in the hotel. [2]

(ii) Calculate the cost per day of an Executive room. [3]

4004/2 N2019 Q1(c)

The cost of 3 kg of apples and 7 kg of bananas is \$16.
The cost of 4 kg of apples and 5 kg of bananas is \$17.
Calculate the cost per kg of apples and the cost per kg of bananas. [4]

4030/2 J2018 Q3(a)

(a) Peter, John and James share a certain amount of money.
Peter gets $\frac{2}{3}$ of the amount of money,
John gets $\frac{3}{4}$ of the remainder and James gets \$3.00,
Calculate the total amount of money shared. [4]

(b) Three men working at the same rate can dig a trench, 5 m long, in 4 hours. Calculate the time that two men working at the same rate would take to dig a similar trench, 5 m long. [2]

4030/2 J2018 Q5

Joseph cycles at a speed of 5 metres per second. Calculate the time, in hours, he takes to cycle a distance of 18 km. [2]

4030/2 J2018 Q9(b)

(a) Express the ratio 3,5 kg : 800 g in its simplest form. [1]

(b) In 2016 a farmer harvested 4,5 tonnes of maize. This was 20% more than what he had harvested in 2015. Find the number of tonnes of maize the farmer harvested in 2015. [2]

4004/1 N2018 Q13

A farmer has a plot which measures 150 m by 140 m. The farmer wants to use chemicals to destroy weeds in the plot. For every 100 m^2, 5 litres of chemicals are used.

(a) Calculate the quantity of the chemicals in litres, needed to destroy the weeds in the whole plot. [2]

(b) Five litres of the chemicals cost \$8. Find the cost of the chemicals needed to destroy the seeds in the whole plot. [2]

4030/1 J2017 Q23

(a) Express the ratio 3,5 : 1 in the form, $\boldsymbol{a} : \boldsymbol{b}$ where $\boldsymbol{a}$ and $\boldsymbol{b}$ are integers. [1]

(b) Shuvai mixed hot water and cold water in the ratio 3,5 : 1 to get warm water. If she ended up with 45 litres of warm water, calculate the amount of hot water she used. [2]

4030/1 N2017 Q8

Three people can complete a certain task in 6 days. Calculate the number of people, working at the same rate, who can complete the same task in 9 days. [2]

4030/2 N2017 Q7(b)

Mary, Peter and John share a total amount of \$500 in the ratio 3 : 2 : 5. Mary uses part of her share to buy a pair of shoes costing \$30.

(i) Calculate Mary's share. [2]

(ii) Calculate the percentage of Mary's share that

is left. [2]

4030/2 J2016 Q1(c)

If Mrs. Pindo pays with a R100 note for an item worth US$2.20, she gets US$10.40 change. Calculate the exchange rate in the form R$\boldsymbol{n}$: US$ where $\boldsymbol{n}$ is correct to 2 decimal places. [3]

4030/2 N2016 Q2(c)

It is given that 300 cattle are to be shared in the ratio $12 : 10 : 8$,

(i) Express the ratio in its simplest form.

(ii) Calculate the difference between the largest and smallest shares. [5]

4028/2 J2015 Q3(a)

When baking scones, a baker mixes **six** cups of flour, **one** cup of sugar, **two** cups of water and **half** a cup of milk, together with other ingredients.

(a) Express the quantities of flour, sugar, water and milk as a ratio in its simplest form. [1]

(b) Calculate the number of cups of water needed if the baker uses four cups of flour. [2]

4028/1 N2015 Q9

Given that $4m = 7n$, find the ratio $m : n$. [1]

4008/1 J2014 Q14(a)

John, Ticha and Sharai share some sweets. John and Ticha's shares are in the ratio $1 : 2$. Ticha and Sharai's shares are in the ratio $3 : 4$.

(a) Express the shares in the ratio John : Ticha : Sharai. [2]

(b) Calculate

(i) Ticha's share if Sharai got 24 sweets, [2]

(ii) the total number of sweets shared. [2]

4008/1 N2014 Q17

Albert can weed the family garden in 4 hours. His sister, Biddy, takes 6 hours to complete the same job. If they decide to work together, assuming they maintain their working rates, calculate

(i) the fraction of the garden that they can weed in 1 hour,

(ii) the total time that they can take to weed the whole garden. [3]

4008/2 N2013 Q2(c)

Jojo works in the afternoons only for 5 days a week. He starts work at 1.15 pm and finishes at 7.45 pm.

(a) Express 7.45 pm as time in the 24-hour notation. [1]

(b) If he is paid $1,20 per hour, calculate his weekly wage. [2]

4008/1 N2012 Q8

(a) Express the ratio 20 minutes : $1\frac{1}{3}$ hours, in its simplest form. [1]

(b) Two partners, A and B, shared their profits from a business in the ratio 5 : 3.
If B received $4 800 000, calculate A's share. [2]

4008/4028/1 J2011 Q2

Three farmers share 120 hectares of land in the ratio $3 : 4 : 5$. Calculate the area of the largest piece of land. [2]

4008/2 J2011 Q1(c)

A compound is made up of potassium nitrate, sulphur and charcoal, mixed in the ratio $33 : 5 : 7$ respectively.

(i) Calculate the percentage of sulphur in the compound.

(ii) Find the mass of charcoal needed to make 900 kg of the compound.

(iii) Given that 10 kg of sulphur and 14 kg of charcoal are mixed, find the mass of potassium nitrate needed to make up the compound. [5]

4008/2 N2011 Q4(a)

(a) Given that $12 : d = 3 : 7$, find the value of d. [1]

(b) A sum of money is divided in the ratio $2 : 3 : 7$. Given that the largest share is $224 000, calculate the smallest share. [2]

4008/4028/1 J2010 Q6

The dimensions of a rectangle measuring 32 cm by 24 cm are enlarged in the ratio $5 : 2$. Find the new dimensions. [3]

4008/4028/1 N2010 Q5

In a recipe for an apple pie, 500 g of apples and 200 g of flour are needed in making an apple pie for 4 people.

(i) If an apple pie was to be made for 6 people, calculate the quantity of apples needed.

(ii) If the apple pie was to be made for 3 people, calculate the quantity of flour needed. [4]

4008/2 N2010 Q5(b)

SCALES & SIMPLE MAP PROBLEMS

On a certain map, a length of 2 cm represents a distance of 5 km.

(a) Express the scale of the map giving the answer in the form $1:n$. [2]

(b) Calculate the area on the map in cm^2 which represents an actual area of 4 km^2. [2]

4004/1 J2020 Q22

A map is drawn to a scale of 1: 80 000. Calculate

(a) length of a line, in cm, on the map which represents 5,6 km, [1]

(b) actual area, in km^2, represented on the map by an area of 100 cm^2. [3]

4004/1 N2020 Q18

On a map of scale 1: 50 000, a stream is 7 cm long. Calculate the actual length of the stream, giving the answer in km. [2]

4030/1 N2017 Q17(b)

The scale of a map is given as $1:250\ 000$.

Find

(a) the distance on the ground, in km, represented by a length of 5 cm on the map, [1]

(b) the actual area in km^2, represented by an area of 6 cm^2 on the map. [2]

4030/1 J2016 Q17

On a map, a length of 5 cm represents an actual distance of 1 km.

(a) Express the scale of the map in the form $1:n$. [2]

(b) Calculate the actual distance, in kilometres, represented by 21 cm. [1]

4030/1 N2016 Q11

The scale of the plan of a house is 1: 500.

(a) Find the length of a room on the plan which measures 8m. [1]

(b) Calculate the actual height of a wall which is represented by 3,6 cm on the plan. [1]

(c) Find the actual area of a room which has an area of 1,6 cm^2 on the plan. [3]

4008/1 J2015 Q26

A map is drawn to a scale of $1:75\ 000$.

(a) Calculate in km the actual distance between two towns which are 40 cm apart on the map. [2]

(b) An airport has an actual area of 22,5 km^2. Calculate in cm^2 the area of the airport on the map. [2]

4028/1 N2015 Q23

All lengths on a map are $\frac{1}{500}$ of their actual lengths.

Calculate

(a) the actual length of the line represented on the map by a line 7.3 cm, [1]

(b) the area on the map which represents an actual area of 525 m^2, giving your answer in cm^2. [3]

4008/1 J2014 Q20

A lake has a surface area of 36 km^2. On a map, drawn to scale, the lake has an area of 9 cm^2. Calculate the scale used in drawing the map giving the answer in the form $1:n$. [2]

4008/1R N2014 Q13(c)

The scale of a map is $1:10\ 000$.

(a) Two hills are 4,5 cm apart on the map. Find the actual distance between the hills, giving your answer in kilometres. [2]

(b) Two towns are 80 km apart. Find the distance between them on the map, giving your answer in centimetres. [2]

4008/1 N2013 Q18

Express a scale of 2 cm to 5 m in the form $1:n$, where n is a whole number. [1]

4008/1 N2012 Q19(a)

On a map, a distance of 20 km is represented by a length of 40 cm. the scale of the map is $1:n$.

(a) Calculate the value of n. [2]

(b) The distance between two towns on the map is 70 cm. Calculate the actual distance in kilometres between the towns. [2]

4008/1 N2011 Q18

A map is drawn to a scale of 1: 100 000.

(a) Find the distance on the map between two villages which are 24 *km* apart on the ground, giving your answer in *cm*. [1]

(b) Calculate the actual area of a farm in hectares, which is represented by 408 cm^2 on the map.

[3]

4008/4028/1 J2010 Q20

A map has a scale of 1: 250.

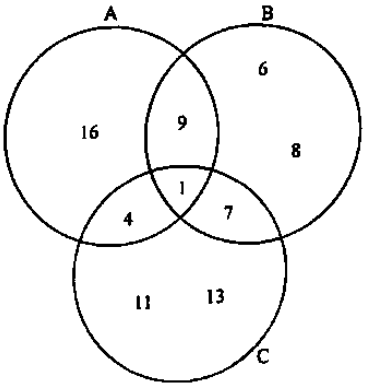
(a) A building on the map has a length of 6 cm. Calculate the actual length of the building in metres. [1]

(b) The area of a pool on the map is 10 cm^2. Calculate the actual area of the pool in m^2. [2]

4008/4028/1 N2010 Q10

SETS

The Venn diagram shows three sets A, B and C with their respective elements.



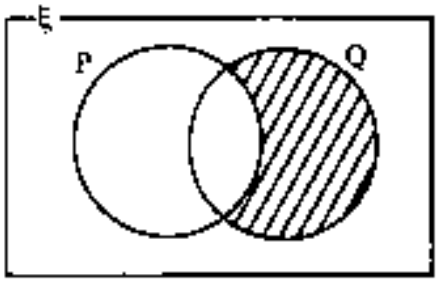
(a) List all elements of
(i) $A \cap B$, [1]
(ii) $(A \cup B)' \cap C$. [1]
(b) Find $n(A \cup C)$. [1]

4004/1 J2020 Q3

From a group of 30 people at a party, it was observed that 17 people ate beef, 16 people ate pork, x people ate both beef and pork and 6 people ate neither beef nor pork. Calculate x, the number of people who ate both beef and pork. [2]

4004/2 J2020 Q9(c)

(a) The Venn diagram shows the universal set ξ and subsets **P** and **Q**.



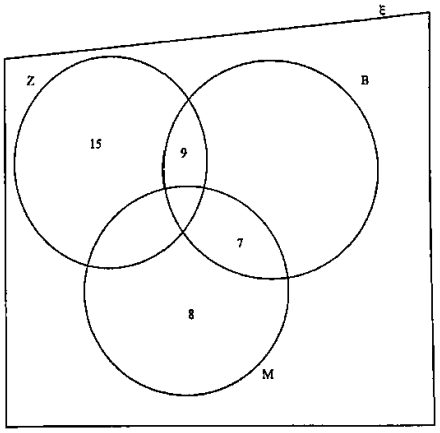
Use set notation to describe the shaded region. [1]

(b) It is given that $n(\xi) = 40, n(A) = 17$ and $n(B) = 11$. Find the
(i) maximum possible value of $n(A \cup B)$, [1]
(ii) minimum possible value of $n(A \cup B)'$. [1]

4004/1 N2020 Q11

A primary school decided to send all their Grade 3 learners on a trip. The learners were asked to indicate the places they would like to visit, choosing from Birchenough Bridge, Great Zimbabwe Monuments and Matopo Monuments. The following statistics were gathered:
39 wanted to visit the Great Zimbabwe Monuments.
31 wanted to visit the Birchenough Bridge.
30 wanted to visit the Matopo Monuments.
10 wanted to visit all the three places.
6 were **not** keen to visit any one of the three places.
19 wanted to visit both the Great Zimbabwe Monuments and Birchenough Bridge.
15 wanted to visit both the Great Zimbabwe Monuments and the Matopo Monuments.
17 wanted to visit the Birchenough Bridge and the Matopo Monuments.

(i) Using the given information, copy and complete the Venn diagram shown where
ξ is the set of all Grade 3 pupils in that school
Z is the set of learners who chose Great Zimbabwe Monuments,
B is the set of learners who chose Birchenough Bridge and M is the set of learners who chose Matopo Monuments.

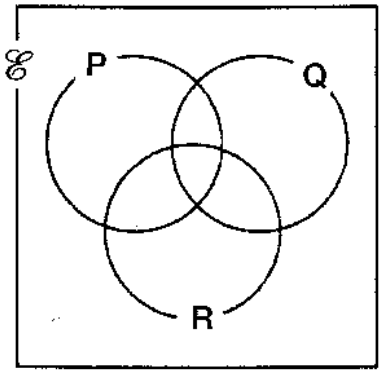


[4]

(ii) Write down the total number of the Grade 3 learners. [1]

4004/2 N2020 Q4(c)

The Venn diagram shows the universal set ξ and subsets P, Q and R.
In the Venn diagram, shade the set $(P' \cap R) \cup (R' \cap Q)$. [3]



4004/1 J2019 Q6

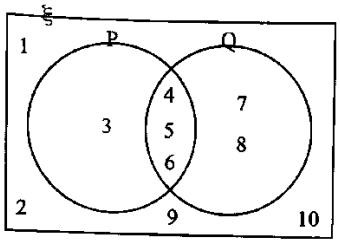
The universal set ξ, has subsets P and Q such that $n(\xi) = 59, n(P) = 15, n(Q) = 35$ and $n(P \cup Q)' = 9$. Write down

(i) $n(P \cap Q)$, [1]

(ii) $n(P \cup Q)$. [1]

4004/2 J2019 Q6(a)

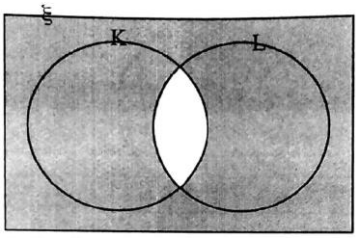
(a) The Venn diagram consists of the universal set ξ, and subsets P and Q with their respective elements.



(i) List the elements of $P' \cap Q$. [1]

(ii) Find $n(P \cup Q)'$. [1]

(b) The Venn diagram consists of the universal set ξ, and subsets K and L.

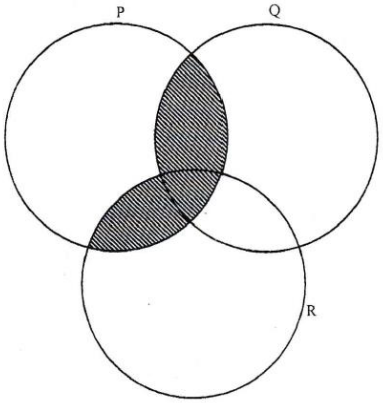


Describe the shaded region in set notation. [1]

4004/1 N2019 Q7

(a) Three sets A, B and C are such that $A \subset B$ and $C \subset A$. Draw the Venn diagram to show the relationship between sets A, B and C. [2]

(b) In the diagram, three sets P, Q and R are intersecting.



Use set notation to describe the shaded region. [1]

4030/1 J2018 Q9

It is given that the Universal set, ξ is such that $\xi = \{x: -3 \leq x \leq 3, x \text{ is an integer}\}$.

A and **B** are subsets of ξ such that

$\mathbf{A} = \{x: -2 \leq x \leq 2\}$ and

$\mathbf{B} = \{x: -1 \leq x \leq 3\}$.

(i) List the elements of

1. **A**, [2]
2. $\mathbf{A}' \cup \mathbf{B}'$. where $\mathbf{A}'$ is the complement of set **A**. [2]

(ii) Find $n(\mathbf{A} \cap \mathbf{B})$. [1]

4030/2 J2018 Q4(b)

It is given that the universal set, ξ, has subsets **P**, **S**, and **M** such that,

$\xi = \{1; 2; 3; 4; 5; 6; 7; 8; 9\}$,

P = {prime numbers},

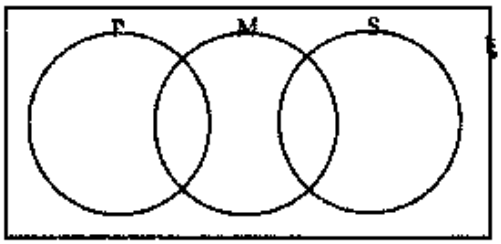
S = {perfect square numbers},

M = {multiples of 3}.

(a) List all elements of set **P**. [2]

(b) Write down $n(P \cap S \cap M)$. [1]

(c) Complete the Venn diagram by inserting elements in the correct regions. [3]



4004/1 N2018 Q24

(a) It is given that the universal set $\xi = \{x: 1 \leq x \leq 10, x \text{ is an integer.}\}$, subsets **A** and **B** such that

A = {perfect square numbers} and

B = {multiples of 4}

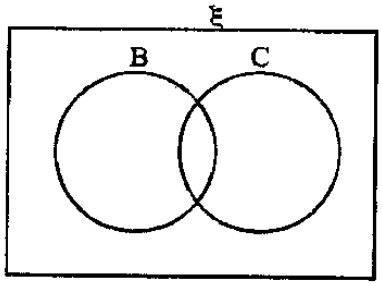
(i) List all elements of set **A**, [2]
(ii) List all elements of set $A \cap B$, [1]
(iii) Find $n(A \cup B)$. [1]

(b) It is given that $P \subset Q$ and $Q \subset R$.
(i) Draw a Venn diagram to show the three sets P, Q and R. [2]
(ii) Write in set notation the relationship between set **P** and set **R**. [1]

4004/2 N2018 Q5

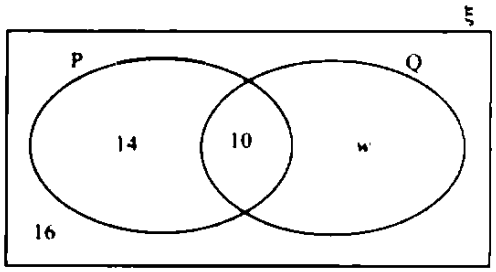
It is given that the universal set, ξ, is a class of 46 pupils.
B is a set of pupils who study Biology,
C is the set of pupils who study Chemistry,
23 pupils study Biology,
32 pupils study Chemistry,
x pupils study both Biology and Chemistry,
5 pupils study neither Biology nor Chemistry.

(a) Complete the Venn diagram by filling in the number of pupils in each region. [2]
(b) Find x, the number of pupils who study both Biology and Chemistry. [2]



4030/1 J2017 Q21

The Venn diagram shows the universal set, ξ, and subsets P and Q. The number of elements in each region is as shown.



Find
(i) $n(\mathrm{P})$, [1]
(ii) $n(\mathrm{Q}')$, where Q' is the complement of set Q. [1]
(iii) the value of w if the number of elements in the universal set, ξ, is **twice** the number of elements in Q. [3]

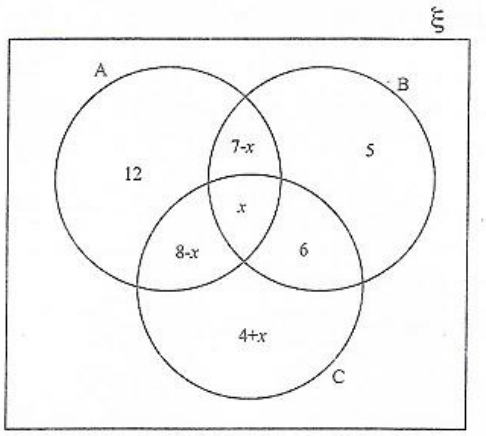
4030/2 J2017 Q2(c)

It is given that the universal set
$\xi = \{x: 10 \leq x < 20, x \text{ is an integer.}\}$,
subset **A** $= \{x: x \text{ is a prime number}\}$,
subset **B** $= \{x: x \text{ is a factor of } 3\}$ and
subset **C** $= \{x: x \text{ is an odd number}\}$.

(a) Write down the largest element of subset **A**,
(b) Find $n(\mathrm{B})$,
(c) List elements of $\mathrm{A} \cap \mathrm{C}$. [3]

4030/1 N2017 Q12

The Venn diagram shows the universal set, ξ, and its subsets A, B and C. The number of elements in each region is shown.



(i) Find $n(\mathrm{B})$. [1]
(ii) Find $n(\mathrm{A}' \cap \mathrm{B} \cap \mathrm{C})$, where A' is the complement of set A. [1]
(iii) Find the value of x given that $n(\mathrm{A}) = 23$. [2]

4030/2 N2017 Q4(a)

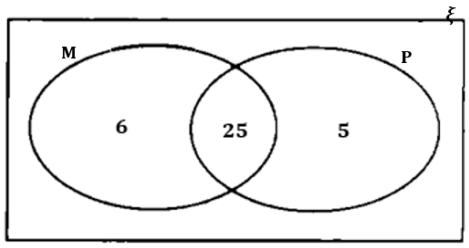
It is given that $\xi = \{0; 1; 2; 3; 4; 5; 6; 7; 8; 9\}$, A is a set of prime numbers and B is a set of factors of 12.

(a) List the elements of
(i) A, [1]
(ii) $\mathrm{A} \cap \mathrm{B}$. [1]
(b) Find $n(\mathrm{A} \cup \mathrm{B})'$. [1]

4030/1 J2016 Q6

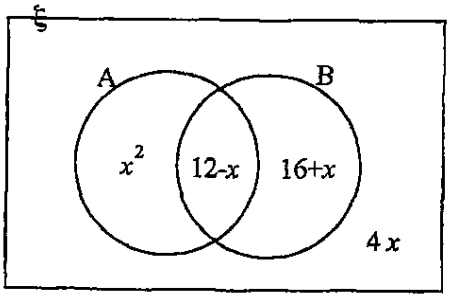
A form four class has 40 pupils. All of them were asked whether they would like to study Mathematics or Physics after form four. Some of the results are shown in the Venn diagram.
The Universal set, ξ, is the set of all pupils in the class. M is the set of pupils who like Mathematics.
P is the set of pupils who like Physics.

(i) Find $n(M \cup P)$. [1]
(ii) Find the number of pupils who do not like either subjects. [1]



(iii) Find $n(M' \cap P)$. [1]

4030/2 J2016 Q3(b)



The Venn diagram shows the universal set, ξ, with its subsets, A and B. The numbers of elements in each region are expressed in terms of x as shown.

(a) Write an expression in terms of x for $n(A \cup B)$. [1]

(b) Given that $n(\xi) = 40$, form an equation in x and show that it reduces to $x^2 + 4x - 12 = 0$. [2]

(c) (i) Solve the equation $x^2 + 4x - 12 = 0$. [2]

(ii) Hence find $n(A' \cap B)$. [1]

4030/1 N2016 Q26

A is a set of perfect square numbers less than 50 and B is a set of even numbers not greater than 20. Given that the elements of sets A and B are whole numbers,

(a) list the elements of set A, [2]

(b) find $n(\text{A} \cap \text{B})$. [1]

4008/1 J2015 Q7

It is given that

$\xi = \{x: 1 \leq x \leq 10, \text{where } x \text{ is an integer}\}$

$A = \{x: x \text{ is a prime number}\}$ and

$B = \{x: x \text{ is a factor of } 20\}$.

(i) List all the elements of A.

(ii) List all the elements of $(\text{A} \cup \text{B})'$.

(iii) Find $n(A \cap B)$.

(iv) Draw and clearly labelled Venn diagram to show the sets and their elements. [7]

4028/2 J2015 Q2(a)

It is given that,

$\xi = \{x: 31 \leq x < 37 \text{ and } x \text{ is an integer}\}$ has subsets P, Q and R such that

$\text{P} = \{x: x \text{ is a multiple of } 3\}$,

$\text{Q} = \{x: x \text{ is a factor of } 99\}$ and

$\text{R} = \{x: x \text{ is a prime number}\}$.

(a) List all the elements of R. [1]

(b) Write down $n(\text{P} \cup \text{R})'$. [1]

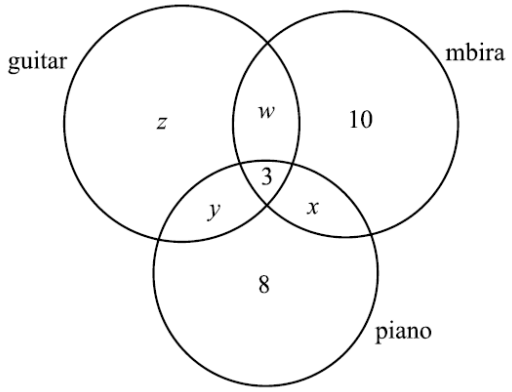
(c) List all elements of $(\text{P} \cup \text{Q} \cup \text{R})'$. [2]

4028/1 N2015 Q22

In a survey, a class of 40 music students were taught to play mbira, piano and guitar. At the end of their course they were asked to state at least one of the three instruments they found enjoyable to play. The table shows the students' choices

type of instrument indicated as enjoyable	number of students
mbira	18
piano	14
guitar	20
mbira only	10
piano only	8
mbira and guitar	6
piano and mbira	5
guitar and piano	4
all the three	3

The Venn diagram shows some of the number of students in each subset.



(i) Find the values of w, x, y and z. [4]

(ii) If two students were selected at random from the class, find the probability that both enjoyed playing the guitar. [2]

4028/2 N2015 Q4(a)

It is given that

$\xi = \{30; 31; 32; 33; 34; 35; 36; 37; 38; 39\}$,

A is the set of odd numbers and

B is the set of prime numbers.

(a) List the elements of

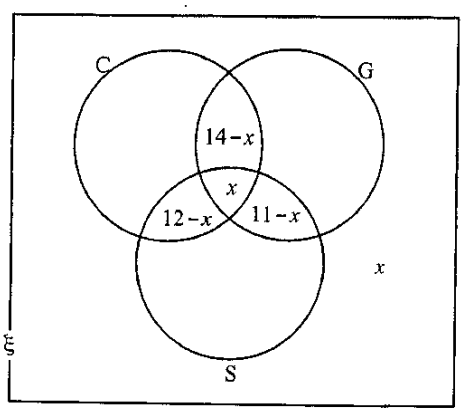
(i) A, [1]

(ii) B. [1]

(b) Find $n(\mathrm{A} \cap \mathrm{B}')$. [1]

4008/1 J2014 Q5

The Venn diagram shows some information about all the 52 families in a village. C is a set of 37 families that have cattle, G is a set of 24 families that have goats and S is the set of 20 families that have sheep.



It is also given that 14 families have cattle and goats, 11 families have cattle and sheep, x families have all three types of animals and another x families have no animals.

(a) Find, in terms of x, the number of families with
  (i) cattle only,
  (ii) goats only,
  (iii) sheep only. [6]

(b) Find
  (i) the value of x,
  (ii) the number of families with goats but have no cattle. [4]

4028/2 J2014 Q3

It is given that $\xi = \{1; 2; 3; 4; 5; 6; 7; 8; 9; 10\}$, where H is a set of prime numbers and K is a set of odd numbers.

(a) List the elements of set H. [1]

(b) Find $n(H \cup K)$. [2]

4008/1 N2014 Q3

It is given that $n(\xi) = 14, n(P) = 7, n(P \cap Q) = 2$ and $n(P \cup Q) = 11$.

(a) Show this information on a Venn diagram. [2]

(b) Find
  (i) $n(Q)$, [1]
  (ii) $n(Q \cup P')$. [1]

4008/1R N2014 Q20

It is given that
$\xi = [x: 8 < x \leq 16, x \text{ is an integer}]$,
$\mathrm{A} = \{x: x \text{ is a perfect square}\}$ and
$\mathrm{B} = \{x: x \text{ is an even number}\}$.

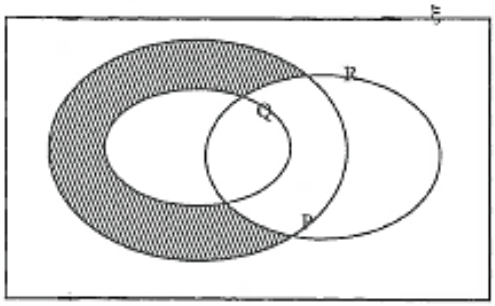
(i) List all the elements of A.

(ii) Find $n(\mathrm{B})$.

(iii) Show this information on a fully labelled Venn diagram. [7]

4008/2 N2014 Q3(b)

Write down, in set notation and in terms of P, Q and R, the set that is represented by the shaded part in the Venn diagram.

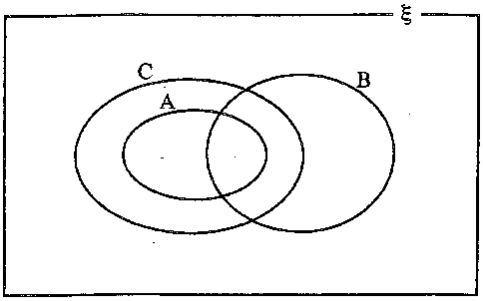


[2]

4008/2R N2014 Q4(a)

Given that $\xi = \{x: 1 \leq x \leq 15, x \text{ is an integer}\}$,
$\mathrm{A} = \{x: x \text{ is a multiple of 4}\}$,
$\mathrm{B} = \{x: x \text{ is a perfect square}\}$,
and $\mathrm{C} = \{x: x \text{ is a multiple of 2}\}$

(a) In the Venn diagram in the working space, fill in the members of each subset. [3]

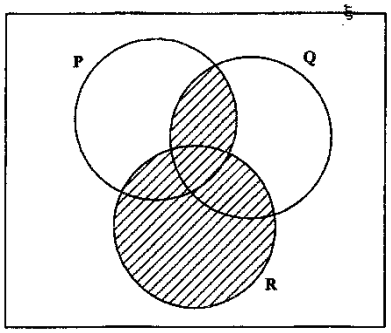


(b) (i) Write down the relationship between sets A and C in set notation. [1]
  (ii) Find $n(A \cap B \cap C)$. [1]

4028/1 J2013 Q22

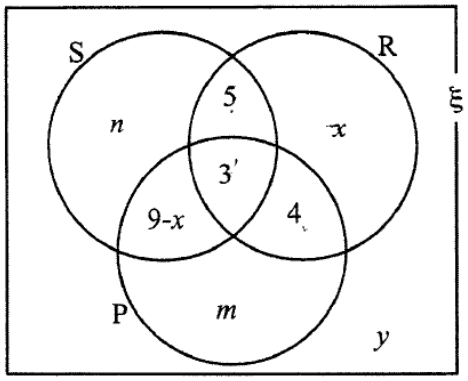
(a) Given that $n(\mathrm{A}) = 10$ and $n(\mathrm{B}) = 15$, find the greatest possible value of
  (i) $n(\mathrm{A} \cup \mathrm{B})$, [1]
  (ii) $n(\mathrm{A} \cap \mathrm{B})$. [1]

(b) Use set notation to describe the shaded region in the above diagram in terms of sets **P**, **Q** and **R**. [2]



4008/1 N2013 Q14

Fifty-five people attending a workshop were asked to indicate which food item they liked, choosing from 'sadza', rice or potatoes.
S is the set of people who liked 'sadza', where $n(S) = 23$,
R is the set of people who liked rice, where $n(R) = 19$ and
P is the set of people who liked potatoes, where $n(P) = 12$.
The information was displayed in a Venn diagram and the numbers in each region represent the numbers of people who liked at least one of those food items.



(i) Find the value of x.
(ii) Calculate the number of people who liked 'sadza' only.
(iii) Find the number of people who did **not** like any of the food items on offer. [6]

4008/2 N2013 Q4(b)

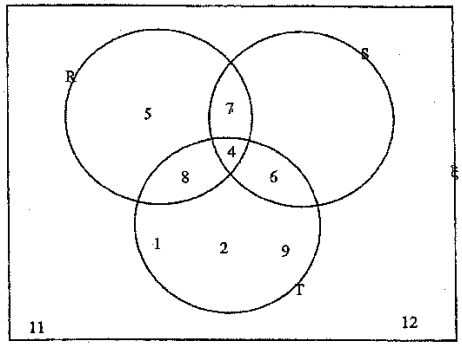
Two sets A and B are such that
$A \cap B \neq \emptyset$, $A \cup B = \xi$, $n(A) = 15$, $n(B) = 25$ and $n(A \cup B) = 30$. Find $n(A \cap B)$. [2]

4008/1 N2012 Q18(b)

It is given that $\xi = \{1\,;2\,;3\,;\ldots;8\,;9\,;10\}$, with subsets A and B such that A is a set of perfect squares and B is a set of multiples of 3.
(i) Draw a Venn diagram to represent the sets above.
(ii) Find $n(A \cup B)$. [4]

4008/2 N2012 Q2(a)

In the Venn diagram, R, S, T and ξ are sets with their elements as shown. Use the Venn diagram to find



(a) $R' \cap S$, [1]
(b) $(R \cap S) \cup (R \cap T)$, [1]
(c) $n(R \cup S \cup T)'$. [1]

4008/4028/1 J2011 Q13

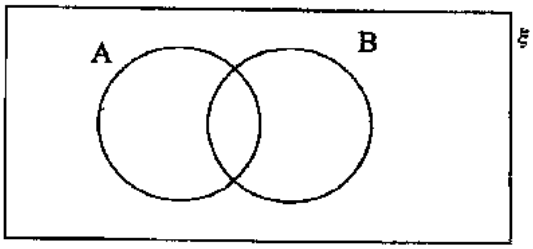
In a survey of 72 girls, it was found out that every girl watched at least one of the following TV programmes, Teen Scene or Fashion Show.
Fifty girls watched Teen Scene and 62 girls watched Fashion Show. Find the number of girls who watched
(i) both programmes,
(ii) Fashion Show only. [4]

4008/2 J2011 Q4(b)

A and B are sets. Write the following sets in their simplest form.
(a) $A \cap A'$, [1]
(b) $A \cup A'$, [1]
(c) $(A \cap B) \cup (A \cap B')$. [1]

4008/1 N2011 Q7

Given that $n(\xi) = 25$, $n(A) = 12$, $n(B') = 6$ and $n(A \cup B)' = 2$, complete the Venn diagram to show the number of elements in each subset.



4008/4028/1 J2010 Q7

It is given that $\xi = \{1; 2; 3; 5; 7; 8; 9\}$,
$A = \{3; 5\}$, $B = \{1; 3; 7; 9\}$ and $C = \{1; 7; 9\}$

(i) Draw a fully labelled Venn diagram to show **all** the elements in each subset. [3]

(ii) Write down the elements of the following subsets

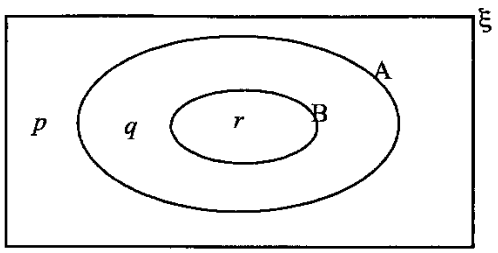
(a) $A \cap B \cap C'$,

(b) $(A \cup B)' \cup C$. [3]

4028/2 J2010 Q2(c)

It is given that $n(A) = 18$, $n(B) = 11$ and $n(A \cup B)' = 0$.

(a) If this information was shown on the Venn diagram below, write down the values of p, q and r, the number of elements in each region. [2]

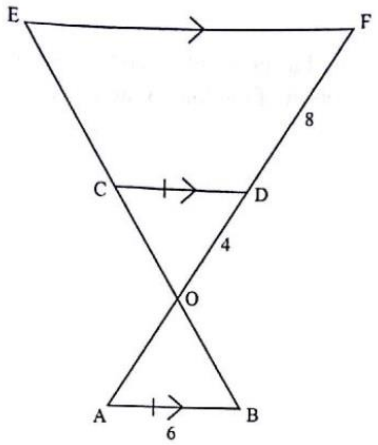


(b) For the same given information, complete the Venn diagram to show the number of elements in each region where $n(A \cup B) = 29$. [2]

4008/4028/1 N2010 Q17

SIMILARITY & CONGRUENCY

In the diagram, AODF and BOCE are straight lines intersecting at O. AB is parallel to CD and EF.
$AB = CD = 6\ cm$, $OD = 4\ cm$ and $DF = 8\ cm$.



(a) Name
  (i) the triangle which is congruent to triangle AOB, [1]
  (ii) two triangles which are similar to triangle AOB, [2]

(b) Calculate the length EF. [2]

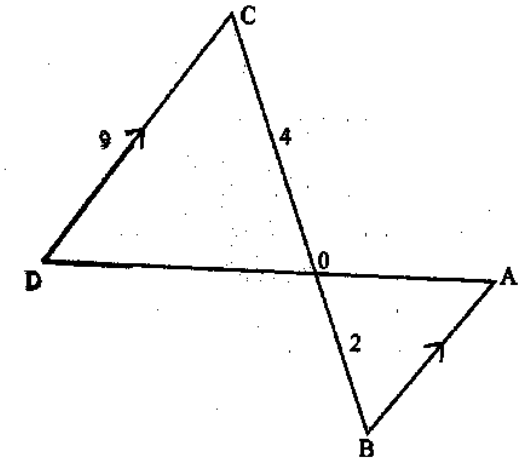
4004/1 J2020 Q23

Two similar cups have diameters of 6 cm and 10 cm.

(i) Write down the ratio of their volumes. [2]

(ii) Given that the volume of the smaller cup is $100\ cm^3$, calculate the volume of the larger cup. [2]

4004/2 J2020 Q2(a)



In the diagram two straight lines AD and BC meet at O such that $OB = 2cm$, $OC = 4cm$ and $CD = 9cm$, AB is parallel to CD.

(a) Name a triangle that is similar to triangle ABO. [1]

(b) Describe a single transformation that maps triangle OCD onto triangle OBA. [3]

(c) Calculate the length of AB. [2]

(d) Find the ratio of area of triangle OAB: area of triangle ODC in its simplest form. [1]

4004/1 N2020 Q27

Two similar containers are of capacities $1{,}728l$ and $5{,}832l$ respectively.
If the surface area of the bigger container is 153 cm^2, find the surface area of the smaller container. [3]

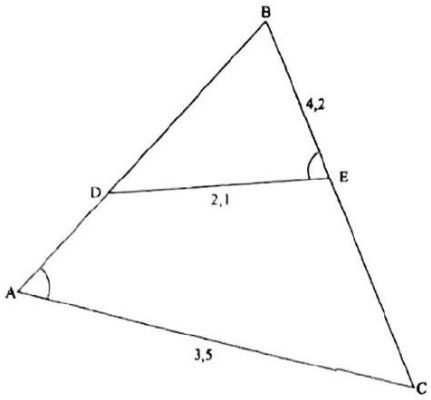
4004/2 N2020 Q3(b)

Two similar bottles are of heights 8 cm and 16 cm.

(a) The bases of the similar bottles are also similar. The surface area of the base of the smaller bottle is 1.44 cm^2. Find the surface area of the base of the bigger bottle. [2]

(b) Find the volume of the smaller bottle if the volume of the bigger bottle is 16 cm^3. [2]

4004/1 J2019 Q25



The diagram shows triangle **ABC** in which point **D** and **E** are on **BA** and **BC** respectively. **AC** = 3,5 cm, **BE** = 4,2 cm, **DE** = 2,1 cm and **BÂC** = **BÊD**.

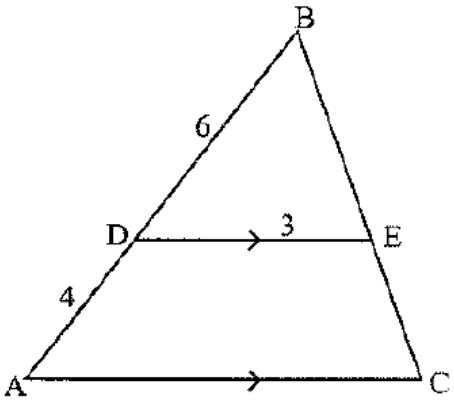
(a) Name the triangle which is similar to triangle **ABC**. [1]

(b) Calculate
  (i) **AB**, [2]
  (ii) the area of triangle ABC, given that the area of triangle **BDE** is 22,5 cm^2. [3]

4004/1 N2019 Q23

Two similar bottles have heights 8 cm and 12 cm. The mass of the bottle of height 8 cm is 40 g. Find the mass of the similar bottle that has a height of 12 cm. [2]

4030/1 J2018 Q20(b)



In the diagram, ABC is a triangle in which DE is parallel to AC. AD $= 4\,cm$, BD $= 6\,cm$ and DE $= 3\,cm$.
Find

(a) AC, [2]

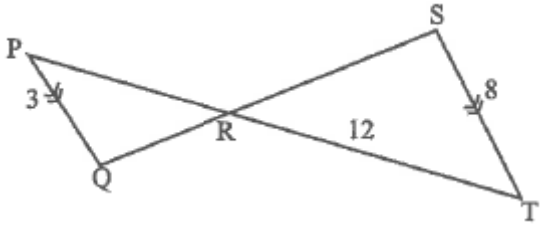
(b) the area of ADEC, if the area of triangle DEB is $3{,}6\,cm^2$. [3]

4030/1 J2017 Q27

Two similar square-based pyramids have base areas of $9\,cm^2$ and $25\,cm^2$. Find the ratio of their volumes, in the form $a : b$, where a and b are integers such that $a < b$. [2]

4030/2 J2017 Q2(a)

The diagram shows two triangles PQR and RST such that PQ is parallel to ST, PQ = 3 cm, ST = 8 cm and RT = 12 cm. PRT and QRS are straight lines.



(a) Name the triangle similar to triangle PQR. [1]

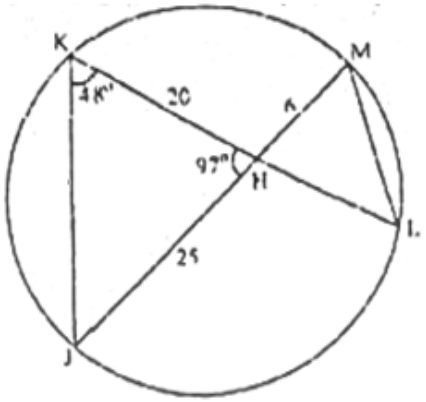
(b) Calculate PR. [2]

(c) Triangle RQP is mapped onto triangle RST by a transformation **A**.
Describe fully transformation **A**. [3]

4030/1 N2017 Q26

A jug 20 cm high has a capacity of 125 ml when full.
Calculate the height of a similar jug which has a capacity of 1 litre when full. [3]

4030/2 N2017 Q4(c)



$J\hat{K}H = 48°$, KH $= 20\,cm$, JH $= 25\,cm$ and HM $= 6\,cm$.

(a) Find $H\hat{L}M$.

(b) Name, in correct order, the triangle which is similar to triangle JKH.

(c) Calculate

(i) the length of JK,

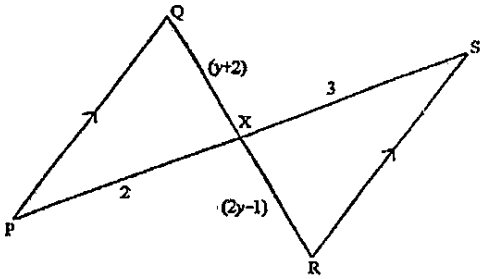
(ii) the area of triangle JKH.

4030/2 J2016 Q4

A cuboid of height 8 cm has a volume of 320 cm^3. Find the volume of a similar cuboid of height 6 cm. [3]

4030/1 N2016 Q12

In the diagram, PQ is parallel to RS. PS and QR intersect at X. It is given that PX = 2 cm, SX = 3 cm, QX $= (y + 2)$ cm and RX $= (2y - 1)$ cm.



(a) Name the triangle which is similar to triangle PQX. [1]

(b) Using your results in (a), find the value of y. [3]

(c) Write down the length of QR. [1]

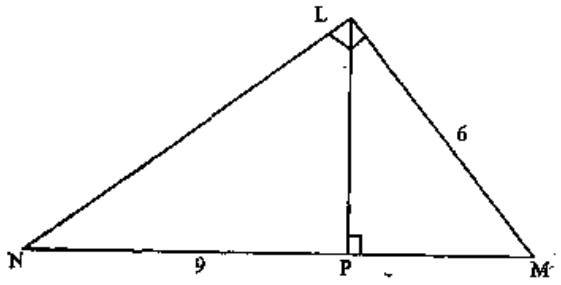
4008/1 J2014 Q25

Two similar drums have their diameters in the ratio 3 : 5.

(a) Write down the ratio of their volumes. [1]

(b) Given that the volume of the bigger drum is 100 l, calculate the volume of the smaller drum. [2]

4008/1R N2014 Q12

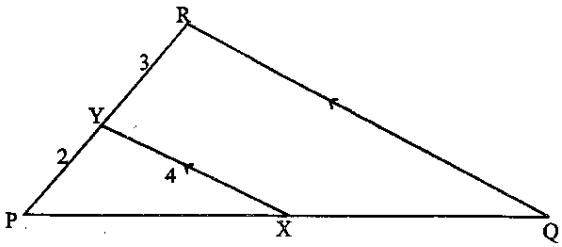


In the diagram, ΔLMN is right-angled at L and LP is an altitude. PN = 9 cm and LM = 6 cm.

(i) Name two triangles which are similar to ΔLMN.

(ii) Find PM. [5]

4008/2 N2014 Q4(a)



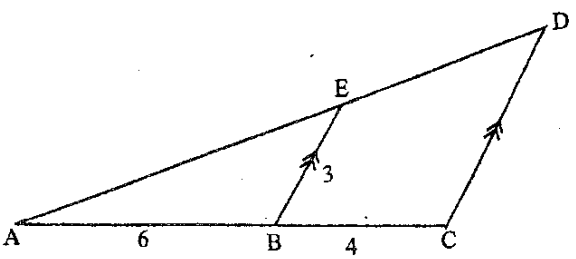
In the diagram, XY is parallel to QR, PY = 2 cm, YR = 3 cm and XY = 4 cm.

Find

(a) the length of QR, [2]

(b) the ratio $\frac{\text{area of } \Delta PXY}{\text{area of } \Delta PQR}$. [2]

4008/1 N2013 Q21



In the diagram, AB = 6 cm, BC = 4 cm, BE = 3 cm and BE is parallel to CD.

(a) Find the length of CD. [2]

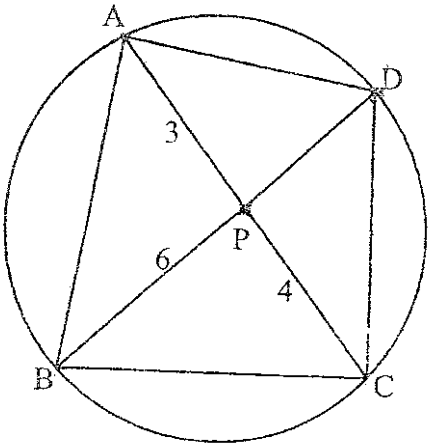
(b) Express each of the following ratios in the simplest form

(i) BE : CD, [1]

(ii) area of ΔABE : area of quadrilateral BCDE. [2]

4008/1 J2012 Q20

In the diagram, ABCD is a cyclic quadrilateral in which AC and BD intersect at P. AP = 3 cm, PC = 4 cm and BP = 6 cm.



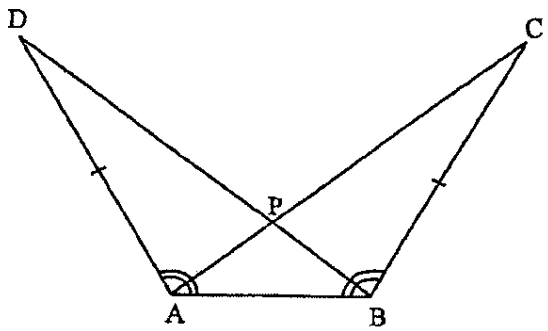
(i) Name in correct order, the triangle that is similar to triangle APD.

(ii) Find the ratio of $\frac{\text{area of } \Delta APD}{\text{area of } \Delta CPD}$.

(iii) Given that the area of ΔCPD = 8 cm^2, calculate the area of the quadrilateral ABCD. [5]

4008/2 J2012 Q6(c)

(a) In the diagram, $D\hat{A}B = A\hat{B}C$, AD = BC and AC and BD intersect at P.



(i) Name the triangle that is congruent to triangle ABC. [1]

(ii) State the case for congruency in **(a)(i)**. [1]

(b) The sides of a triangle X are 9 cm, 7 cm and 6 cm. The shortest side of a triangle Y, which is similar to triangle X, is 3 cm.

Write down the ratio, area of X : area of Y. [2]

4008/4028/1 J2011 Q20

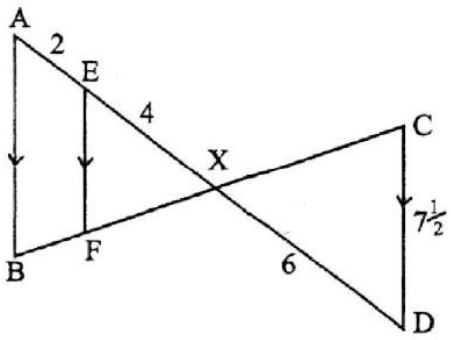
A car manufacturer makes a scale model of one of his real cars.

(a) The capacity of the fuel tank of the real car is 64 litres and that of the model car is 0,512 litres. Find the ratio of

the length of the real car : the length of model car. [2]

(b) The area of the front window of the model is 0.0484 m^2. Find the area of the front window of the real car. [2]

4008/1 N2011 Q15



In the diagram, AEXD and BFXC are straight lines. AE = 2 *cm*, EX = 4 *cm*, XD = 6 *cm* and CD = $7\frac{1}{2}$ *cm*. AB, EF and CD are parallel.

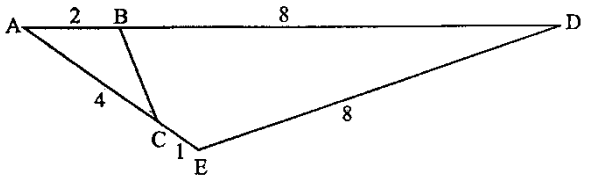
(a) Name, in correct order, the triangle which is

(i) congruent to ΔXCD, [1]

(ii) similar to *but not congruent*, to ΔXCD. [1]

(b) Find the length of EF. [2]

4008/4028/1 J2010 Q21



In the diagram, ADE is a triangle, B is a point on AD such that AB = 2 cm and BD = 8 cm. C is a point on AE such that AC = 4 cm and CE = 1 cm, DE = 8 cm.

(i) Name the triangle that is similar to Δ ABC.

(ii) Calculate the length of BC. [4]

4008/2 N2010 Q3(b)

SIMULTANEOUS EQUATIONS

Solve the simultaneous equations:
$2x + y = 4$
$x - y = -2$ [3]
4004/1 J2020 Q5

Solve the simultaneous equations:
$x + 2y = 0$
$y = 3 - 2x$ [3]
4004/1 N2020 Q6

Solve the simultaneous equations:
$5x - 2y = 26$
$3x + 4y = 0$ [3]
4004/1 J2019 Q8

Solve the simultaneous equations:
$3x - y = 2$
$5x - 2y = 0$ [3]
4004/1 N2019 Q3

Solve the simultaneous equations:
$x + y = 5\frac{1}{2}$
$x - 2y = 2\frac{1}{2}$ [3]
4030/1 J2018 Q11

Solve the simultaneous equations:
$2x + 3y = 11$
$3x - 5y = -12$ [3]
4004/1 N2018 Q7

Solve the simultaneous equations:
$x + \frac{1}{2}y = 1$
$3x - 4y = 14$ [3]
4030/1 J2017 Q10

Solve the simultaneous equations:
$6y - 3x = 1$
$3x + y = 13$ [3]
4030/1 J2016 Q5

Solve the simultaneous equations:
$3x - 2y = 9$
$4x + y = 1$ [3]
4030/1 N2016 Q6

Solve the simultaneous equations:
$3x - y = 7$
$y = 5 - x$ [3]
4008/1 J2015 Q11

Solve the simultaneous equations:
$3x - 2y = 8$
$5x - 4y = 12$ [3]
4028/2 J2015 Q11(a)

Solve the simultaneous equations:
$2x + 3y = 28$
$x + 5y = 35$ [3]
4028/1 N2015 Q6

Solve the simultaneous equations:
$\frac{1}{3}x = y$
$2x + y = -7$ [3]
4008/1 J2014 Q8

Solve the simultaneous equations:
$x - 2y = -2$
$4x + 3y = -19$ [3]
4008/1 N2014 Q

Solve the simultaneous equations:
$5d - 3e = -1$
$2d + 3e = 8$ [3]
4008/1 N2013 Q11

Solve the simultaneous equations:
$4x - 2y = 16$
$3x + 2y = 19$ [3]
4008/1 J2012 Q4

Solve the simultaneous equations:
$4x + 9y = 33$
$2x - 3y = -6$ [3]
4008/1 N2012 Q7

Solve the simultaneous equations:
$x - 6y = -4$
$9x + 3y = -17$ [3]
4008/1 N2011 Q6

$\frac{1}{2}x + 3y = 4$
$3x + 2y = 8$ [3]
4008/4028/1 J2010 Q9

Solve the simultaneous equations:

$0{,}4x + 3y = 2{,}6$

$x - 2y = 4{,}6$ [3]

4008/4028/1 N2010 Q13

In an Olympiad test, there were 26 questions. Eight points were given for each correct answer and five points were deducted for each wrong answer. Tamara answered all questions and scored zero. Find the number of questions she had got correct. [4]

4008/2 N2010 Q2(c)

STATISTICS & PROBABILITY

The mean of 3 numbers is 7. Two of the numbers are 4 and -5. Find the third number. [3]

4004/1 J2020 Q7

The table shows grades obtained by 150 candidates in a Mathematics test.

Grade	A	B	C	D	E	U
Frequency	5	25	30	29	21	40

(a) Find the median. [1]

(b) Calculate the probability that two candidates chosen at random from the 150 obtained grade A or B. [2]

4004/1 J2020 Q15

The table below shows the heights, h cm, of a group of 200 children.

Height (h cm)	$50 < h \leq 60$	$60 < h \leq 70$	$70 < h \leq 75$	$75 < h \leq 80$	$80 < h \leq 100$
Frequency	24	38	53	45	40
Frequency Density	2.4	3.8	10.6	p	q

(a) Find the value of (i) p, (ii) q. [2]

(b) Calculate an estimate of the mean height of the children. [3]

(c) Draw a histogram to show the information in the table. Use a scale of 2 cm to represent 10 units on the h axis and 2 cm to represent 2 units on the Frequency Density axis. [5]

(d) Two children are chosen at random from the group. Find the probability that each has a height which is greater than 75 cm. [2]

4004/2 J2020 Q12

The table shows the distribution of heights of students in a form 3 class.

Height (x)	$140 < x \leq 150$	$150 < x \leq 155$	$155 < x \leq 170$
Frequency	6	m	9
Frequency Density	0.6	2.2	n

(a) Calculate the value of (i) m, [1] (ii) n. [1]

(b) Estimate the mean height of the class giving your answer correct to 3 significant figures. [3]

4004/1 N2020 Q26

An Agriculture class studied the effect of a certain chemical on the growth rate of 30 Moringa seedlings.

The heights of the Moringa seedlings are shown in the frequency table.

Height h (cm)	$10 < h \leq 20$	$20 < h \leq 25$	$25 < h \leq 35$	$35 < h \leq 40$
Frequency	5	6	10	9

(a) Write down the modal class. [1]

(b) If the information is represented on a histogram, write down the frequency densities of the following classes.

(i) $10 < h \leq 20$. [2]

(ii) $35 < h \leq 40$. [1]

(c) Calculate the size of the angle that would represent the class $35 < h \leq 40$ on a pie chart. [2]

(d) Calculate an estimate of the mean height of the seedlings. [3]

(e) If 2 seedlings are picked at random, find the probability that one is at most 20 cm tall and the other is more than 35 cm tall. [3]

4004/2 N2020 Q10

The masses of 6 bags of mealie-meal on the shelf of a shop were as follows:

$5\ kg; 5\ kg; 10\ kg; 10\ kg; 10\ kg; 20\ kg.$

Find the (a) modal mass, [1]

(b) median mass, [1]

(c) mean mass. [2]

4004/1 J2019 Q16

The table shows information about the heights of a group of 42 learners.

Height (h) cm	$150 < h \leq 160$	$160 < h \leq 165$	$165 < h \leq 180$	$180 < h \leq 190$
Frequency	5	9	18	10
Frequency Density	0.5	1.8	1.2	1

(a) State the

(i) modal class,

(ii) class that contains the median height,

(iii) class that contains the lower quartile. [3]

(b) Calculate an estimate of the mean height of the learners. [3]

(c) Two learners are chosen at random from the group. Find the probability that both have heights that are more than 160 cm but less than or equal to 180 cm. [3]

(d) Using a scale of 2 cm to 5 units on the Height axis and 2 cm to 0.5 units on the Frequency Density axis, draw a histogram to show the information. [3]

4004/2 J2019 Q10

The table shows the heights of 30 plants in a school garden.

Height (h) cm	$20 < h \leq 30$	$30 < h \leq 40$	$40 < h \leq 50$	$50 < h \leq 60$	$60 < h \leq 70$
Number of plants	4	6	10	2	8

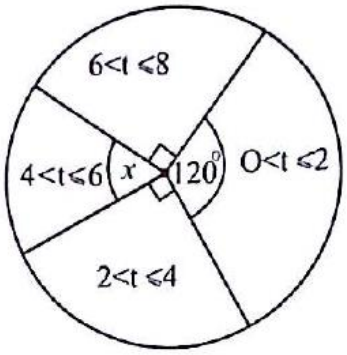
(a) (i) State the modal class height. [1]

(ii) Estimate the mean height of the plants. [3]

(b) A plant is chosen at random from the garden. Find the probability that its height is more than 40 cm but less than or equal to 60 cm. [1]

4004/1 N2019 Q22

The pie chart represents the time, t hours, spent by 240 people on charity work.



(a) Find the value of x. [1]

(b) The following table shows the information contained in the pie chart.

Time (t hours)	$0 < t \leq 2$	$2 < t \leq 4$	$4 < t \leq 6$	$6 < t \leq 8$
Frequency	80	p	q	r

Find the value of (i) p,

(ii) q,

(iii) r. [3]

(c) Calculate an estimate of the mean time spent on charity work. [3]

(d) Two people are chosen at random from the whole group, find the probability that they both spent more than 4 hours doing charity work. [2]

(e) Draw a frequency polygon to show the information in the table in (b). Use a scale of 2 cm to 2 units on the x-axis and 2 cm to 10 units on the y-axis. [3]

4004/2 N2019 Q9

The marks of 6 of the students who wrote a mathematics test are as follows:

15 ; 14 ; 9 ; 12 ; 11 ; 15.

(a) Find the median mark for the 6 students. [1]

(b) A seventh student got x marks from the same test and the mean mark for the seven students was 13. Find x, the mark of the seventh student. [3]

4030/1 J2018 Q18

(a) The table shows the distribution of marks obtained by 30 pupils in a class test.

Mark (x)	$1 < x \leq 5$	$5 < x \leq 10$	$10 < x \leq 15$	$15 < x \leq 20$	$20 < x \leq 25$
Number of pupils (f)	4	8	5	6	7

(i) State the modal class. [1]

(ii) The table shows entries used to calculate the mean of data using an assumed mean of 12,5.

Class Centre (x)	Number of Pupils (f)	Deviation ($x - 12,5$)	$f(x - 12,5)$
3	4	$-9,5$	-38
7,5	8	-5	p
12,5	5	0	0
q	6	$+5$	$+30$
22,5	7	r	$+70$
	Total = 30		
			Total = S

Calculate the values of p, q, r and S. [4]

(iii) Hence or otherwise calculate, an estimate of the mean of the distribution. [2]

(b) Two pupils are chosen at random from the class of 30 pupils. Calculate the probability that

(i) one has a mark in the range $10 < x \leq 15$ and the other a mark of at most 10, [3]

(ii) both pupils got marks that are more than 20. [2]

4030/2 J2018 Q11

The table below shows the heights, h, of 50 trees in a school orchard.

Height (h) m	$2 < h \leq 6$	$6 < h \leq 8$	$8 < h \leq 10$	$10 < h \leq 12$
Frequency	*12*	*16*	*12*	*10*

(a) Write down the interval which contains

(i) the modal height,

(ii) the median height, [2]

(b) Calculate an estimate of the mean height of the trees. [3]

4004/1 N2018 Q20

At a soccer match, a boy conducted a survey of the age of vehicles that were parked at the stadium. The information is displayed in the following table.

Age (x years)	$0 < x \leq 5$	$5 < x \leq 10$	$10 < x \leq 15$	$15 < x \leq 20$	$20 < x \leq 25$
Number of vehicles	10	12	37	51	10

(a) Calculate an estimate of the mean age of the vehicles. [3]

(b) The same information of the survey is displayed in the following cumulative frequency table.

Age (x years)	$0 < 5$	$x < 10$	$x < 15$	$x < 20$	$x < 25$
Cumulative frequency	10	22	n	110	120

(i) Find the value of n. [1]

(ii) Draw a cumulative frequency curve using a scale of 2 cm to 5 years on the age axis and 2 cm to 20 vehicles on the cumulative frequency axis. [4]

(c) Use the graph to find the

(i) median age, [2]

(ii) upper quartile. [2]

4004/2 N2018 Q6

The heights of 60 children were recorded. Below is an incomplete frequency and frequency density table of the results.

Height (h cm)	$110 < h \leq 120$	$120 < h \leq 125$	$125 < h \leq 130$	$130 < h \leq 145$	$145 < h \leq 150$
Frequency	12	18	8	12	10
Frequency Density	1.2	3.6	m	0.8	2

(a) State the modal class. [1]

(b) Find the value of m. [1]

(c) Calculate an estimate of the mean height. [3]

(d) If two children were chosen at random, calculate the probability that one had a height of not more than 120 cm and the other had a height greater than 145 cm. [3]

(e) Draw a histogram which represents this information. Use a scale of 2 cm to represent 5 units on the h axis and 2 cm to represent 0.5 units on the Frequency Density axis. [4]

4030/2 J2017 Q12

The mean of 9 numbers is 11,9. The mean of 8 of the numbers is 13. Find the ninth number. [3]

4030/1 N2017 Q9

(a) A survey was carried out to find the ages of 60 patients at a hospital. The table shows the information collected.

age x (years)	$0 < x \leq 10$	$10 < x \leq 20$	$20 < x \leq 30$	$30 < x \leq 35$	$35 < x \leq 40$	$40 < x \leq 45$	$45 < x \leq 50$	$50 < x \leq 60$
Frequency	0	4	m	11	15	10	5	7

Find the value of m. [1]

(b) The table shows cumulative frequency of the same 60 patients.

age x (years)	$x \leq 10$	$x \leq 20$	$x \leq 30$	$x \leq 35$	$x \leq 40$	≤ 45	$x \leq 50$	$x \leq 60$
cumulative frequency	0	4	n	23	38	48	53	60

Find the value of n. [1]

(c) Find the probability that 2 patients chosen at random will both be less than or equal to 45 years in age. [2]

(d) Draw a cumulative frequency curve for the data shown. Use a scale of 2 cm to 10 years on the age axis and 2 cm to 10 patients on the cumulative frequency axis. [4]

(e) (i) Use the graph to estimate the median. [2]

(ii) Use the graph to estimate the upper quartile. [2]

4030/2 N2017 Q9

The table shows the sizes of shoes worn by pupils in a class.

shoe size	**5**	**6**	**7**	**8**	**9**
frequency	**6**	**14**	**12**	**8**	**2**

Find

(a) the total number of pupils in the class,

(b) the modal shoe size,

(c) the median shoe size. [3]

4030/1 J2016 Q15

A survey of the weekly sales of 1 000 traders at a flea market gave the following results.

weekly sales, S, \$	$50 \leq S < 100$	$100 \leq S < 200$	$200 \leq S < 300$	$300 \leq S < 400$	$400 \leq S < 450$
frequency	80	360	380	120	x
frequency density	1.6	3.6	y	1.2	1.2

(a) (i) Find the value of x, [1]

(ii) Find the value of y. [2]

(b) (i) State the modal class. [1]

(ii) A pie-chart was drawn using frequency densities given in the table. Calculate the angle at the centre, correct to the nearest degree, that would represent the class $50 \leq S < 100$. [2]

(c) Calculate an estimate of the mean sales for that week. [3]

(d) Two traders are chosen at random. Find the probability that the two had earnings greater than or equal to \$300 for that week. [3]

4030/2 J2016 Q8

The masses of 20 patients at a hospital are shown in the table.

mass (m) kg	**$60 < m \leq 70$**	**$70 < m \leq 80$**	**$80 < m \leq 100$**
number of patients	**7**	**8**	**5**

(a) Calculate an estimate of the mean mass of the patients. [3]

(b) Two patients are chosen at random from the 20 patients. Find the probability that both have masses greater than 80 kg. [2]

4030/1 N2016 Q23

(a) The table shows the results of 40 candidates' marks in a Physics examination.

mark (%)	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80
frequency	0	3	7	12	9	5	m	1	1

(i) Find the value of m. [1]

(ii) Calculate the approximate mean mark for these candidates correct to the nearest whole number. [3]

(b) The table shows the cumulative frequency of the results of the same Physics examination.

mark (%)	$x < 40$	$x < 45$	$x < 50$	$x < 55$	$x < 60$	$x < 65$	$x < 70$	$x < 75$	$x < 80$
cumulative frequency	0	3	10	n	31	36	38	39	40

Find the value of n. [1]

(c) Draw a cumulative frequency curve for the data. Use a scale of 2 cm to 10 marks on the percentage axis and 2 cm to 10 candidates on the cumulative frequency axis. [4]

(d) Use the graph to find

(i) the median mark, [2]

(ii) the number of candidates who passed the examination if the pass mark was 49%. [2]

4030/2 N2016 Q8

Ten students walk to Chitsa High School every day. The distances they walk, to the nearest kilometre, are given in the frequency table below.

distance in kilometres	1	2	3	4	5
frequency	4	2	2	1	1

(a) State the least possible distance walked by a student. [1]

(b) Find

(i) the modal distance walked, [1]

(ii) the median distance walked. [1]

(c) Calculate the mean distance walked. [2]

4008/1 J2015 Q24

Answer the whole of this question on a sheet of graph paper.

The table below shows the distribution of Maths marks for 500 students in an examination.

mark (x)	$x \leq 10$	$x \leq 20$	$x \leq 30$	$x \leq 40$	$x \leq 50$	$x \leq 60$	$x \leq 70$	$x \leq 80$	$x \leq 90$	$x \leq 100$
cumulative frequency (f)	10	50	150	245	325	400	465	490	495	500

(a) Using a scale of 2 cm to represent 10 marks on the horizontal axis and 2 cm to represent 50 students on the vertical axis, draw a cumulative frequency curve for this distribution. [4]

(b) Use your graph to find the

(i) median mark,

(ii) inter-quartile range. [5]

(c) Two students are chosen at random. Find the probability that both students got marks less than or equal to 50. [3]

4028/2 J2015 Q12

The marks obtained by 80 students in a Mathematics test are shown in the table.

mark m (%)	frequency
$0 < m \leq 20$	0
$20 < m \leq 30$	5
$30 < m \leq 40$	19
$40 < m \leq 50$	18
$50 < m \leq 60$	16
$60 < m \leq 70$	14
$70 < m \leq 80$	4
$80 < m \leq 90$	2
$90 < m \leq 100$	2

(a) Estimate the mean mark for the students' test. [3]

(b) The information is an incomplete cumulative frequency table for the distribution.

Mark (%)	$m \leq 20$	$m \leq 30$	$m \leq 40$	$m \leq 50$	$m \leq 60$	$m \leq 70$	$m \leq 80$	$m \leq 90$	$m \leq 100$
Cumulative Frequency	0	5	24	42	58	72	q	78	80

(i) Find the value of q. [1]

Answer the whole of this part of the question on a sheet of graph paper. *Use a scale of 2 cm to represent 20 marks on the horizontal axis and 2 cm to represent 20 students on the vertical axis.*

(ii) Draw a cumulative frequency curve to illustrate this information. [4]

(iii) Showing your method clearly on the graph, use your graph to estimate

1. the median mark,
2. the number of students whose marks were more than 45% but less than 75%. [4]

4028/2 N2015 Q11

The ages of pupils in a class of 30 are shown in the table.

age in years	11	12	13	14	15
no. of pupils	3	10	8	6	3

(a) Two pupils are chosen at random from the class, find the probability that one is aged 11 and the other is aged 14, [2]

(b) Calculate the mean age of the pupils. [3]

4008/1 J2014 Q24

Answer this part of the question on a sheet of graph paper.

The following is a cumulative frequency table for a survey carried out on the masses of 80 secondary school pupils.

mass (kg)	$m \leq 45$	$m \leq 50$	$m \leq 55$	$m \leq 60$	$m \leq 65$	$m \leq 70$	$m \leq 75$	$m \leq 80$
cumulative frequency	2	10	21	41	60	72	78	80

(i) *Using a scale of 2 cm to represent 5 kg on the horizontal axis and 2 cm to represent 10 pupils on the vertical axis,* draw a cumulative frequency curve for the data.

(ii) Use your graph to find

1. the median mass of the pupils,
2. the number of pupils whose masses are more than 72 kg. [7]

4028/2 J2014 Q10(b)

The following is a list of marks obtained by a group of students.

20 ; 18 ; 12 ; 19 ; 18 ; 14 ; 18

(a) Find

(i) the mode, [1]

(ii) the median. [1]

(b) if two more marks, x and $x + 1$, are included in the list, the mean becomes 16. Find x. [3]

4008/1 N2014 Q16

The table shows the number of passengers in each of 50 taxis leaving airport one day.

number of passengers in taxi	1	2	3	4
number of taxis	x	20	y	13

(a) Find the value of $x + y$ in its simplest form. [2]

(b) If the mean number of passengers per taxi is 2,66; show that $x + 3y = 41$. [2]

(c) Find the value of x and the value of y by solving appropriate equations. [2]

4008/1R N2014 Q26

Answer the whole of this question on a sheet of plain paper.

The table shows the number of books borrowed from a University library in one week.

subject	Geography	Science	Maths	Shona	Theory of Education
number of books	30	45	25	20	60

(a) Find the total number of books borrowed in that week. [2]

(b) Express the number of Theory of Education books as a fraction of all the books borrowed in its lowest terms. [2]

(c) Show this information on a clearly labelled pie-chart. [6]

(d) Two students borrowed books from the library during that week.
Calculate the probability that the first student borrowed a Science book and the second a Maths book. [2]

4008/2 N2014 Q9

A class of 40 pupils from different families were asked how many pets they kept. The results are shown in the table.

number of pets per family	1	2	3	4
number of families	3	7	17	13

(a) (i) State the mode, [1]

(ii) Calculate the mean number of pets per family. [2]

(b) If the results in the table were shown on a pie chart, calculate the angle representing the number of pupils who kept **two** pets. [2]

(c) Express the number of pupils who kept **three** pets as a percentage of the class. [3]

4028/1 J2013 Q25

Answer the whole of this question on a sheet of graph paper.

One hundred boys watched soccer on TV during the 2010 World Cup. The information is shown in the table.

time (x hours)	number of boys
$x \leq 15$	1
$15 < x \leq 20$	2
$20 < x \leq 25$	7
$25 < x \leq 30$	11
$30 < x \leq 35$	25
$35 < x \leq 40$	23
$40 < x \leq 45$	17
$45 < x \leq 50$	10
$50 < x \leq 55$	3
$55 < x \leq 60$	1

The following is an incomplete cumulative frequency table for the distribution.

time	$x \leq 15$	$x \leq 20$	$x \leq 25$	$x \leq 30$	$x \leq 35$	$x \leq 40$	$x \leq 45$	$x \leq 50$	$x \leq 55$	$x \leq 60$
frequency	1	3	10	21	46	p	q	96	99	100

(a) Find the value of p and the value of q. [2]

(b) Using a scale of 2 cm to represent 10 hours on the horizontal axis and 2 cm to represent 10 boys on the vertical axis, draw the cumulative frequency curve for the data. [4]

(c) Use your graph to find

(i) the number of boys who watched soccer for 30 hours and below,

(ii) the median number of hours spent watching soccer on TV,

(iii) the number of boys who watched soccer for more than 20 hours but not more than 45 hours. [4]

(d) If two boys were chosen at random from the group, find the probability that both watched soccer for 30 hours or less. [2]

4028/2 J2013 Q11

A rugby team scored the following points in 12 matches:

21; 18; 3; 12; 15; 18; 42; 18; 24; 6; 12; 3

For the 12 matches, find

(a) the mode, [1]

(b) the mean, [2]

(c) In the next match, the team scored 55 points. Write down the median score for the 13 matches. [1]

4008/1 N2013 Q17

Forty pupils took part in a race and the distances to the nearest metre, that they covered in a certain time interval, are given in the frequency table below.

distance (in m)	$10 \le x \le 20$	$20 \le x \le 50$	$50 \le x \le 60$	$60 \le x \le 70$	$70 \le x \le 80$	$80 \le x \le 100$
frequency (f)	4	6	8	4	13	5
frequency density	0.4	p	0.8	q	r	0.25

(i) State the modal class.

(ii) If the information is to be represented on a histogram, find the values of p, q and r.

(iii) Calculate the mean distance covered.

(iv) Two of the pupils are selected at random to make a report on the race. Find the probability that both pupils had covered 70 m or more in the race. [8]

4008/2 N2013 Q11(b)

A boy picked up some stones as he was playing. The table below shows the number of stones picked and their respective mass ranges.

Mass (m) in grammes	$0 < m \le 2$	$2 < m \le 4$	$4 < m \le 6$	$6 < m \le 8$
Number of stones	2	6	5	3

Use the table to find

(a) the number of stones which had a mass of more than 4 grammes, [1]

(b) the modal class interval, [1]

(c) an estimate of the mean mass. [1]

4008/1 J2012 Q9

Answer the whole of this question on a sheet of graph paper.

The table below shows the heights, h, of 100 grade seven pupils correct to the nearest centimetre.

Height (h cm)	$110 < h \le 115$	$115 < h \le 120$	$120 < h \le 125$	$125 < h \le 130$	$130 < h \le 135$	$135 < h \le 140$	$140 < h \le 145$	$145 < h \le 150$
Frequency	2	14	24	30	16	10	3	1

The table below is the cumulative frequency table for the information above.

Height (h cm)	$h \le 115$	$h \le 120$	$h \le 125$	$h \le 130$	$h \le 135$	$h \le 140$	$h \le 145$	$h \le 150$
Cumulative Frequency	2	16	p	70	q	r	99	100

(a) Find the value of p, q and r. [2]

(b) Using a scale of 2 cm to represent 10 pupils on the vertical axis and 2 cm to represent 5 cm on the horizontal axis, draw the cumulative frequency curve for the height distribution. [4]

(c) Use your graph to estimate the median height of these pupils. [1]

(d) Calculate the approximate mean of these pupils correct to the nearest centimetre. [3]

(e) Two pupils are chosen at random from this group. Find the probability that both of them have a height of more than 125 cm but not more than 135 cm. [2]

4008/2 J2012 Q12

The mean of 10 numbers is 54,6. If the number $(x + 6)$ is added to the 10 numbers, the mean becomes 51. Find the value of x. [3]

4008/1 N2012 Q15

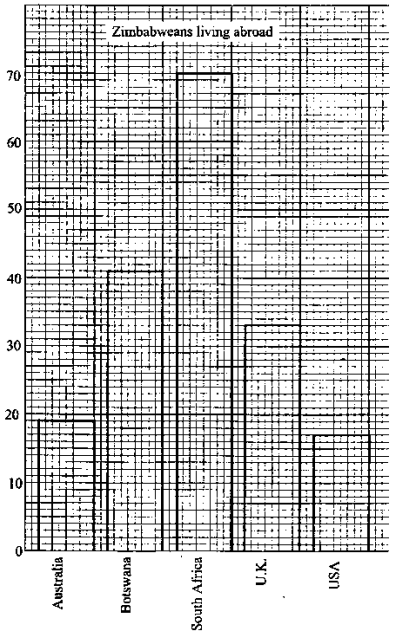
The bar graph shows the results of a survey, carried out at a wedding party, on a group of Zimbabweans living abroad. Use the graph to answer the following questions.

(a) (i) Find the total number of Zimbabweans, living outside the country, who attended the wedding.

(ii) State the country in which most people in the survey live.

(iii) Calculate the percentage of Zimbabweans who live in Australia and the U.S.A combined. [5]

(b) Two people are chosen at random from the group in the survey, one after the other.



Find the probability that

(i) both live in Botswana,

(ii) the first lives in South Africa and the second lives in the U.S.A. [4]

(c) The survey results can be represented on a pie chart. Draw and label clearly the pie-chart. [3]

4008/2 N2012 Q12

The following entries show the number of bicycles sold per day in nine days.

6 ; 10 ; 12 ; 9 ; 14 ; 10 ; 15 ; 10 ; 12

Find

(a) the mode, [1]

(b) the median, [1]

(c) the next entry if the new mean on the tenth day is 12. [2]

4008/4028/1 J2011 Q18

Answer the whole of this question on a sheet of graph paper.

The table below shows the grades obtained by candidates in a Mathematics examination.

Grade	A	B	C	D	E	U
Frequency	10	25	40	24	21	30

(a) Calculate the number of candidates who wrote the examination. [2]

(b) State the modal grade. [1]

(c) Using a scale of 2 cm to represent 5 candidates, draw a bar graph to show the information. [4]

(d) Given that the passing grades are A, B and C, find the probability that two candidates chosen at random passed the examination. [3]

(e) If a pie-chart is drawn for this information, calculate the angle of the sector that represents grade C. [2]

4008/2 J2011 Q9

Answer the whole of this question on a sheet of graph paper.

The table below shows the heights of 32 pupils measured to the nearest cm.

Height (h)	$120 \le h < 130$	$130 \le h < 140$	$140 \le h < 150$	$150 \le h < 160$	$160 \le h < 170$	$170 \le h < 180$	$180 \le h < 190$
Frequency	1	3	6	10	7	4	1

Below is the cumulative frequency table for the information above.

upper class boundary	$h < 130$	$h < 140$	$h < 150$	$h < 160$	$h < 170$	$h < 180$	$h < 190$
cumulative frequency	1	4	10	20	27	31	32

(a) Using a scale of 2 cm to represent 5 pupils on the vertical axis and 2 cm to represent 10 cm on the horizontal axis, draw the cumulative frequency curve to illustrate this information. [4]

(b) Use your graph to find the median height of the pupils. [2]

(c) To get into a game park at half price, pupils have to be under 150 cm tall. Find the number of pupils who can get in at half price. [1]

(d) If two pupils are chosen at random from the class, find the probability that the height of the first is less than 150 cm and that of the second is at least 160 cm. [2]

(e) Calculate an estimate of the mean height of the pupils. [3]

4008/2 N2011 Q10

Answer the whole of this question on a sheet of graph paper.

The table below shows the marks obtained by 40 students in a Mathematics test.

Mark (x)	$8 < x \le 10$	$10 < x \le 11$	$11 < x \le 12$	$12 < x \le 14$	$14 < x \le 16$	$16 < x \le 19$
Frequency	5	5	7	14	6	3

The following is a cumulative frequency table for this distribution.

Mark (x)	$x \le 10$	$x \le 11$	$x \le 12$	$x \le 14$	$x \le 16$	$x \le 19$
Cumulative Frequency	5	q	17	31	37	40

(a) Find the value of q. [1]

(b) State the modal class. [1]

(c) Using a scale of 1 cm to represent 1 mark on the x-axis and 2 cm to represent 5 students on the y-axis, draw the cumulative frequency

curve for the marks. [3]

(d) Use your graph to estimate

(i) the median mark,

(ii) the number of students who got 15 or more marks. [4]

(e) Calculate an estimate of the mean mark. [3]

4028/2 J2010 Q9

SUBSTITUTION

Given that $m = \frac{1}{2}$ and $n = -2$, evaluate

(a) $m - n$, [1]

(b) $\frac{mn}{m+n}$. [2]

4004/1 J2020 Q8

It is given that $l = -3, m = 2$ and $n = -1$.
Find the value of

(a) $lm + n$, [1]

(b) $\sqrt{l^2 - m^2 - n^2}$. [2]

4004/1 N2020 Q4

It is given that $q = -6, r = -1$ and $t = 2$. Evaluate

(a) $\frac{qr}{t}$, [1]

(b) $qt - r$, [1]

(c) $(q + r)^t$ [1]

4004/1 N2019 Q4

Given that $\boldsymbol{P} = \frac{1}{2}[a + d(a + d)]$, evaluate $\boldsymbol{P}$ when $a = \frac{1}{2}$ and $d = 1$. [2]

4004/2 N2018 Q1(b)

Given that $d = 2n - 1$, find d when $n = 8$. [1]

4030/1 N2017 Q17(a)

Given that $r = 27$, $s = \frac{1}{3}$ and $t = 2$, find the value of

(i) r^s, [1]

(ii) s^{-t}. [2]

4030/1 N2017 Q22(b)

Find the value of $(y + z)^x$, given that $x = 2$, $y = -2$
and $z = 5$. [2]

4030/1 N2016 Q8(b)

Given that $a = -3, b = 3$ and $c = -1$, evaluate $\left(\frac{c-a}{b-a}\right)^2$, giving the answer as a common fraction in its lowest terms. [2]

4008/1 J2015 Q4(b)

Given that $p = -4, q = 3$ and $r = -1$, evaluate

(a) $\frac{p-q}{r}$, [1]

(b) $\sqrt{p^2q - r}$. [2]

4028/1 N2015 Q2

Find the value of $n^4 - 4n$ if $n = 3$. [2]

4028/1 J2013 Q21(c)

Given that $m = 2p + 1$ and $n = p - 2$, express mn in terms of p in its simplest form. [2]

4008/2 N2013 Q3(a)

Find the numerical value of $d(n - d^2)$ when $n = 4$ and $d = \frac{1}{2}$. [2]

4008/2 J2012 Q1(b)

Given that $y = m^2 - 4n^2$, find the value of y when $m = 4$ and $n = 2$. [1]

4008/1 N2011 Q16(a)

Given that $m = \frac{1}{2}, n = 0$ and $r = 3$, evaluate

(a) $(mr)^n$, [1]

(b) $(2\frac{1}{4})^m$, [1]

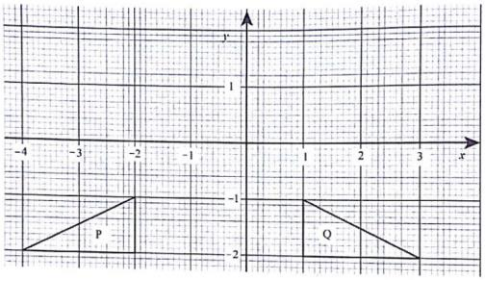
(c) $\sqrt[r]{-64}$. [1]

4008/4028/1 J2010 Q5

GEOMETRICAL TRANSFORMATION

(a) Point $R(-3;\ -2)$ is mapped onto point R, by a transformation represented by the matrix $\begin{pmatrix}1 & 0\\ 0 & -1\end{pmatrix}$. Find the coordinates of R,. [1]

(b) In the diagram, triangle P is the image of triangle Q under a certain transformation.



Describe fully the **single** transformation that maps triangle P onto triangle Q. [2]

4004/1 J2020 Q16

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to 1 unit on both axes.

(a) Triangle PQR has vertices at $P(1;\ 3)$, $Q(2;\ 1)$ and $R(4;\ 3)$.
Draw and label triangle PQR. [1]

(b) Triangle $P_1Q_1R_1$ is the image of triangle PQR under a reflection in the line $y = -x$.

(i) Draw the line $y = -x$. [1]

(ii) Draw and label triangle $P_1Q_1R_1$. [3]

(iii) A transformation, G, maps triangle PQR onto triangle $P_2Q_2R_2$ with vertices at $P_2(1;\ -6)$, $Q_2(2;\ -2)$ and $R_2(4;\ -6)$. Draw and label triangle $P_2Q_2R_2$. [1]

(iv) Describe **fully** the single transformation, G, which maps triangle PQR onto triangle $P_2Q_2R_2$. [3]

(c) The point $R_3(-1;\ 2)$ is the image of R under a translation.

(i) Find the translation vector. [1]

(ii) Write down the coordinates of P_3 and Q_3 the images of P and Q respectively, under the same translation. [2]

4004/2 J2020 Q7

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to represent 2 units on both axes for $-10 \le x \le 8$ and $-4 \le y \le 8$.

(a) Triangle ABC has vertices at A$(2;-2)$, B$(4;\ 2)$ and C$(6;\ 2)$. Draw and label triangle ABC. [1]

(b) Triangle $A_1B_1C_1$ has vertices at $A_1(-2;\ 2)$, $B_1(0;\ 6)$ and $C_1(2;\ 6)$.
Draw and label triangle $A_1B_1C_1$. [1]

(c) Describe **fully** the single transformation which maps triangle ABC onto triangle $A_1B_1C_1$. [2]

(d) Triangle ABC is mapped onto triangle $A_2B_2C_2$ by a reflection in the x-axis.
Draw and label triangle $A_2B_2C_2$ [2]

(e) Draw and label triangle $A_3B_3C_3$, the enlargement of triangle ABC about centre $(-4;\ 2)$ and scale factor of $-\frac{1}{2}$. [3]

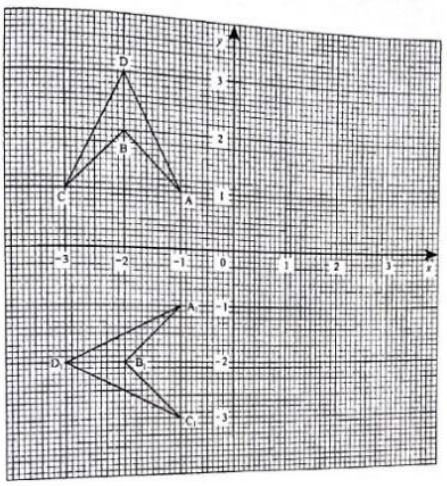
(f) Transformation **V** is defined by the matrix $\begin{pmatrix}1 & -2\\ 0 & 1\end{pmatrix}$. Draw and label triangle $A_4B_4C_4$, the image of triangle ABC under transformation **V**. [3]

4004/2 N2020 Q11

The diagram shows two quadrilaterals ABCD and $A_1B_1C_1D_1$ on the Cartesian plane.

(a) Describe fully the single transformation which maps ABCD onto $A_1B_1C_1D_1$. [3]

(b) Point $A_2(1\ ;\ -2)$ is the image of A under a translation. Find the translation vector. [2]



4004/1 J2019 Q26

Point $A(4;\ 2)$ is mapped onto A,, by a transformation represented by matrix $\begin{pmatrix}1 & 0\\ -3 & 1\end{pmatrix}$.

(a) Calculate the coordinates of A,. [1]

(b) Describe fully the transformation represented by the matrix $\begin{pmatrix}1 & 0\\ -3 & 1\end{pmatrix}$. [3]

4004/1 N2019 Q17

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to 2 units on both axes.

(a) Triangle A has vertices at $(-5;\ 2)$, $(-2;\ 2)$ and $(-2;\ 4)$ and triangle B has vertices at $(2;\ 3)$, $(2;\ 0)$ and $(4;\ 0)$.
Draw and label
(i) triangle A, [1]
(ii) triangle B, [1]

(b) Triangle C is the image of triangle B under an enlargement with centre $(2;\ -1)$ and enlargement factor of $-1\frac{1}{2}$. Draw and label triangle C. [3]

(c) Point $(-2;\ 2)$ is translated onto $(6;\ -2)$.
Find the translation vector. [1]

(d) Triangle D is the image of triangle A under a transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$. Find the coordinates of the vertices of triangle D. [3]

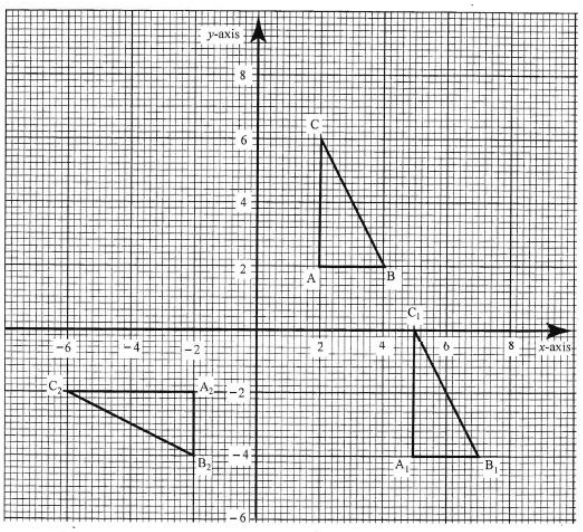
(e) Describe fully the single transformation that maps triangle A onto triangle B. [3]

4004/2 N2019 Q12

The diagram shows three triangles ABC, $A_1B_1C_1$ and $A_2B_2C_2$.

(a) Triangle ABC is mapped onto triangle $A_1B_1C_1$ by a single transformation. Describe **fully** this transformation. [3]

(b) Triangle ABC is mapped onto triangle $A_2B_2C_2$ by a reflection. Find the
(i) equation of the axis of reflection, [1]
(ii) matrix that represents this reflection. [2]



4030/1 J2018 Q26

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to represent 2 units on both axes for $-8 \le x \le 8$ and $-6 \le y \le 12$.

(a) (i) Triangle ABC has vertices at A$(1;\ 1)$, B$(3;\ 1)$ and C$(1;\ 3)$.
Draw and label triangle ABC. [1]

(ii) Triangle $A_1B_1C_1$ has vertices at $A_1(-2;\ -2)$, $B_1(-6;\ -2)$ and $C_1(-2;\ -6)$.
Draw and label triangle $A_1B_1C_1$. [1]

(iii) Transformation S represents a stretch with invariant line the x-axis and stretch factor 4.
Draw and label triangle $A_2B_2C_2$, the image of triangle ABC under S. [2]

(iv) Transformation R represents a rotation of 90° clockwise about the origin.
Draw and label triangle $A_3B_3C_3$, the image of triangle ABC under R. [3]

(b) (i) Describe **fully** the **single** transformation that maps triangle ABC onto triangle $A_1B_1C_1$. [3]

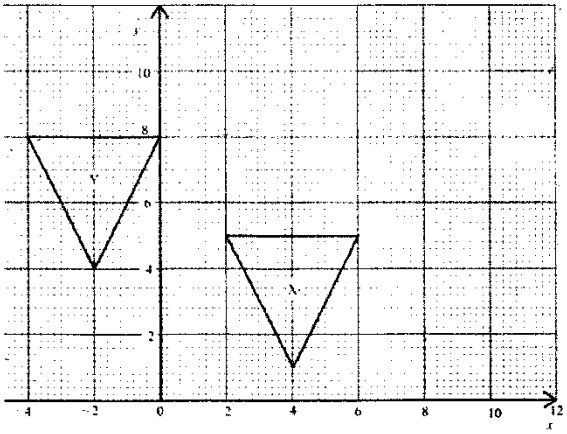
(ii) Find the matrix which represents the transformation R. [2]

4030/2 J2018 Q10

The graph shows triangles X and Y.

(a) Triangle Y is an image of triangle X under a certain single transformation.
Describe **fully** the single transformation which maps triangle X onto triangle Y. [3]

(b) Triangle Z is the image of triangle X under an Enlargement of scale factor 2 and centre $(0;\ 0)$.
(i) State the matrix that represents the enlargement [2]
(ii) Draw and label triangle Z. [3]



4004/1 N2018 Q25

Answer the whole of this question on a sheet of graph paper using a scale of 2cm to 2 units on both axes for $-4 \le x \le 6$ and $-8 \le y \le 4$.

(a) Triangle P has vertices at $(1;\ 2)$, $(1;\ 4)$ and $(2;\ 4)$. Draw and label triangle P. [1]

(b) Triangle P is mapped onto triangle Q by an enlargement of factor -2, centre the origin.
Draw and label triangle Q. [2]

(c) Triangle P is mapped onto triangle R by a translation through $\begin{pmatrix}-3\\-5\end{pmatrix}$. Draw and label triangle R. [2]

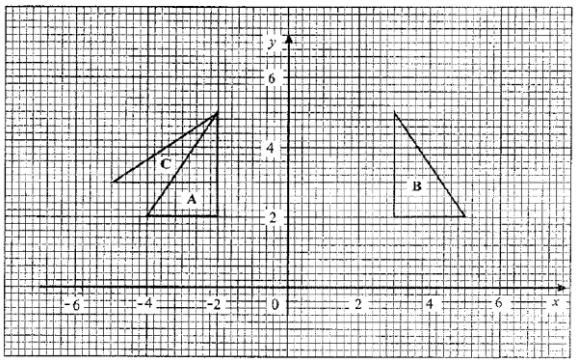
(d) Draw triangle N the image of the triangle P under a transformation represented by the matrix $\begin{pmatrix}1 & 1\\-1 & 1\end{pmatrix}$. [3]

(e) Triangle S has vertices $(2;\ 2)$, $(2;\ 4)$ and $(4;\ 4)$.

(i) Draw and label triangle S. [1]

(ii) Describe fully the single transformation which maps triangle P onto triangle S. [3]

4004/2 N2018 Q12



In the diagram, triangle A, B and C are congruent. Describe fully the single transformation which maps

(a) triangle A onto triangle B, [2]

(b) triangle B onto triangle C. [3]

4030/1 J2017 Q25

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to represent 2 units on both axes for $-6 \le x \le 6$ and $-6 \le y \le 8$.

Triangle ABC has vertices at $A(1;\ 1)$, $B(3;\ 1)$ and $C(2;\ 3)$.

(a) (i) Draw and label triangle ABC. [1]

(ii) Triangle ABC is mapped onto triangle $A_1B_1C_1$ by a transformation represented by the matrix $\begin{pmatrix}1 & 0\\2 & 1\end{pmatrix}$.

Draw and label triangle $A_1B_1C_1$. [3]

(iii) An enlargement of factor $-1\frac{1}{2}$, centre $(0;\ 0)$ maps triangle ABC onto triangle $A_2B_2C_2$

Draw and label triangle $A_2B_2C_2$. [3]

(b) (i) Describe completely the transformation represented by matrix $\begin{pmatrix}1 & 0\\2 & 1\end{pmatrix}$ in **(a)(ii)**. [3]

(ii) Write down the matrix that represents the enlargement in **(a)(iii)**. [1]

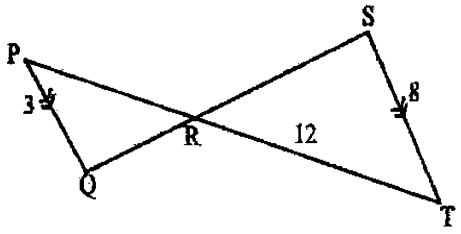
(c) A translation $\begin{pmatrix}3\\-4\end{pmatrix}$ maps point B onto point B_3.

Write down the coordinates of point B_3. [1]

4030/2 J2017 Q9

Matrix $R = \begin{pmatrix}3 & 0\\0 & 1\end{pmatrix}$. R represents a transformation that maps point $P(x;\ y)$ onto $P_1(3;\ 4)$. Calculate the value of x and the value of y. [2]

4030/1 N2017 Q22(a)



Triangle RQP is mapped onto triangle RST by a transformation **A**. Describe fully transformation **A**. [3]

4030/1 N2017 Q26(c)

ABC is a scalene triangle with $A\hat{B}C = 90$. Write down the special name of a quadrilateral that is formed by triangle ABC and its image after

(i) a reflection in the line AC. [1]

(ii) a rotation through $180°$ about the mid-point of AC. [1]

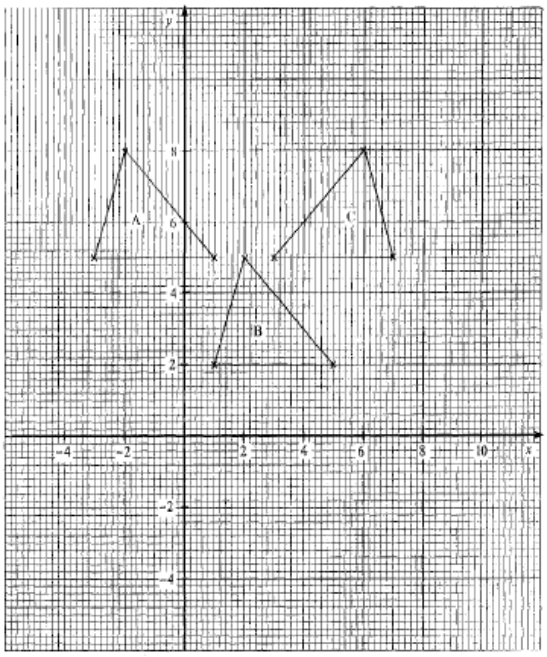
4030/2 N2017 Q3(c)

The diagram shows triangles A, B and C.

(a) Triangle B is the image of A under a Translation $T = \begin{pmatrix}p\\q\end{pmatrix}$.

(i) State the values of p and q. [2]

(ii) Find $|T|$. [2]



(b) Triangle C is the image of triangle A under a transformation M. Describe **fully** transformation M. [2]

4030/1 J2016 Q28

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to represent 2 units on both axes for $-6 \leq x \leq 6$ and $-6 \leq y \leq 10$.

Triangle DEF has vertices at D(1; 3), E(1; 5) and F(2; 5).

(a) Draw and label triangle DEF. [1]

(b) Transformation **U** is defined by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

Draw triangle $D_1E_1F_1$, the image of triangle DEF under the transformation **U**. [2]

(c) Draw and label triangle $D_2E_2F_2$, the image of triangle DEF under an enlargement of factor 2 and centre (4; 2). [3]

(d) Triangle $D_3E_3F_3$ is the image of triangle DEF after a shear of factor -2 with the y-axis invariant. Draw and label triangle $D_3E_3F_3$.[3]

(e) Describe **fully** the transformation that maps triangle DEF onto triangle $D_1E_1F_1$. [3]

4030/2 J2016 Q9

The matrix $\begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$ represents a transformation ***X***.

(a) Find the coordinates of the image of the point $(-1; 4)$ under ***X***. [2]

(b) Describe fully the single transformation ***X***. [3]

4030/1 N2016 Q24

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to represent 2 units on both axes for $-8 \leq x \leq 10$ and $-8 \leq y \leq 8$.

Triangle P has vertices at (1; 2), (3; 2) and (5; 4).

(a) (i) Draw and label clearly the triangle P. [1]

(ii) Triangle Q is the image of triangle P under a shear of factor -2 with the x-axis invariant. Draw and label clearly the triangle Q. [2]

(iii) Triangle V has vertices at $(-1; -2)$, $(-3; -2)$ and $(-5; -4)$. Draw and label clearly the triangle V. [1]

(iv) Triangle W is the image of triangle P under a reflection in the line $y = x - 2$. Draw and label clearly the

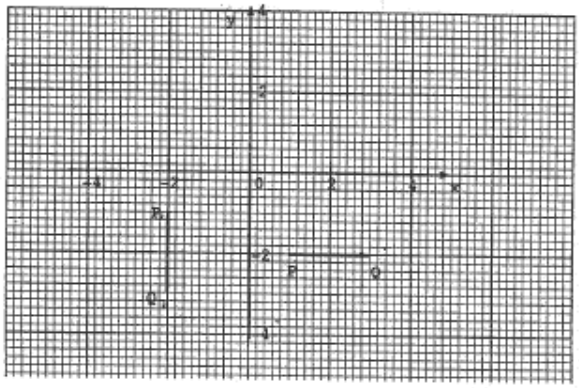
1. line $y = x - 2$
2. triangle W. [3]

(v) Draw and label clearly, the triangle U, the image of triangle P under an enlargement of scale factor -2 with (4; 0) as centre. [3]

(b) Describe fully the **single** transformation which maps triangle P onto triangle V. [2]

4030/2 N2016 Q12

Use the diagram to answer the following questions.



(a) Write down the coordinates of the image of P, if P is translated by vector $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$. [1]

(b) Describe **fully a single** transformation which maps PQ onto P_2Q_2. [3]

4008/1 J2015 Q23

Answer the whole of this question on a sheet of graph paper.

Quadrilateral ABCD has vertices at A(1; 0), B(2; 0), C(2; 2) and D(1; 2).

Using a scale of 2 cm to represent 1 unit on each axis, draw the x and y axes for $-4 \leq x \leq 6$ and $-5 \leq y \leq 5$.

(a) (i) Draw and label ABCD.

(ii) State the special name given to quadrilateral ABCD. [2]

(b) Quadrilateral ABC_1D_1 has coordinates at A(1; 0), B(2; 0), C_1(6; 2) and D_1(5; 2).

(i) Draw and label quadrilateral ABC_1D_1.

(ii) Describe **fully the single** transformation that maps ABCD onto ABC_1D_1. [4]

(c) Quadrilateral ABCD is mapped onto quadrilateral $A_2B_2C_2D_2$ by a reflection in the line $y = x + 2$.

(i) Draw and label line $y = x + 2$.

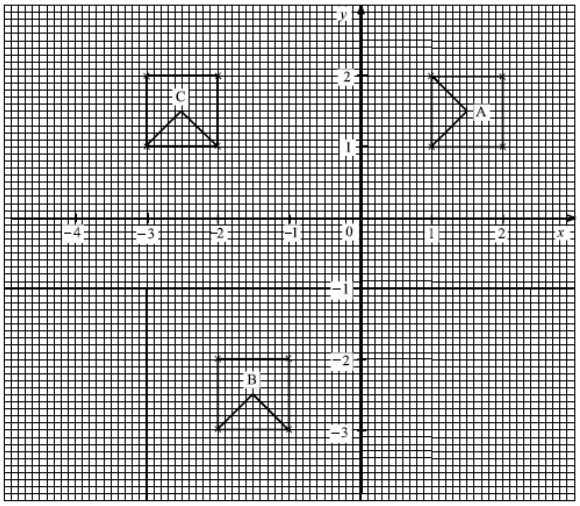
(ii) Draw and label quadrilateral $A_2B_2C_2D_2$. [3]

(d) $A_3B_3C_3D_3$ is the image of ABCD under an enlargement of scale factor -1 with $(-1; -1)$ as centre.

Draw and label quadrilateral $A_3B_3C_3D_3$. [3]

4028/2 J2015 Q9

The diagram shows three shapes A, B and C on a Cartesian plane.



(a) Describe completely the single transformation which maps shape A onto shape B. [3]

(b) Shape B is mapped onto shape C by a transformation P.
Describe fully the transformation P. [2]

4028/1 N2015 Q25

Answer the whole of this question on a sheet of graph paper. Use a scale of 2 cm to represent 2 units on both axes for $-6 \leq x \leq 4$ and $-4 \leq y \leq 4$.

The triangle LMN has vertices at L$(3;\ 1)$, M$(2;\ 2)$ and N$(0;\ 1)$.

(a) Draw and label triangle LMN. [1]

(b) Triangle LMN is mapped onto triangle $L_1M_1N_1$ by a reflection in the line $y = 1$.
Draw and label triangle $L_1M_1N_1$. [3]

(c) Triangle LMN is mapped onto triangle $L_2M_2N_2$ by a rotation through $180°$ about the point $(-1;\ 0)$.
Draw and label triangle $L_2M_2N_2$. [3]

(d) Triangle $L_3M_3N_3$ is the image of triangle LMN under a transformation P, represented by the matrix $\begin{pmatrix} -2 & 0 \\ 0 & 1 \end{pmatrix}$.

(i) Draw and label triangle $L_3M_3N_3$.

(ii) Describe fully the single transformation P, which maps triangle LMN onto triangle $L_3M_3N_3$. [5]

4028/2 N2015 Q10

Answer the whole of the question on a sheet of graph paper.

Triangle W has vertices at $(1;\ -1)$, $(7;\ -1)$ and $(4;\ 4)$. *Using a scale of 2 cm to represent 2 units on both axes, draw the x and y-axes for $-10 \leq x \leq 10$ and $-10 \leq y \leq 10$.*

(a) Draw and label clearly triangle W. [1]

(b) Triangle X is the image of triangle W under a reflection in the line $y = x + 2$.
Draw and label clearly,

(i) the line $y = x + 2$,

(ii) triangle X. [3]

(c) (i) Draw and label clearly triangle Y, the image of triangle W under an enlargement of scale factor $-\frac{1}{2}$ with the origin as centre.

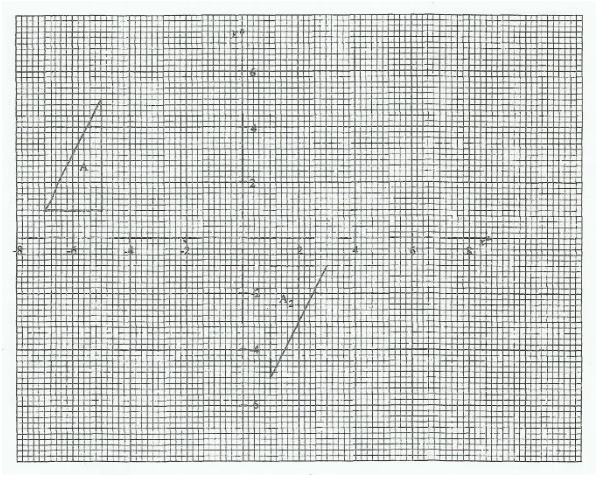
(ii) Write down the matrix which represents this transformation. [4]

(d) Triangle Z with vertices at $(1;\ -3)$, $(1;\ -9)$ and $(6;\ -6)$, is the image of triangle W under a certain transformation.

(i) Draw and label clearly triangle Z.

(ii) Describe **fully** the **single** transformation which maps triangle W onto triangle Z. [4]

4028/2 J2014 Q12

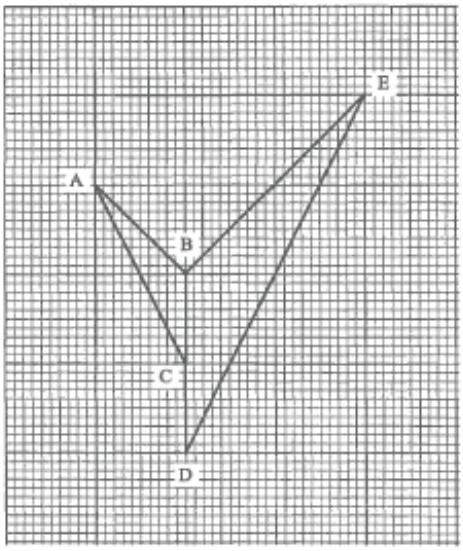


The diagram shows triangles A and A_2 drawn on the Cartesian plane.

(a) Draw triangle A_1, the image of triangle A under a reflection with mirror line $x = -1$. [2]

(b) Describe fully the **single** transformation which maps triangle A onto triangle A_2 [3]

4008/1 N2014 Q23



Triangle ABC is mapped onto triangle EBD by a combination of two transformations.

(a) Name the **two** transformations. [2]

(b) Write down the ratio AB: BE in its simplest form. [1]

4008/1R N2014 Q4

Answer the whole of this question on a sheet of graph paper.

A triangle PQR has vertices at P(1; 1), Q(3; 4) and R(4; 0).

Using a scale of 2 cm to represent 2 units on both axes, draw the x and y-axes for $-10 \leq x \leq 10$ *and* $-6 \leq y \leq 6$.

(a) Draw and label triangle PQR. [1]

(b) Triangle PQR is mapped onto triangle $P_1Q_1R_1$ by a transformation, **N**, where **N** is represented by the matrix $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$.

(i) Draw and label triangle $P_1Q_1R_1$.

(ii) Describe **fully** the **single** transformation represented by matrix **N**. [6]

(c) Triangle PQR is mapped onto triangle $P_2Q_2R_2$ by a translation **T** which is represented by the vector $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$ and then followed by the transformation **N**.

(i) Calculate the coordinates of the vertices of $\Delta P_2Q_2R_2$.

(ii) Draw and label $\Delta P_2Q_2R_2$. [5]

4008/2 N2014 Q8

Answer the whole of this part of the question on a sheet of graph paper.

Use a scale of 2 cm to represent 2 units on the x-axis and 2 cm to represent 1 unit on the y-axis for $-4 \leq x \leq 14$ and $-5 \leq y \leq 5$.

(i) Triangle ABC has vertices A(4; 1), B(6; 1) and C(6; 2).
Draw and label triangle ABC.

(ii) Transformation T represents a translation vector $\begin{pmatrix} -2 \\ -6 \end{pmatrix}$.
Draw and label $A_1B_1C_1$, the image of triangle ABC under **T.**

(iii) Transformation **R** represents a clockwise rotation of 90° about (4; 4).
Draw and label triangle $A_2B_2C_2$, the image of triangle ABC under **R**.

(iv) 1. Triangle $A_3B_3C_3$ has vertices at $A_3(8; 2), B_3(12; 2)$ and $C_3(12; 4)$.
Draw and label triangle $A_3B_3C_3$.

2. Describe **fully** the single transformation that maps triangle ABC onto triangle $A_3B_3C_3$. [8]

4008/2R N2014 Q10(b)

Answer the whole of this question on a sheet of graph paper.

Triangle A has vertices at (2; 2), (5; 2) and (8; 4).

Using a scale of 2 cm to represent 2 units on both axes, draw the x and y axes for $-8 \leq x \leq 10$ and $-8 \leq y \leq 8$.

(a) Draw and label triangle A. [1]

(b) Triangle A is mapped onto triangle B by a translation $\begin{pmatrix} -9 \\ 2 \end{pmatrix}$.
Draw and label triangle B. [1]

(c) Triangle A is reflected onto triangle C in the line $y = -x$. Draw and label triangle C. [2]

(d) Triangle D with vertices at $(-2; 4)$, $(4; 4)$ and $(10; 8)$ is the image of triangle A under a certain transformation.

(i) Draw and label triangle D.

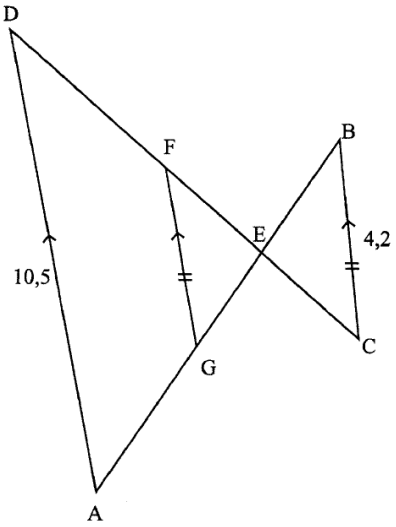
(ii) Describe completely the **single** transformation which maps triangle A onto triangle D. [4]

(e) Draw triangle E, the image of triangle A under a transformation represented by matrix $\begin{pmatrix} \frac{1}{2} & 0 \\ 0 & 1\frac{1}{2} \end{pmatrix}$. [2]

(f) Triangle F is the image of triangle A under a clockwise rotation of 90° about the point $(2; -2)$. Draw and label triangle F. [2]

4028/2 J2013 Q9

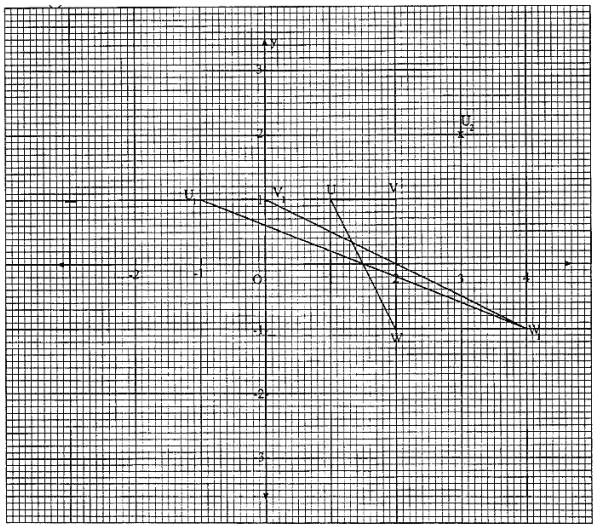
(b) In the diagram, AB and CD intersect at E. The lines AD, GF and CB are parallel to each other. It is given that BC = GF = 4,2 cm and AD = 10,5 cm.



(i) Describe fully the **single** transformation that maps ΔBCE onto ΔGFE.

(ii) ΔADE is the image of ΔBCE under an enlargement. State the centre and the scale factor of the enlargement. [5]

(c)



The diagram shows ΔUVW, $\Delta U_1V_1W_1$ and a point U_2.

(i) Describe completely the **single** transformation that maps ΔUVW onto $\Delta U_1V_1W_1$.

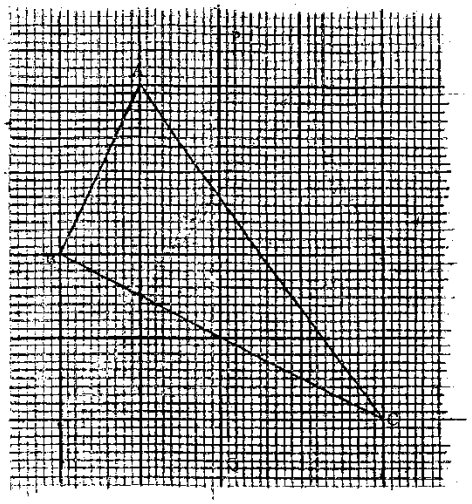
(ii) Point U_2 is the image of point U under a two-way stretch.

Find 1. the stretch factor with the y-axis invariant,

2. the co-ordinates of V_2, the image of V under this two-way stretch. [5]

4008/2 N2013 Q7

Draw triangle $A'B'C'$, the image of triangle ABC under a reflection in the line PQ.



4008/1 J2012 Q8

Answer the whole of this question on a sheet of graph paper.

Using a scale of 2 cm to represent 2 units on both axes, draw the x and y axes for $-6 \leq x \leq 10$ and $-10 \leq y \leq 8$.

(a) Triangle A has vertices at $(3;\ 1)$, $(1;\ 2)$ and $(2;\ 4)$.
Draw and label clearly the triangle. [1]

(b) Triangle B is the image of triangle A under an anticlockwise rotation of 90° about $(-2;\ 2)$.
Draw and label clearly the triangle B. [2]

(c) A **single** transformation P maps triangle A **onto** triangle C with vertices at $(9;\ 1)$, $(3;\ 2)$ and $(6;\ 4)$.

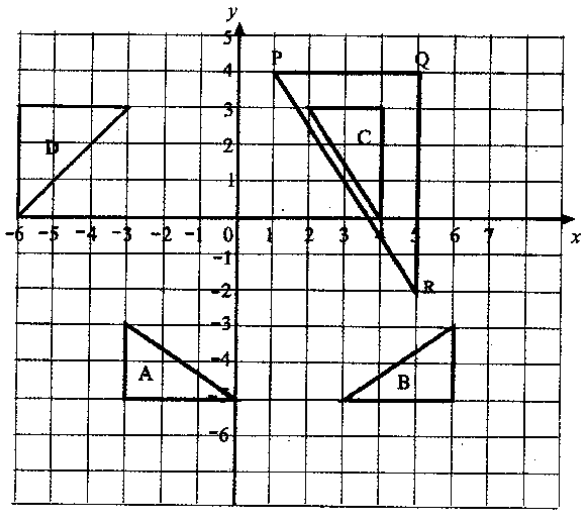
(i) Draw and label clearly triangle C.

(ii) Find and write down, the matrix which represents the transformation P.

(iii) Describe fully the **single** transformation P. [6]

(d) Triangle A is mapped **onto** triangle D by an enlargement of scale factor -2 with the origin as the centre.
Draw and label clearly triangle D. [3]

4008/2 J2012 Q8



(a) Triangle A is mapped onto triangle B by a reflection.
Write down the equation of the line of reflection. [1]

(b) Triangle B is mapped onto triangle C by an anticlockwise rotation through 90°.
Write down the coordinates of the centre of rotation. [1]

(c) Describe fully the **single** transformation which maps
(i) triangle C onto triangle D, [3]
(ii) triangle PQR onto triangle C. [3]

4008/1 N2012 Q27

Answer the whole of this question on a sheet of graph paper.

Triangle KLM has vertices $K(-5;\ 3)$, $L(-1;\ 2)$ and $M(-4;\ 4)$. Using a scale of 2 cm to represent 1 unit on each axis, draw the x and y axes for $-5 \leq x \leq 4$ and $-8 \leq y \leq 4$.

(a) Draw and label the triangle KLM. [1]

(b) A single transformation maps triangle KLM onto triangle $K_1L_1M_1$ with vertices $K_1(-1;\ 3)$, $L_1(-5;\ 2)$ and $M_1(-2;\ 4)$.
(i) Draw and label the triangle $K_1L_1M_1$.
(ii) Describe this transformation **fully**. [3]

(c) $M_2(3;\ -1)$ is the image of M after translating triangle KLM.
(i) State the translation vector.
(ii) Write down the coordinates of the points K_2 and L_2, the images of K and L respectively, under this translation. [4]

(d) The triangle KLM is mapped onto the triangle $K_3L_3M_3$ by a shear of factor 2 with the y-axis invariant.
(i) Write down the matrix of the shear.
(ii) Draw and label the triangle $K_3L_3M_3$. [4]

4008/2 N2012 Q7

Answer the whole of this question on a sheet of graph paper.

Triangle ABC has vertices $A(2;\ 1)$, $B(4;\ 1)$ and $C(4;\ 4)$. Using a scale of 1 cm to represent 1 unit on both axes, draw the x and y axes for $-4 \leq x \leq 14$ and $-10 \leq y \leq 12$.

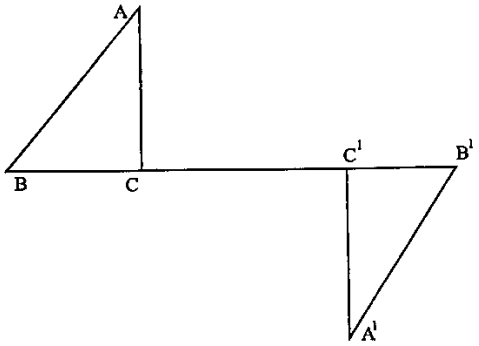
(a) Draw and label clearly triangle ABC. [1]

(b) Triangle $A_1B_1C_1$, is a reflection of triangle ABC in the line $y = -2$.
Draw and label clearly triangle $A_1B_1C_1$. [3]

(c) Triangle $A_2B_2C_2$ has vertices $A_2(6;\ 4)$, $B_2(10;\ 4)$ and $C_2(10;\ 10)$
(i) Draw and label clearly triangle $A_2B_2C_2$.
(ii) Describe fully the **single** transformation that maps triangle ABC onto triangle $A_2B_2C_2$. [4]

(d) Triangle ABC is rotated through 90° anticlockwise about $(0;\ 0)$ onto triangle $A_3B_3C_3$.
(i) Draw and label clearly triangle $A_3B_3C_3$.
(ii) Write down the matrix that represents this transformation. [4]

4008/2 J2011 Q8



In the diagram ABC and $A^1B^1C^1$ are congruent triangles and BCC^1B^1 is a straight line.
Describe fully a single transformation that maps triangle ABC onto triangle $A^1B^1C^1$. [3]

4008/1 N2011 Q13

Answer the whole of this question on a sheet of graph paper.

Quadrilateral Q has vertices $(-2;\ 0)$, $(-3;\ 0)$, $(-3;\ 1\frac{1}{2})$ and $(-2;\ 1)$.

Using a scale of 2 cm to represent one unit on both axes, draw the x and y-axes for $-6 \leq x \leq 2$ and $-3 \leq y \leq 5$.

(a) Draw and label quadrilateral Q. [1]

(b) Quadrilateral Q is mapped onto Q_1 by a reflection in the line $y = 1 - x$.
(i) Draw the line $y = 1 - x$.

(ii) Draw and label quadrilateral Q_1. [4]

(c) Quadrilateral Q is mapped onto quadrilateral Q_2 with vertices $(-1;\ -1)$, $(-1;\ -2)$, $(-2\frac{1}{2};\ -2)$ and $(-2;\ -1)$.

(i) Draw and label quadrilateral Q_2.

(ii) Describe completely, the **single** transformation which maps quadrilateral Q_1 onto Q_2. [4]

(d) Quadrilateral Q_3 is the image of Q under a transformation represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}$.

Draw and label quadrilateral Q_3. [3]

4008/2 N2011 Q12

Answer the whole of this question on a sheet of graph paper.

Using a scale of 2 cm to represent one unit on both axes, draw the x *and* y axes for $-4 \leq x \leq 5$ and $-5 \leq y \leq 5$.

(a) The letter V has a vertex at $A(-2;\ 2)$ and the ends at $B(-3;\ 5)$ and $C(-1;\ 5)$.

Draw and label the shape ABC. [1]

(b) The shape ABC is mapped onto $A_1B_1C_1$ with coordinates $A_1(1{,}2\ ;\ 0{,}4)$, $B_1(4{,}2\ ;\ 1{,}4)$ and $C_1(3;\ 3)$ by a certain transformation.

(i) Draw and label shape $A_1B_1C_1$.

(ii) Describe completely the **single** transformation which maps shape ABC onto $A_1B_1C_1$. [5]

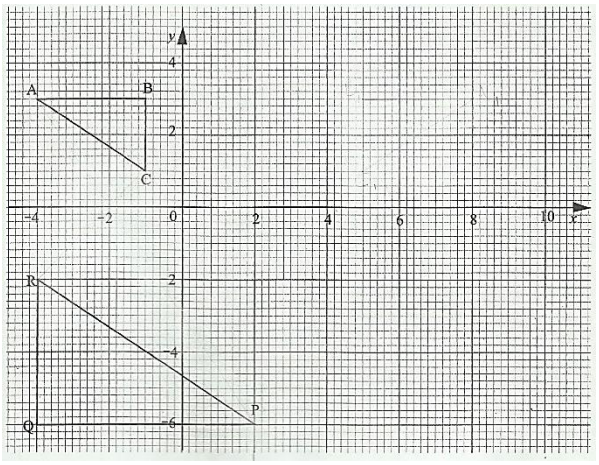
(c) Shape ABC is enlarged by a scale factor $-\frac{1}{2}$ with the origin as centre onto $A_2B_2C_2$.

Draw and label $A_2B_2C_2$. [3]

(d) A shear with y-axis invariant and scale factor 2 maps shape ABC onto $A_3B_3C_3$.

Draw and label $A_3B_3C_3$. [3]

4028/2 J2010 Q8



(a) Draw the image of Δ ABC under a reflection in the line $x = 2$. [2]

(b) Describe fully the **single** transformation which maps Δ ABC onto Δ PQR. [3]

4008/4028/1 N2010 Q24

Answer the whole of this question on a sheet of graph paper.

The vertices of Δ PQR has vertices at $P(3;\ 1)$, $Q(4;\ 1)$ and $R(4;\ 3)$.

(a) Taking 2 cm to represent one unit on both axes, draw the x and y axes for $-3 \leq x \leq 5$ and $-6 \leq y \leq 5$. Draw and label Δ PQR. [1]

(b) A certain transformation maps ΔPQR onto Δ $P_1Q_1R_1$ where $P_1(-2;\ -3)$, $Q_1(-1;\ -3)$ and $R_1(-1;\ -1)$.

(i) Draw and label Δ $P_1Q_1R_1$.

(ii) Describe completely the **single** transformation which maps Δ PQR onto Δ $P_1Q_1R_1$. [3]

(c) Δ $P_2Q_2R_2$ is the image of Δ PQR under a reflection in the line $y = x$.

Draw and label Δ $P_2Q_2R_2$. [3]

(d) Δ PQR is enlarged with centre $(0;\ 1)$ and scale factor $-\frac{1}{2}$ onto Δ $P_3Q_3R_3$.

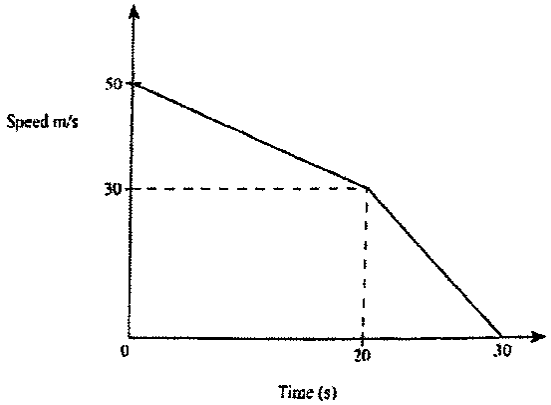
Draw and label Δ $P_3Q_3R_3$. [3]

(e) A stretch represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$ maps Δ PQR onto Δ $P_4Q_4R_4$.

Draw and label Δ $P_4Q_4R_4$. [2]

4008/2 N2010 Q12

TRAVEL GRAPHS



The diagram is a speed-time graph of an object which decelerates uniformly from a speed of 50 m/s to a speed of 30 m/s in 20 seconds. It further decelerates uniformly for 10 seconds until it comes to rest.

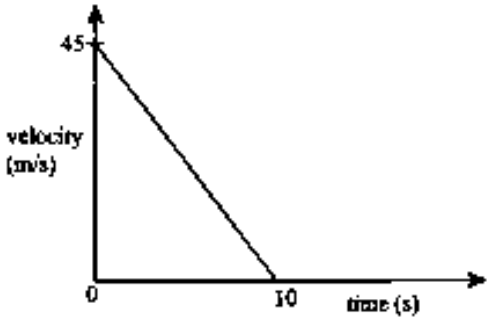
(a) Find the speed when t = 5 seconds. [2]

(b) Calculate the

(i) acceleration of the object during the last 10 seconds. [2]

(ii) distance travelled during the 30 seconds. [2]

4004/1 J2020 Q26



The diagram shows a car retarding uniformly from 45 m/s until it comes to rest after 10 seconds.

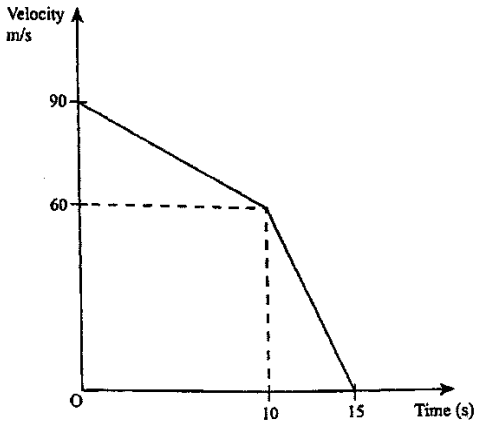
Calculate the

(a) retardation, [1]

(b) distance travelled during the 10 seconds. [2]

4004/1 N2020 Q7

The diagram is a velocity-time graph of an object which decelerates uniformly from a velocity of 90 m/s to a velocity of 60 m/s in 10 seconds. It then decelerates uniformly to rest in a further 5 seconds.



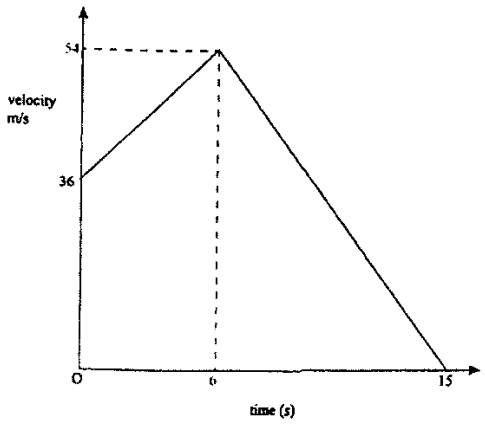
Calculate the

(a) total distance covered by the object during the 15 seconds, [2]

(b) average velocity of the object during the 15 seconds, [2]

(c) deceleration of the object during the last five seconds. [2]

4004/1 J2019 Q27



The diagram shows the velocity-time graph of a moving object which accelerates uniformly from 36 m/s to a velocity of 54 m/s in 6 seconds. It then retards uniformly to rest in a further 9 seconds.

Calculate the

(a) acceleration during the first 6 seconds, [2]

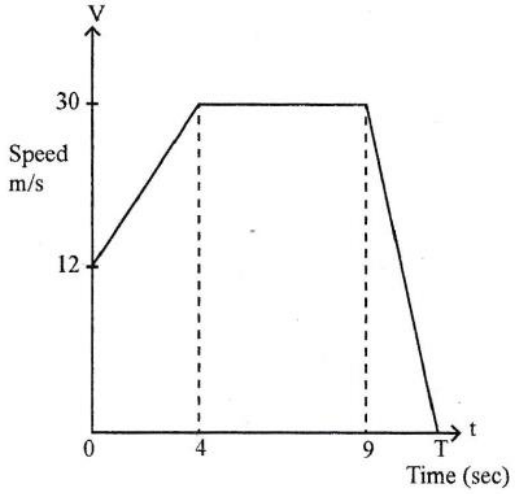
(b) velocity after 10 seconds, [2]

(c) average speed of the object for the 15 seconds. [3]

4004/1 N2019 Q24

The diagram is a speed-time graph of an object whose initial speed is $12\,m/s$. The object accelerates uniformly for 4 seconds until it reaches a speed of $30\,m/s$. It then travels at this speed for 5

seconds and then decelerates at $6\,m/s^2$ until it comes to rest.



Calculate the

(a) acceleration from $t = 0$ to $t = 4$, [1]

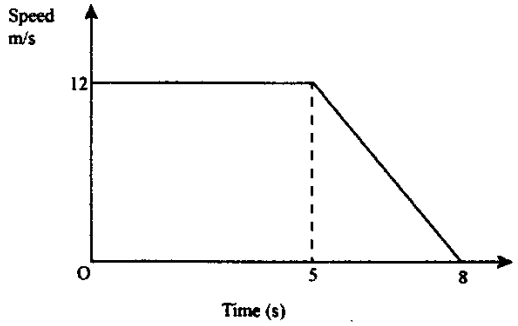
(b) distance travelled from $t = 0$ to $t = 9$, [2]

(c) value of T, the total time taken for the whole journey. [2]

4030/1 J2018 Q22

(a) Convert a speed of 12 m/s to a speed in km/h. [2]

(b)



The graph shows the motion of an athlete running on level ground at a constant speed of 12 m/s for 5 seconds. The athlete then retards uniformly to rest after a further 3 seconds. Calculate the

(i) total distance covered in the 8 seconds, [2]

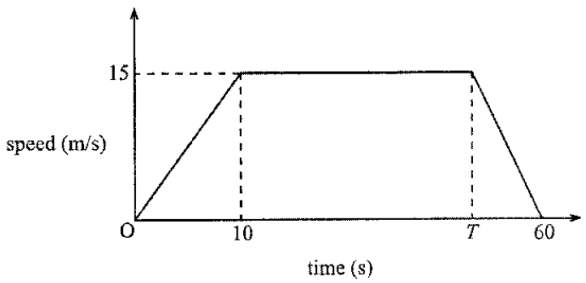
(ii) acceleration of the athlete in the last 3 seconds. [2]

4004/1 N2018 Q22

The diagram shows the speed-time graph of a car which travelled 705 metres in 60 seconds.

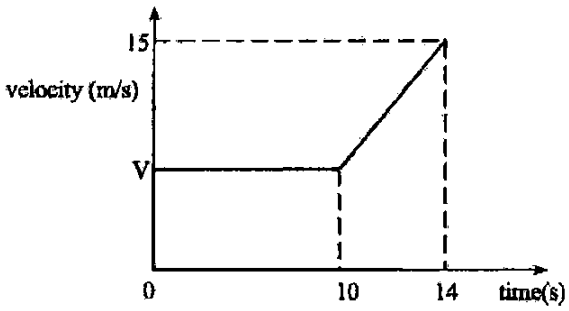
(a) Calculate the acceleration during the first 10 seconds. [1]

(b) Find the time T. [3]



4030/1 J2017 Q18

The graph shows part of a velocity-time graph of a moving object. The object travels at a constant velocity of V m/s for 10 seconds. It then accelerates uniformly until it reaches a velocity of 15 m/s in 4 seconds.



(a) The distance travelled during the first 10 seconds is 50 m. Calculate V. [2]

(b) Find the

(i) acceleration during the last 4 seconds, [2]

(ii) total distance travelled by the object in the 14 seconds. [2]

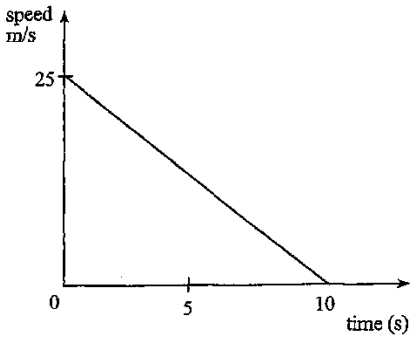
4030/1 N2017 Q25

An object starts from rest and accelerates uniformly until its speed is 90 km/h in 5 seconds.

(i) Express 90 km/h in m/s. [2]

(ii) Calculate the acceleration of the object in m/s^2 [1]

4030/1 J2016 Q24(b)



The graph shows the motion of a car which decelerates uniformly from a speed of 25 m/s until it comes to rest in 10 seconds.

Calculate the

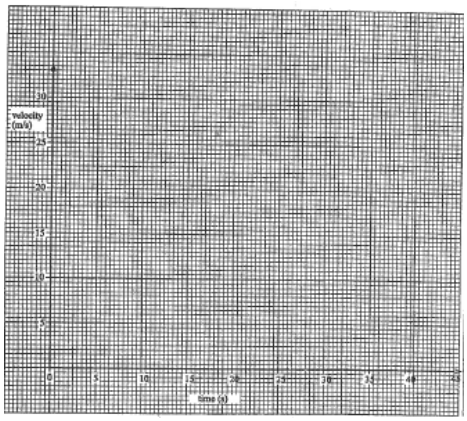
(a) deceleration of the car during the 10 seconds. [2]

(b) total distance travelled in the 10 seconds. [1]

4030/1 N2016 Q16

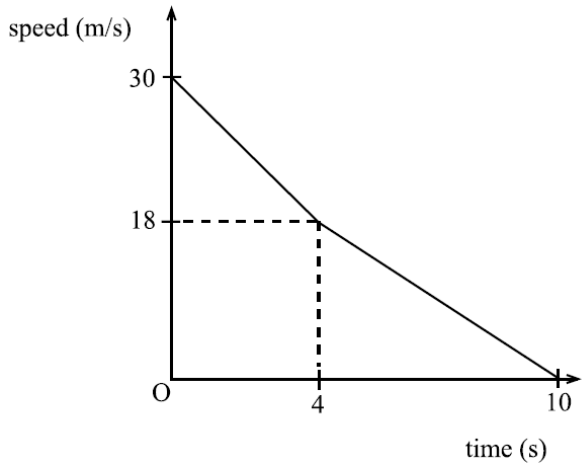
An object starts from rest and accelerates at 4 m/s^2 for 5 seconds until it reaches a speed of 20 m/s. It then travels at this speed for 30 seconds, after which it decelerates uniformly and comes to rest in further 10 seconds.

(a) Draw a velocity-time graph on the grid. [2]



(b) Calculate the total distance travelled. [2]

4008/1 J2015 Q17



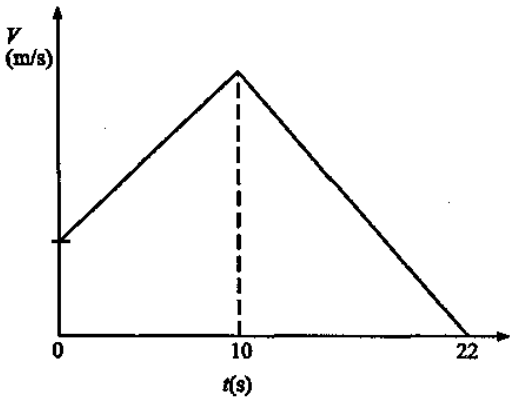
In the diagram, a moving object decelerates from a speed of 30 m/s to a speed of 18 m/s in 4 seconds and further decelerates from a speed of 18 m/s to rest in 6 seconds.

Calculate

(a) the speed of the object after the first 2 seconds. [2]

(b) the total distance covered by the object in the 10 seconds. [2]

4028/1 N2015 Q24



The diagram is the velocity-time graph of an object which accelerated uniformly for 10 seconds. During this time the velocity, V m/s, at time t seconds from the start, was given by $V = 6 + 2t$. It then decelerated uniformly to rest in a further 12 seconds.

Calculate

(a) the velocity of the object when $t = 0$, [1]

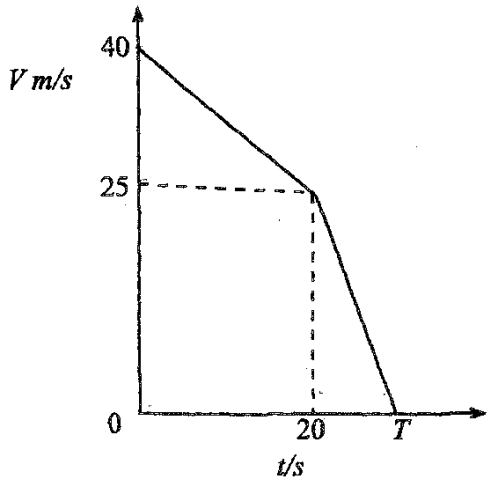
(b) the deceleration of the object, [2]

(c) the distance covered by the object in the 22 seconds, [2]

(d) the average speed of the object for the whole journey. [1]

4008/1 J2014 Q26

The diagram shows a velocity-time graph of a particle which decelerates uniformly from a velocity of 40 m/s to a velocity of 25 m/s in 20 seconds. It further decelerates uniformly at a rate of 2.5 m/s^2 until it comes to rest.



Given that the total time of the journey is T seconds, calculate

(a) the deceleration of the particle during the first 20 seconds, [2]

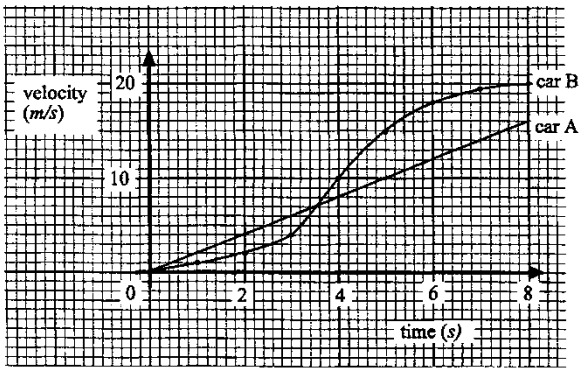
(b) the value of T, [2]

(c) the total distance covered in the T seconds, [2]

(d) the average speed for the whole journey. [1]

4008/1 N2014 Q25

The diagram shows the velocity-time graphs of two cars. Car A and car B start moving from the same point at the same time.



Find the

(a) acceleration of car A, [1]

(b) time the two cars have equal velocities, [1]

(c) distance covered by car A in the 8 seconds, [1]

(d) average velocity of car A during the 8 seconds. [1]

4008/1R N2014 Q15

Answer the whole of this question on a sheet of graph paper.

The velocity, v m/s, of a moving body, at time t seconds, is given by the formula $v = t^2 - 3t + 5$. Below is an incomplete table of values for v.

t (sec)	0	1	2	3	4	5	6	7
v (m/s)	m	3	3	5	n	15	23	33

(a) Find the value of m and the value of n. [2]

(b) Using a scale of 2 cm to represent 1 second on the horizontal axis and 2 cm to represent 5 m/s on the vertical axis, draw the t and v axes for $0 \leq t \leq 7$.
Draw the graph of $v = t^2 - 3t + 5$. [4]

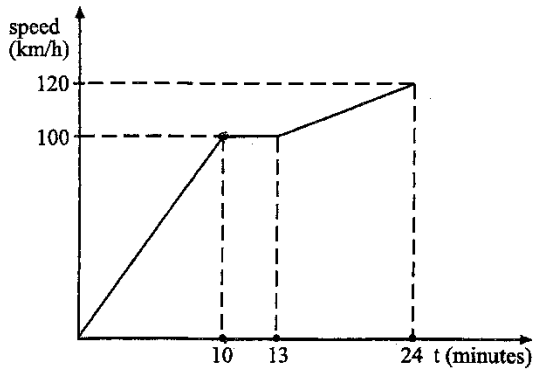
(c) Use your graph to estimate

(i) the values of t when $v = 4$,

(ii) the acceleration when $t = 3$,

(iii) the distance travelled from $t = 4$ to $t = 6$. [6]

4008/2 N2014 Q10



The diagram shows part of a speed-time graph of a car. The car starts from rest and accelerates uniformly to a speed of 100 km/h in 10 minutes. It maintains that speed for 3 minutes and then accelerates uniformly for a further 11 minutes until it reaches a speed of 120 km/h.

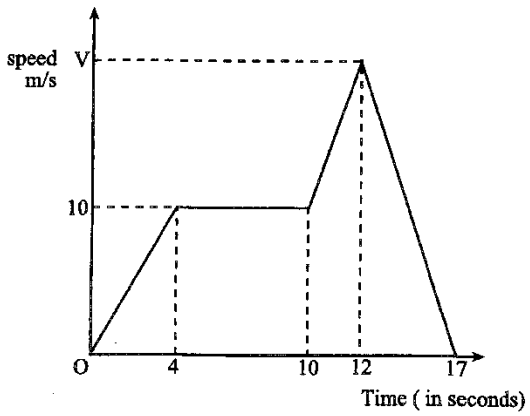
(a) Calculate

(i) the acceleration of the car during the first 10 minutes, [1]

(ii) the distance covered at a constant speed of 100 km/h. [2]

(b) If the total distance covered was $33\frac{1}{2}$ km, calculate the average speed of the car in km/h. [2]

4028/1 J2013 Q19



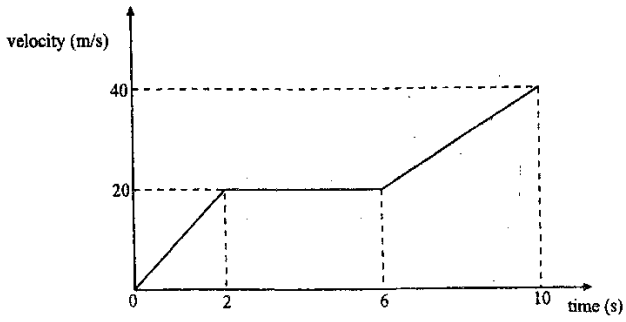
The diagram represents the speed-time graph of a sprinter during an athletics training session.

(a) Calculate the distance the sprinter covers during the first 10 seconds. [2]

(b) Given that the acceleration during the time interval from $t = 10$ to $t = 12$ is $5\ \text{m/s}^2$, find the value of V. [2]

(c) Calculate the deceleration of the sprinter, from $t = 12$ to the time the sprinter stops running. [2]

4008/1 N2013 Q23



The diagram is the velocity-time graph of an object which accelerates uniformly from rest and attains a velocity of 20 m/s in 2s. The object maintains a constant velocity for a further 4s and then accelerates uniformly again for 4s after which it reaches a velocity of 40 m/s.

Calculate

(i) the acceleration of the object during the first 2 seconds, [1]

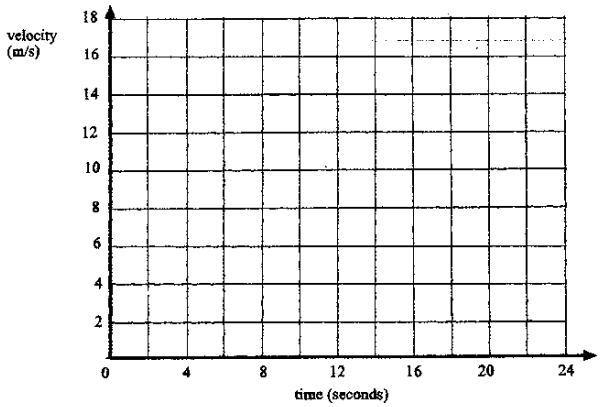
(ii) the distance covered by the object during the 10 seconds, [3]

(iii) the average speed of the object during the 10 seconds, [1]

(iv) the velocity of the object 9 seconds from rest. [1]

4008/1 J2012 Q25

A car decelerates from 18 m/s at $2\ \text{m/s}^2$ for 6 seconds. It then travels with a constant velocity for 10 seconds before it decelerates at $h\ \text{m/s}^2$ until it comes to rest in a further 8 seconds.

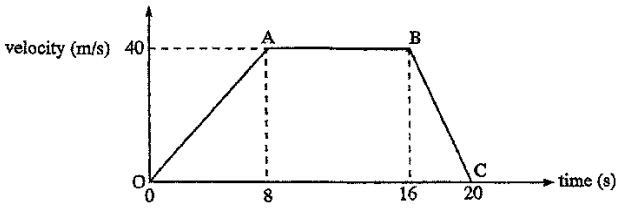


(a) Draw the velocity-time graph for the car on the grid above. [3]

(b) Calculate the distance the car travels at constant velocity. [1]

(c) Find the value of h. [1]

4008/1 N2012 Q26



In the diagram, O, A, B and C are four points on the velocity-time graph of an object.

(a) Describe the motion of the object as illustrated on the section of the graph.

(i) O to A, [1]

(ii) A to B. [1]

(b) Calculate the distance covered by the object during the 20 seconds. [2]

4008/4028/1 J2011 Q17

Answer the whole of this question on a sheet of graph paper.

The velocity of a particle moving along a straight line is given by $v = 15 + 7t - 2t^2$.

The table below shows corresponding values of v and t.

Time (t) sec	0	1	2	3	4	5	6
Velocity (v) m/s	15	p	21	18	q	0	-15

(a) Find the value of p and the value of q. [2]

(b) Using a scale of 2 cm to represent 5 m/s on the v-axis and 2 cm to represent 1 second on the t-axis, draw the graph of $v = 15 + 7t - 2t^2$ from $t = 0$ to $t = 6$. [4]

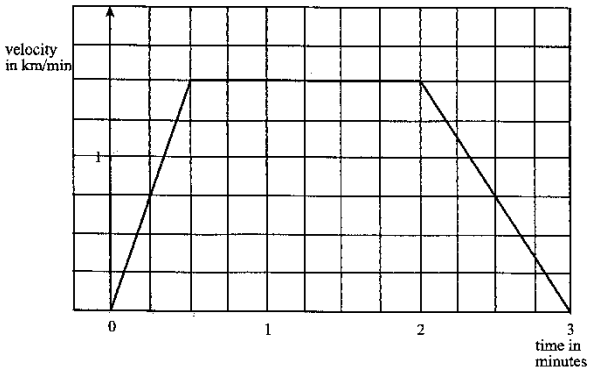
(c) Use your graph to estimate

(i) the maximum value of v,

(ii) the acceleration of the particle when $t = 3$ seconds,

(iii) the distance travelled by the particle from $t = 0$ to $t = 5$. [6]

4008/2 J2011 Q12



The diagram is a velocity-time graph of the train journey between two stations.
Find

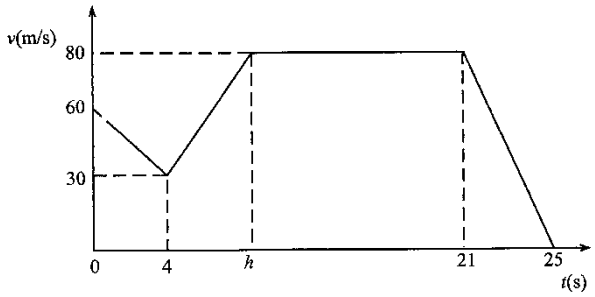
(a) the maximum speed of the train in km/h, [2]

(b) the train's acceleration in the first half minute, [2]

(c) the distance the train travels at maximum speed, [1]

(d) the distance between the stations. [1]

4008/1 N2011 Q23



The diagram is a velocity time graph of a particle.

(a) Find the acceleration of the particle during the first 4 seconds. [2]

(b) Calculate, in terms of h, the distance covered from

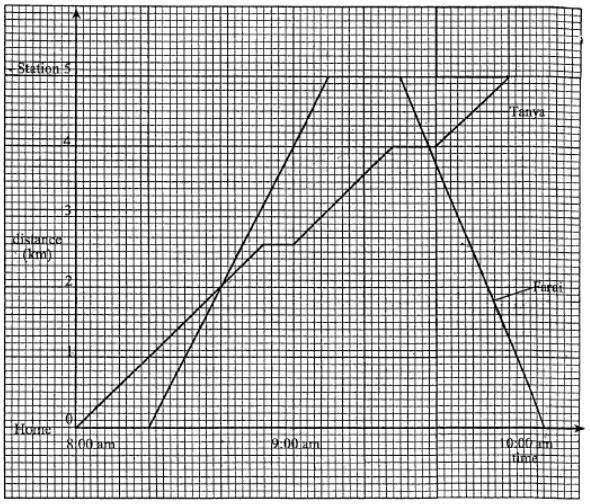
(i) $t = 4$ to $t = h$, [1]

(ii) $t = h$ to $t = 25$. [1]

(c) Given that the distance covered from $t = 4$ to $t = 25$ is 1,395 km, find the value of h. [2]

4008/4028/1 N2010 Q25

The diagram shows the distance-time graph of a cyclist, Farai and a pedestrian, Tanya, who travelled from their home to the train station which was 5 km away. After sometime Farai came back home.



Use the diagram to answer the following questions.

(i) Find Farai's speed on the outward journey. [2]

(ii) State

1. the time when, Tanya arrived at the stations,
2. the time when Farai overtook Tanya on the way to the station,
3. the distance that Tanya had covered when she was overtaken,
4. the total time that Farai was resting,
5. the distance that Tanya had left to cover when Farai met her the second time. [5]

(iii) Calculate Tanya's average speed for the whole journey. [2]

4008/2 N2010 Q9(a)

TRIGONOMETRY, BEARING & DISTANCES

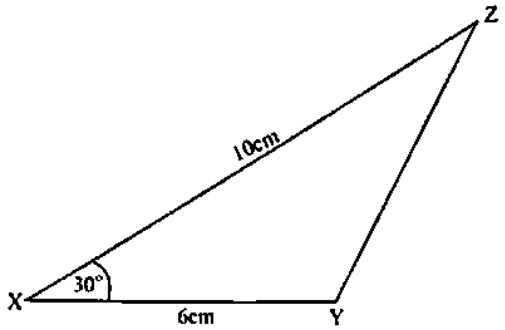
It is given that $\sin y = \frac{5}{13}$ and that y is an acute angle. Find as a common fraction,

(a) $\cos(180° - y°)$, [2]

(b) $\tan y°$. [1]

4004/1 J2020 Q14

The diagram shows triangle XYZ with XY $= 6\ cm$, XZ $= 10\ cm$ and $Y\hat{X}Z = 30°$.



Use as much of the information given below as is necessary.

$[sin\ 30° = 0.50; cos\ 30° = 0.87; tan\ 30° = 0.58]$

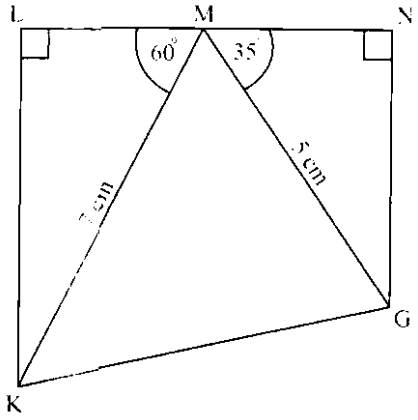
Calculate the

(a) area of the triangle XYZ, [2]

(b) length of YZ leaving the answer in surd form. [3]

4004/1 J2020 Q25

In the diagram KLNG is a trapezium in which LMN is a straight line and $K\hat{L}M = M\hat{N}G = 90°$. $MK = 7\ cm$, $MG = 5\ cm$, $L\hat{M}K = 60°$ and $N\hat{M}G = 35°$.



Calculate the

(a) length of NG, [2]

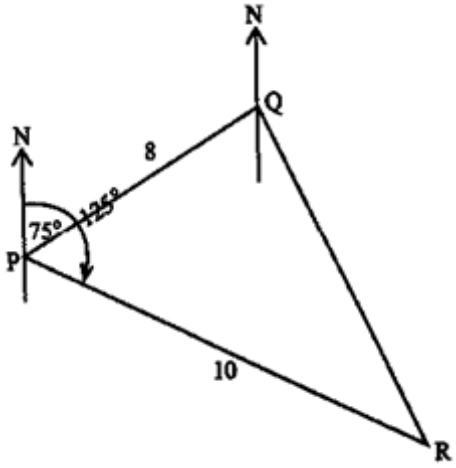
(b) size of $K\hat{M}G$, [1]

(c) area of triangle KMG, [2]

(d) length of KG, [4]

(e) size of $M\hat{K}G$. [3]

4004/2 J2020 Q10



In the diagram, point Q is 8m from point P on a bearing of 075°. Point R is 10m from point P on a bearing of 125°.

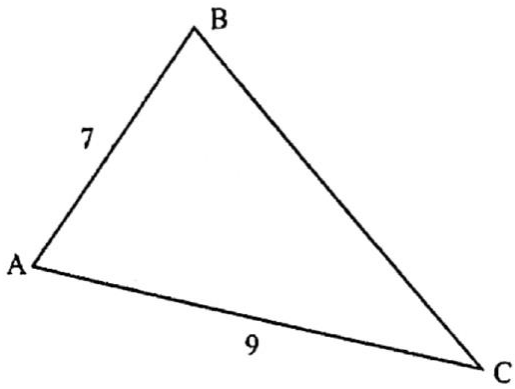
(a) Find the 3-figure bearing of point P from point Q. [1]

(b) Calculate the distance between Q and R, leaving the answer in surd form. [3]

Using as much of the information given below as is necessary.

$[sin\ 50° = 0.80;\ cos\ 50° = 0.60;\ tan\ 50° = 1.20]$

4004/1 N2020 Q22



In the diagram, ABC is a triangle in which $AB = 7\ cm$, $AC = 9\ cm$ and $Sin\ B\hat{A}C = \frac{2}{3}$, where $B\hat{A}C$ is acute.

Find the

(i) $Cos\ B\hat{A}C$, [3]

(ii) length of BC. [4]

4004/2 N2020 Q9(b)

In a rectangle ABCD, $AB = 12\ cm$ and $BC = 5\ cm$. Express as a common fraction,

(a) $tan\ A\hat{C}D$, [1]

(b) $cos\ D\hat{A}C$, [2]

(c) $sin\ B\hat{D}C$. [1]

4004/1 J2019 Q15

Moyo village is 5 km away from Dube village on a bearing of 020°.

Ncube village is 6 km away from Dube village on a bearing of 060°.

(a) Find the bearing of Dube village from Moyo village. [1]

(b) Find the distance from Moyo village to Ncube village, leaving the answer in surd form. [3]

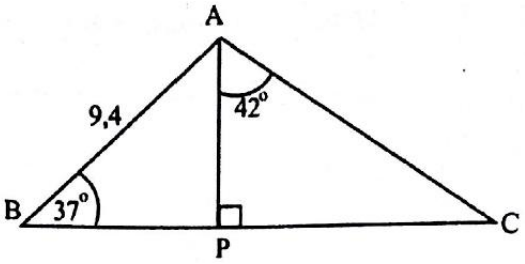
Use as much of the information given below as is necessary.

$[cos\ 40° = 0.77;\ sin\ 40° = 0.64;\ tan\ 40° = 0.84]$

4004/1 J2019 Q24

(a) $Sin\ \theta = Cos\ 40°$. Find the 2 possible values of θ if $0° < \theta < 180°$. [2]

(b)



In the diagram, **ABC** is a triangle in which **AP** is perpendicular to **BC**. **AB** = 9,4 cm, $A\hat{B}C = 37°$ and $P\hat{A}C = 42°$

(i) Calculate the length of **AP**. [2]

(ii) Calculate the length of **AC**. [2]

4004/2 J2019 Q2

Triangle ABC is such that $A\hat{B}C = 90°$, $AB = (x + 2)cm$ and $AC = (2x + 3)cm$.

(i) Write down an expression in terms of x, for Sin $A\hat{C}B$. [1]

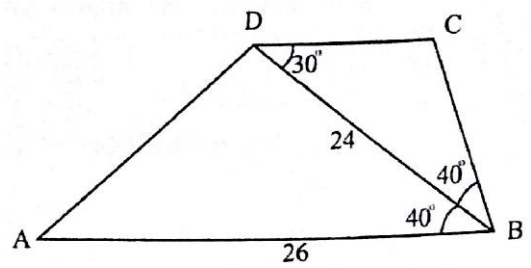
(ii) Given that Sin $A\hat{C}B = \frac{9}{16}$, form an equation in x. [1]

(iii) Solve the equation in (b)(ii). [2]

(iv) Hence find the length of side AC. [1]

(v) Hence, calculate the length of side BC. [2]

4004/2 J2019 Q7(b)



In the diagram, ABCD is a quadrilateral in which BD is a diagonal. AB = 26 cm, BD = 24 cm, $A\hat{B}D = C\hat{B}D = 40°$ and $C\hat{D}B = 30°$. Calculate the

(a) area of triangle ABD, [2]

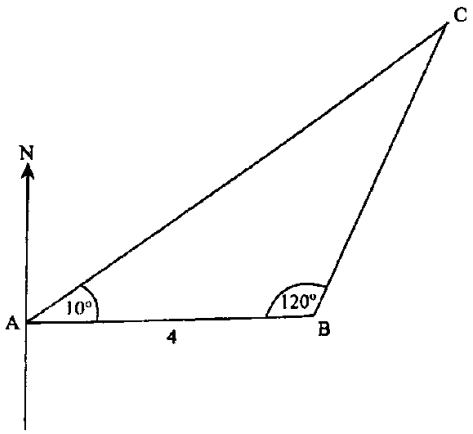
(b) length of AD, [4]

(c) length of BC, [4]

(d) shortest distance from C to BD. [2]

4004/2 J2019 Q9

In the diagram **A**, **B**, and **C** are points on level ground. Point **B** is 4 km due east of **A**. $B\hat{A}C = 10°$ and $A\hat{B}C = 120°$.



(a) State the bearing of **B** from **C**. [1]

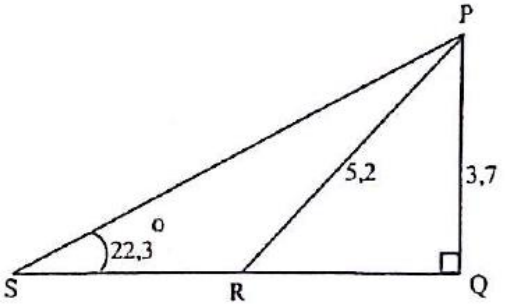
(b) Use as much of the information given below as is necessary to calculate **BC**. [3]

$[sin\ 10° = 0.2\ \ cos\ 10° = 1.0\ \ tan\ 10° = 0.2]$

$[sin\ 50° = 0.8\ \ cos\ 50° = 0.6\ \ tan\ 50° = 1.2]$

4004/1 N2019 Q14

In the diagram, triangle **PQS** is right-angled at **Q**. **SRQ** is a straight line. **PQ** = 3,7 cm, **PR** = 5,2 cm and $P\hat{S}R = 22{,}3°$.

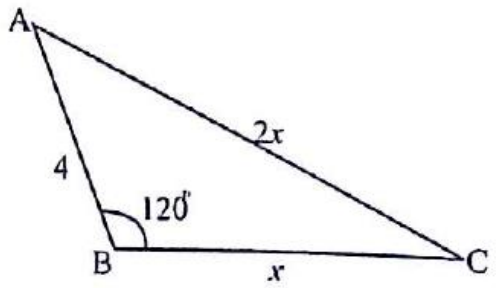


Calculate the

(i) length of **PS**, [2]

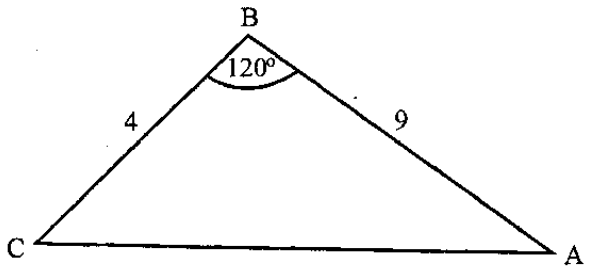
(ii) $S\hat{P}R$, [2]
(iii) $Q\hat{P}R$. [2]

4004/2 N2019 Q3(b)



In the diagram, ABC is a triangle in which AB = 4 cm, BC = x cm, AC = 2x cm and $A\hat{B}C = 120°$.
Form an equation in x and show that it reduces to $3x^2 - 4x - 16 = 0$. [3]

4004/2 N2019 Q8(b)(i)



ABC is a triangle with AB = 9 cm, BC = 4 cm and $A\hat{B}C = 120°$.
Use as much of the information given below as is necessary.
$[tan\ 60° = 1.73;\ sin\ 60° = 0.87;\ cos\ 60° = 0.5]$
Find the
(a) area of triangle ABC, [2]
(b) length of AC leaving the answer in surd form. [3]

4030/1 J2018 Q21

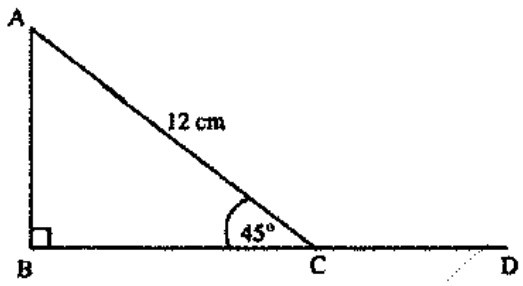
Three points P, X and Y are on level ground and are such that P is 200 m from X on a bearing of 064°. Y is on a bearing of 144° from P and is such that Y is due east of X.
Calculate the
(i) length XY, [2]
(ii) distance P is north of X. [2]

4030/2 J2018 Q9(a)

In the diagram, triangle **ABC** is right angled at **B**, **BCD** is a straight line, **AC** = 12 cm and $B\hat{C}A = 45°$.

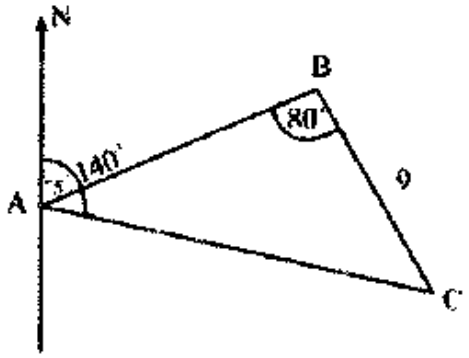
$$[sin\ 45° = \frac{\sqrt{2}}{2}\quad cos\ 45° = \frac{\sqrt{2}}{2}]$$

Using as much of the information given above as is necessary, calculate
(a) BC, leaving the answer in surd form, [2]



(b) $sin\ A\hat{C}D$, leaving the answer in surd form, [1]
(c) $tan\ A\hat{C}D$. [2]

4004/1 N2018 Q19



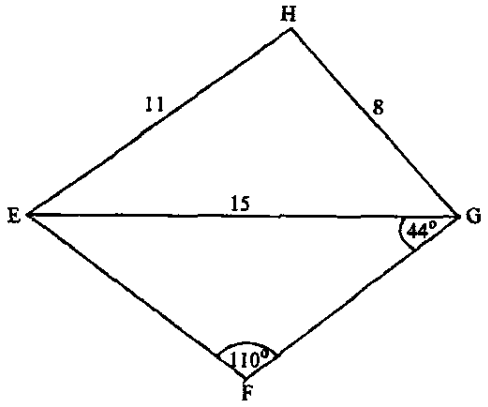
In the diagram, A, B and C are 3 points on level ground such that the bearing of B from A is 075° and that of C from A is 140°. B is 9 km from C and $A\hat{B}C = 80°$.
(i) Calculate $B\hat{A}C$, [1]
(ii) Calculate the distance from A to C, [2]
(iii) Calculate the shortest distance from B to AC. [2]

4004/2 N2018 Q7(a)

Three schools A, B and C are situated such that B is 9 km from A on a bearing of 060° and C is 8 km due east of B.
(a) Find the three-figure bearing of A from B. [1]
(b) Calculate the distance from A to C, leaving the answer in surd form. [3]
[Use as much of the information given below as is necessary.]
$(\sin 30° = 0.50; \cos 30° = 0.87; \tan 30° = 0.58)$

4030/1 J2017 Q20

In the diagram, EH = 11 cm, HG = 8 cm, EG = 15 cm, $E\hat{G}F = 44°$ and $E\hat{F}G = 110°$.



Calculate

(i) EF, [3]

(ii) $E\hat{H}G$, giving the answer to the nearest degree, [3]

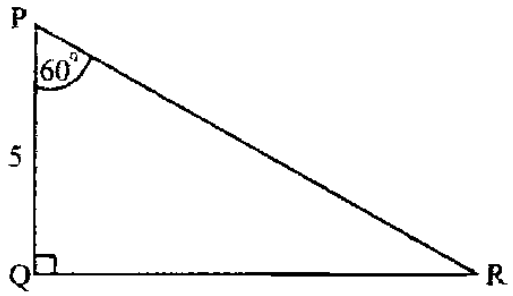
(iii) the shortest distance from E to GF produced, [2]

(iv) the bearing of F from G, given that E is due west of G and E, F, G and H are on level ground. [2]

4030/2 J2017 Q8(b)

Write down the three-figure bearing equivalent to the direction North West. [1]

4030/1 N2017 Q18(a)



In the diagram $P\hat{Q}R = 90°$, PQ $= 5\ cm$ and $Q\hat{P}R = 60°$. Calculate PR. [2]

[Use as much of the information given below as is necessary.]

$(\sin 60° = 0.866; \cos 60° = 0.500; \tan 60° = 1.732)$

4030/1 N2017 Q24(a)

(a) Point Q is on a bearing of S35°E from point P. Calculate the three-figure bearing of P from Q. [1]

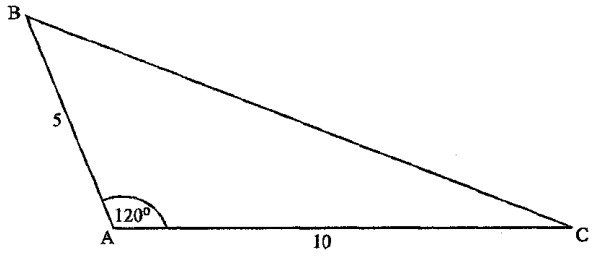
(b) In the diagram AB $= 5\ cm$, AC $= 10\ cm$ and $B\hat{A}C = 120°$.

Using as much of the information given below as is necessary, calculate the

(i) area of triangle ABC, [2]

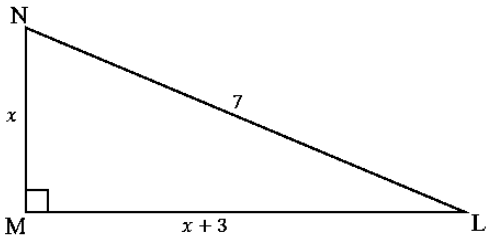
(ii) length of BC, leaving the answer in surd form. [3]

$[\tan 60° = 1.73;\ \sin 60° = 0.86;\ \cos 60° = 0.50]$



4030/1 J2016 Q27

In the diagram, $L\hat{M}N = 90°$, $MN = x\ cm$, $ML = (x + 3)\ cm$ and $LN = 7\ cm$.

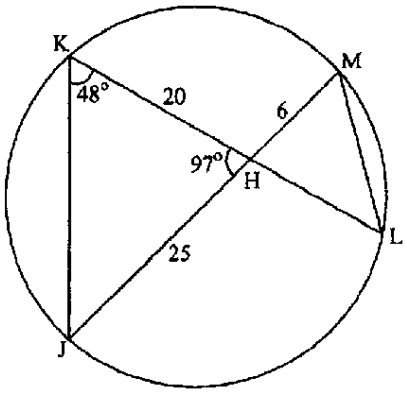


(i) Form an equation in x and show that its reduces to $x^2 + 3x - 20 = 0$. [2]

(ii) Solve the equation $x^2 + 3x - 20 = 0$, giving the answers correct to 2 significant figures. [4]

(iii) Hence calculate the perimeter of the triangle LMN. [2]

4030/2 J2016 Q3(a)



In the diagram J, K, L and M lie on the circumference of a circle. JM and KL intersect at H. $J\hat{H}K = 97°$, $J\hat{K}H = 48°$, KH $= 20\ cm$, JH $= 25\ cm$ and HM $= 6\ cm$.

(a) Find $H\hat{L}M$. [3]

(b) Name, in correct order, the triangle which is similar to triangle JKH. [1]

(c) Calculate

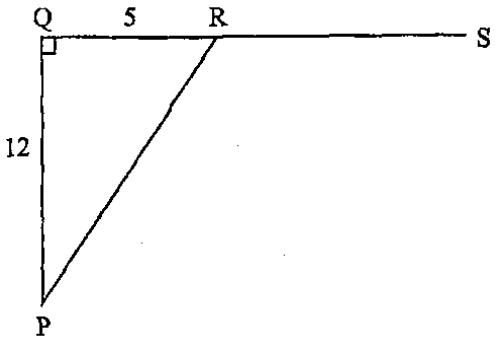
(i) the length of JK, [3]

(ii) the area of the triangle JKH, [2]
(iii) the area of triangle HLM. [3]

4030/2 J2016 Q4

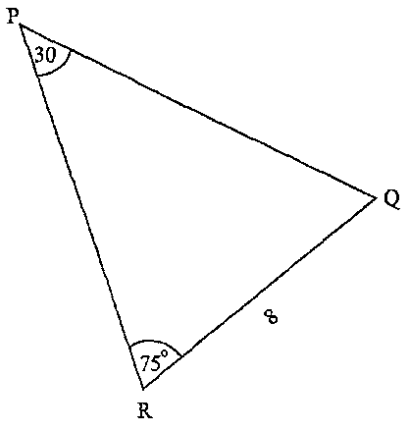
In the diagram, QRS is a straight line and PQR is a triangle such that $P\hat{Q}R = 90°$, PQ = 12 cm and QR = 5 cm.

(a) Calculate PR, [1]
(b) Expressing the answer as a common fraction, write down the value of



(i) $tan\, Q\hat{P}R$, [1]
(ii) $cos\, P\hat{R}S$. [1]

4030/1 N2016 Q15



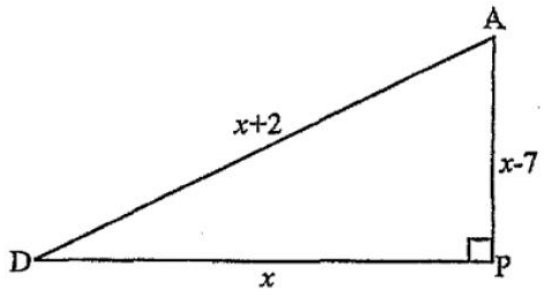
In the diagram, PQR is a triangle in which $R\hat{P}Q = 30°$, $P\hat{R}Q = 75°$ and RQ = 8cm.
Using as much of the information given below as is necessary, Calculate

(a) PQ, [3]
(b) area of triangle PQR. [2]

$[sin\, 30° = 0.50;\ cos\, 30° = 0.87;\ tan\, 30° = 0.58]$
$[sin\, 75° = 0.97;\ cos\, 75° = 0.26;\ tan\, 75° = 3.73]$

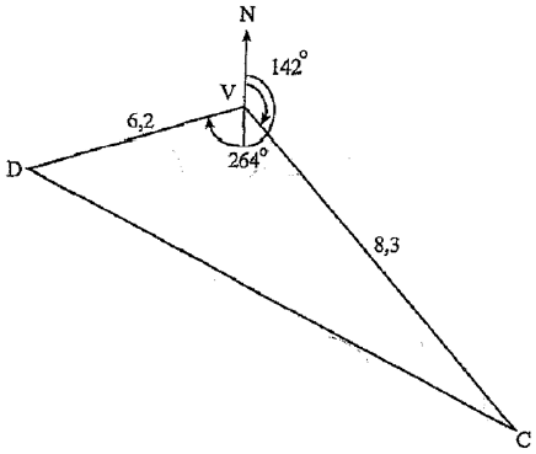
4030/1 N2016 Q22

In the diagram, triangle ADP is right-angled at P. AP $= (x - 7)\ cm$, AD $= (x + 2)\ cm$ and DP $= x\ cm$.



(i) Form an equation in x and show that it reduces to $x^2 - 18x + 45 = 0$. [2]
(ii) Solve the equation $x^2 - 18x + 45 = 0$. [3]
(iii) Hence write down the length of AP. [1]

4030/2 N2016 Q6



In the diagram, C is 8,3 km on a bearing of 142° from V. D is 6,2 km on a bearing of 264° from V.

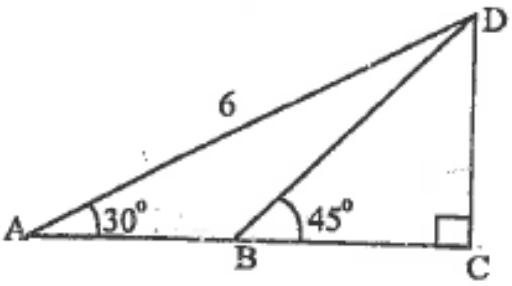
(a) Calculate the length of CD. [5]
(b) Calculate the bearing of D from C, correct to the nearest degree. [5]
(c) Calculate the distance that D is to the west of C. [2]

4030/2 N2016 Q11

(a) If B is East of A, state the three-figure bearing of A from B. [1]
(b) Express 33,55° in degrees and minutes. [2]

4008/1 J2015 Q9

Triangle ACD is right angled at C. AD = 6 cm, $D\hat{B}C = 45°$ and $D\hat{A}C = 30°$. ABC is a straight line.



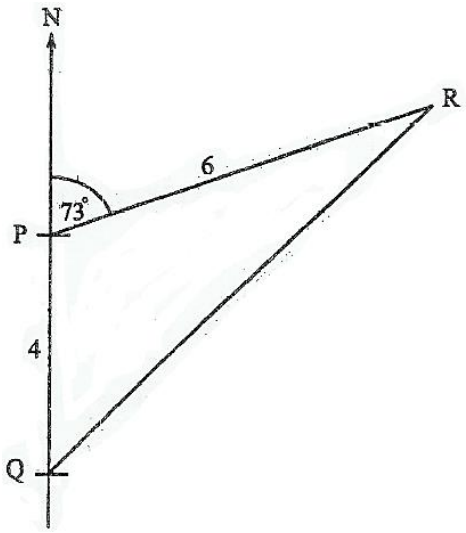
Using the information below, calculate

(a) CD, [1]

(b) AB, giving your answer correct to 1 decimal place. [2]

$[\sin 30° = 0.50\,;\cos 30° = 0.87\,;\tan 30° = 0.58$
$\sin 45° = 0.71\,;\cos 45° = 0.71\,;\tan 45° = 1.00]$

4008/1 J2015 Q13



The diagram shows three points, P, Q and R such that P is 4 km North of Q and R is 6 km from P on a bearing of 073°.

Calculate

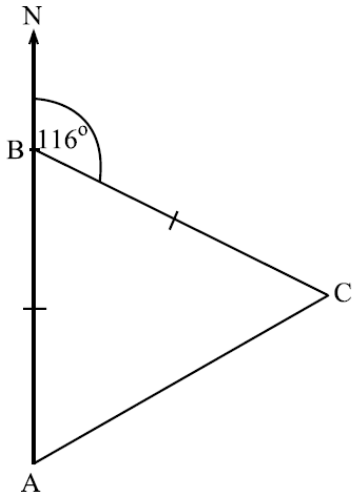
(i) QR,

(ii) $P\hat{Q}R$,

(iii) the bearing of R from Q to the nearest degree. [9]

4028/2 J2015 Q11(b)

In the diagram, A, B and C are positions of 3 boreholes where BA = BC. The borehole at C has a bearing of 116° from the borehole at B.



Calculate

(a) $A\hat{C}B$, [1]

(b) the bearing of the borehole at A from the borehole at C. [2]

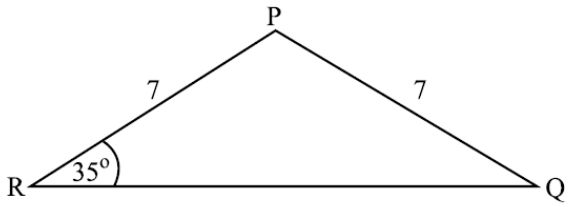
4028/1 N2015 Q13

In the diagram, PQR is an isosceles triangle such that PQ = PR = 7 cm and $P\hat{R}Q = 35°$.

Using as much of the given information below as is necessary, calculate

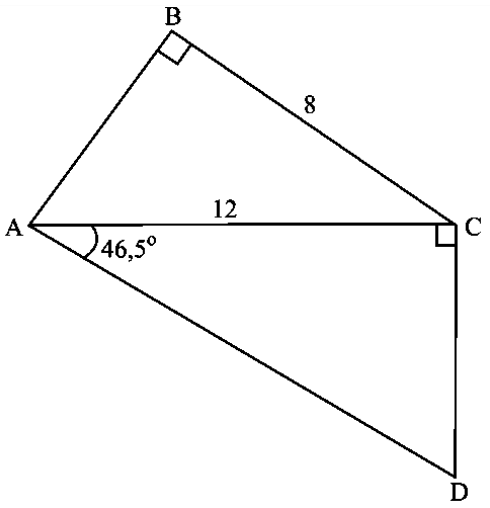
(a) QR, [2]

(b) the area of triangle PQR. [2]



$[\sin 35° = 0.57\,;\cos 35° = 0.82\,;\tan 35° = 0.70$
$\sin 70° = 0.94\,;\cos 70° = 0.34\,;\tan 70° = 2.75]$

4028/1 N2015 Q21



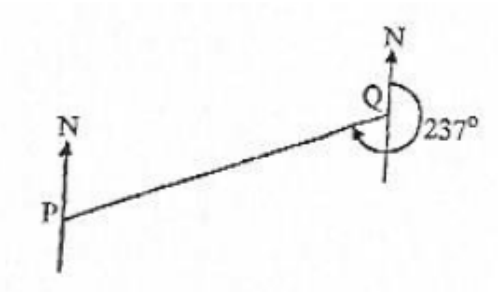
The diagram shows a quadrilateral ABCD with $BC = 8$ cm, $AC = 12$ cm, $C\hat{A}D = 46.5°$ and $A\hat{B}C = A\hat{C}D = 90°$.

(i) Calculate AB, [2]

(ii) Calculate CD, [2]

(iii) Calculate the area of quadrilateral ABCD. [3]

4028/2 N2015 Q2(b)



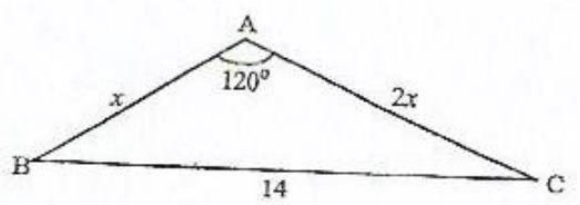
In the diagram, P and Q are points on level ground. The bearing of P from Q is 237°.

Find the bearing of Q from P. [2]

4008/1 J2014 Q23(a)

In the diagram, ABC is a triangle in which $AB = x$ cm, $AC = 2x$ cm, $BC = 14$ cm and $B\hat{A}C = 120°$. Using as much of the information given below as is necessary, calculate

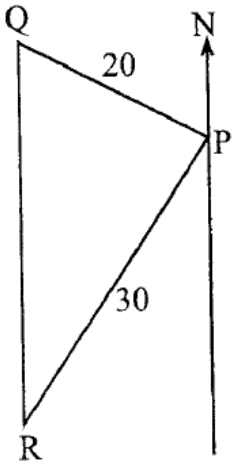
(a) the value of x, leaving your answer in surd form, [4]



(b) the area of triangle ABC. [2]

[$\sin 60° = 0.87$; $\cos 60° = 0.50$; $\tan 60° = 1.73$]

4008/1 J2014 Q27



In the diagram, P, Q and R are three points on level ground. PQ = 20 m, PR = 30 m and $\cos R\hat{P}Q = -\frac{1}{3}$. If R is due south of Q, calculate

(a) $R\hat{P}Q$, [2]

(b) the length of QR, [4]

(c) $P\hat{R}Q$, [3]

(d) the three-figure bearing of Q from P correct to the nearest degree. [2]

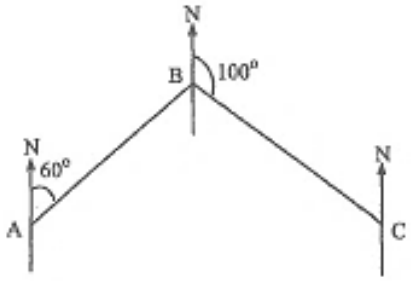
4028/2 J2014 Q4

Given that $\sin\theta = \frac{5}{13}$ and $90° < \theta < 180°$, express as a common fraction

(i) $\cos\theta$, [1]

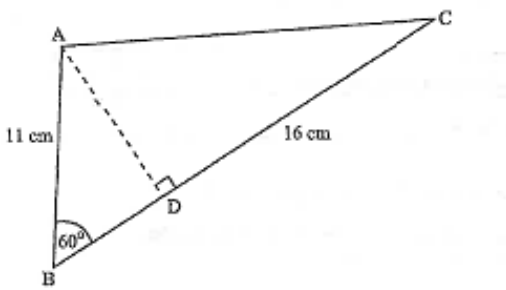
(ii) $\tan\theta$. [1]

4008/1 N2014 Q9(a)



In the diagram, the bearing of B from A is 060° and the bearing of C from B is 100°. Find the bearing of B from C. [1]

4008/1R N2014 Q8(a)



In the diagram, ABC is a triangle in which AB = 11 cm, BC = 16 cm, $A\hat{B}C = 60°$ and AD is the altitude.

Using as much of the information given below as is necessary and leaving the answers in surd form where appropriate, find

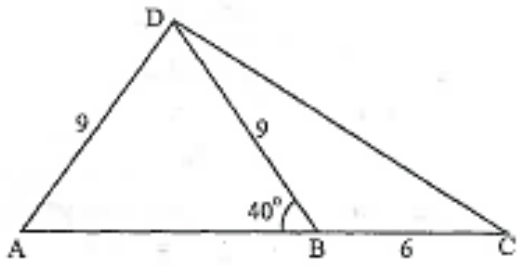
(a) $(\sin 60°)^2 + (\cos 60)^2$, [2]

(b) the area of triangle ABC, [2]

(c) the length of BD. [2]

$$[\sin 60° = \frac{\sqrt{3}}{2};\ \cos 60° = \frac{1}{2};\ \tan 60° = \frac{\sqrt{3}}{1}]$$

4008/1R N2014 Q25



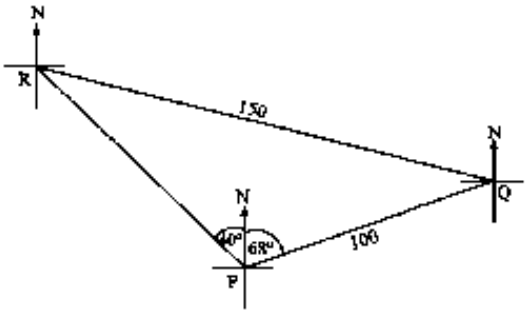
In the diagram, the points A, B, C and D lie on level ground. ABC is a straight road which runs in a west-east direction. AD = BD = 9 km, $A\hat{B}D = 40°$ and BC = 6 km.
Calculate
(i) the bearing of A from D,
(ii) the distance CD,
(iii) the area of ΔBCD. [8]

4008/2 N2014 Q11(b)

Triangle ABC is right-angled at B. AB = 2,5 cm, BC = 6 cm and the perpendicular from B meets AC at D.
Find the length of
(i) AC,
(ii) BD. [4]

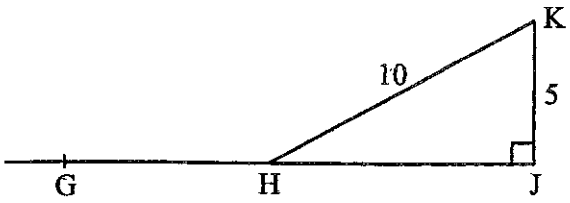
4008/2R N2014 Q3(b)

In the diagram are three points P, Q and R on level ground. Q is 100 m away from P on a bearing of N68°E. R is on a bearing of N40°W from P and the distance between R and Q is 150 m.



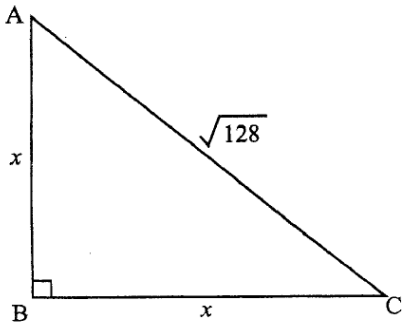
(a) Calculate
(i) the distance that Q is to the east of P,
(ii) $P\hat{R}Q$ giving the answer correct to the nearest degree,
(iii) the three-figure bearing of R from Q,
(iv) the area of the triangle PQR in hectares. [10]
(b) From P, the angle of elevation of the top of a vertical mast at Q is 31°. Calculate the height of the mast to the nearest 10 m. [2]

4008/2R N2014 Q12



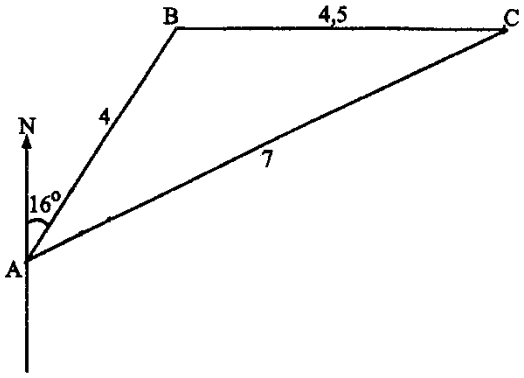
In the diagram GHJ is a straight line. $H\hat{J}K = 90°$, JK = 5 cm and HK = 10 cm.
(a) Find sin $G\hat{H}K$, [1]
(b) Calculate HJ leaving your answer in surd form. [2]

4028/1 J2013 Q11



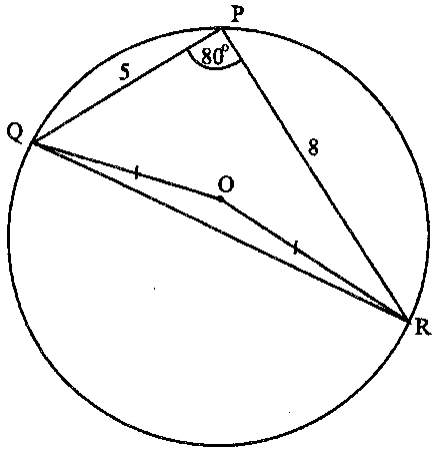
In the diagram AB = BC = x cm, AC = $\sqrt{128}$ cm and $A\hat{B}C = 90°$.
(i) Form an equation in x. [1]
(ii) Find the value of x. [2]

4028/1 J2013 Q24(b)



In the diagram, A, B and C are points on level ground. The bearing of B from A is 016°, AB = 4 km,
BC = 4,5 km and AC = 7 km.
Find (i) $B\hat{A}C$, giving your answer to the nearest degree,
(ii) the bearing of C from A. [5]

4028/2 J2013 Q5(b)



The points P, Q and R lie on the circumference of a circle, centre O. PQ = 5 cm, PR = 8 cm and $Q\hat{P}R = 80°$.

Using as much of the information given as is necessary, calculate

(a) the area of triangle PQR, [2]

(b) the value of QR^2, [2]

(c) find the reflex $Q\hat{O}R$. [2]

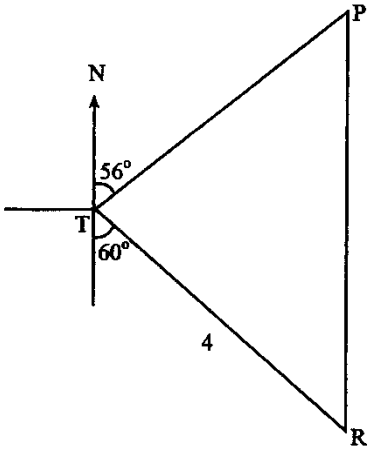
[$\sin 80° = 0.985$; $\cos 80° = 0.174$; $\tan 80° = 5.67$]

4008/1 N2013 Q26

The diagram shows three points, P, R and T which are on level ground and TR = 4 km. From T, the bearing of P is N56°E, the bearing of R is S60°E and P is due north of R.

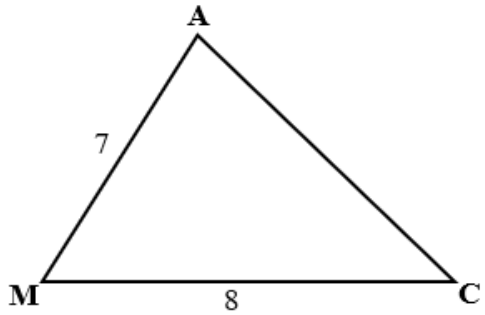
(i) Calculate

1. the shortest distance between line PR and T.
2. PR.



(ii) From an aeroplane flying directly above point T the angle of depression of R is 20,3°. Calculate the height of the aeroplane above the ground at T. [7]

4008/2 N2013 Q10(b)



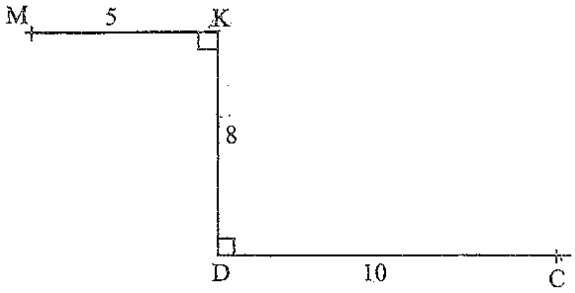
In the diagram, AM = 7 cm and MC = 8 cm. If the area of $\Delta AMC = 25\ cm^2$, calculate $A\hat{M}C$. [3]

4008/2 J2012 Q3(b)

In the diagram, K is 5 km due east of M, D is 8 km due south of K and C is 10 m due east of D. Calculate

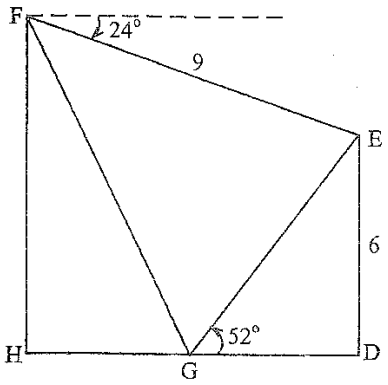
(i) the length of straight line MC,

(ii) the bearing of C from M correct to the nearest degree. [5]



4008/2 J2012 Q5(a)

In the diagram, the points H, G and D are in a straight line on level ground. DE is a tree 6 m high and the



angle of elevation of E from G is 52°. The angle of depression of E from the top of a tower HF, is 24°. Given that EF = 9 cm, calculate

(a) $G\hat{E}F$, [2]

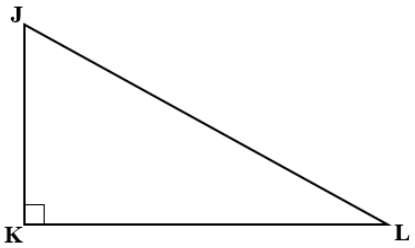
(b) the length of

(i) GE,

(ii) FG. [6]

(c) the angle of depression of G from F. [4]

4008/2 J2012 Q7



In the diagram, triangle JKL is right-angled at K.

(a) Measure and write down

(i) the length of KL correct to the nearest centimetre, [1]

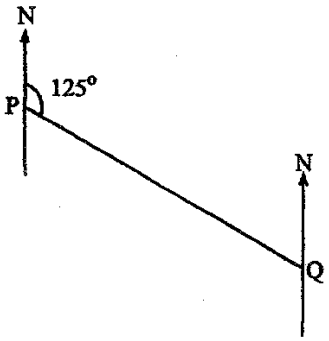
(ii) the size of angle KJL correct to the nearest degree. [1]

(b) Write down the special name given to the side JL. [1]

4008/1 N2012 Q2

(a) Write down the supplement of 35°. [1]

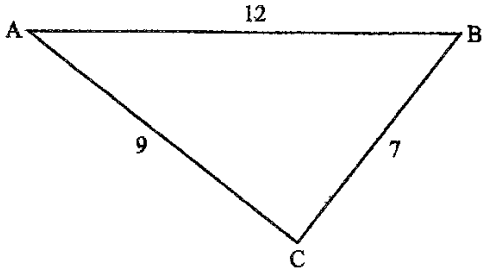
(b) The diagram shows the positions of two TV masts P and Q.



The bearing of Q from P is 125°.

Find the 3-figure bearing of P from Q. [2]

4008/1 N2012 Q5



In the diagram, AB = 12 cm, AC = 9 cm and BC = 7 cm.

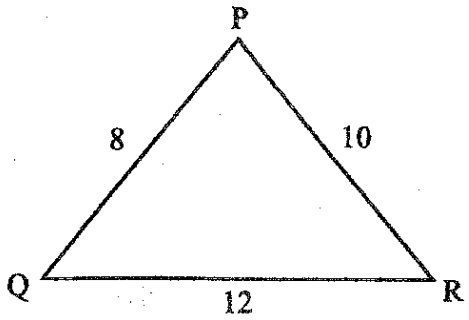
Using as much of the information given below as is necessary

(a) express the ratio AC: AB in its simplest form, [1]

(b) find the area of triangle ABC. [2]

$[\sin\hat{A} = 0.58\,;\cos\hat{A} = 0.81\,;\tan\hat{A} = 0.71]$

4008/1 N2012 Q 11



In the diagram, PQ = 8 cm, QR = 12 cm and PR = 10 cm.

Express $\cos\hat{P}$ as a common fraction. [3]

4008/1 N2012 Q16

The bearing of village P from village Q is 109°. Find

(a) the three-figure bearing of Q from P, [2]

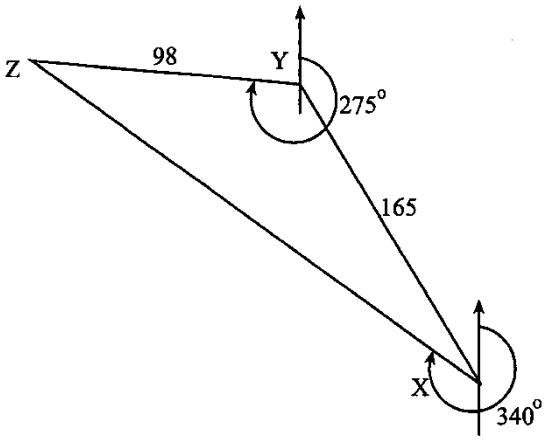
(b) the compass bearing of Q from P. [1]

4008/4028/1 J2011 Q4

The triangle XYZ has XY = 5 cm and YZ = 6 cm. Given that the triangle XYZ has only one line of symmetry, write down the two possible length of XZ. [2]

4008/4028/1 J2011 Q8(b)

In the diagram, Y is 165 km from X on a bearing 340° and Z is 98 km from Y on a bearing of 275°.



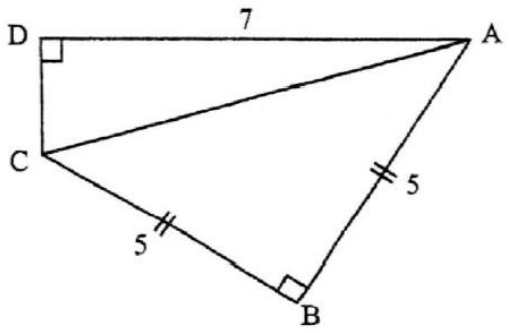
(a) Calculate the distance between X and Z. [5]

(b) A helicopter took $1\frac{1}{2}$ hours to fly from X to Y direct. Find the speed of the helicopter. [2]

(c) (i) Find $Y\hat{X}Z$.

(ii) State the bearing of Z from X. [5]

4008/2 N2011 Q9



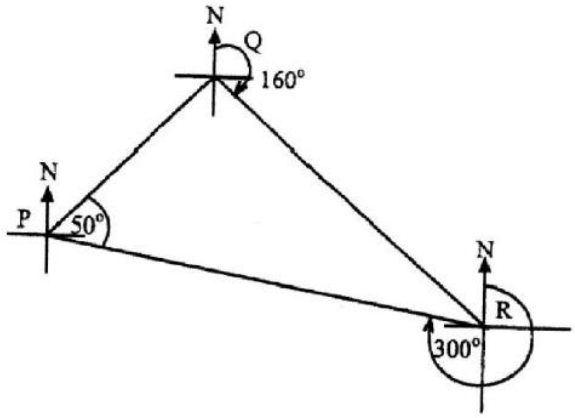
In the diagram, $A\hat{B}C = A\hat{D}C = 90°$, AB = BC = 5 cm and AD = 7 cm.

(a) Write down the value of $tan\ B\hat{A}C$. [1]

(b) Calculate the length of the line DC. [2]

4008/4028/1 J2010 Q12

P, Q and R are three points on level ground. The bearing of R from Q is 160°, the bearing of P from R is 300° and $Q\hat{P}R = 50°$.

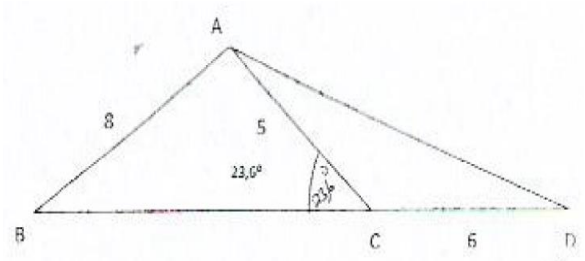


Find the three-figure bearing of

(a) Q from R, [1]

(b) Q from P. [2]

4008/4028/1 J2010 Q17



In the diagram BCD is a straight line, AB = 8 cm, AC = 5 cm, CD = 6 cm and $A\hat{C}B = 23,6°$.

Using as much of the information given below as is necessary, calculate

(a) the value of $\sin A\hat{B}C$, giving your answer as a common fraction in its lowest terms, [2]

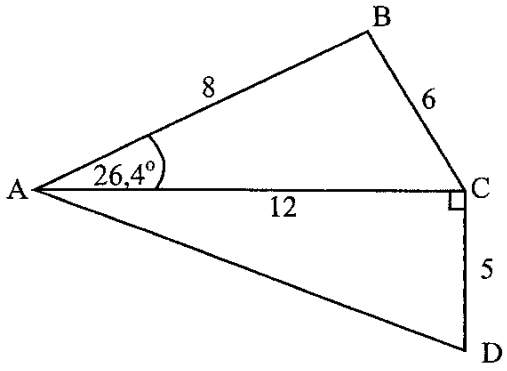
(b) AD^2. [3]

[$\sin 23,6° = 0.40; \cos 23,6° = 0.92; \tan 23,6° = 0.44$]

4008/4028/1 J2010 Q29

The bearing of A from B is 243°. Write down the three-figure bearing of B from A. [1]

4008/4028/1 N2010 Q11(a)



In the diagram, AB = 8 cm, BC = 6 cm, AC = 12 cm, CD = 5 cm, $B\hat{A}C = 26,4°$ and $A\hat{C}D = 90°$.

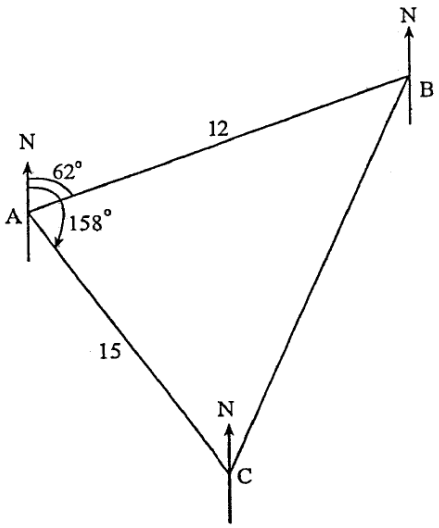
Using as much of the information given below as is necessary, find

(a) the area of triangle ABC, [2]

(b) AD. [2]

[$\sin 26,4° = 0.44; \cos 26,4° = 0.90; \tan 26,4° = 0.5$]

4008/4028/1 N2010 Q19



In the diagram, A, B and C are three points on level ground. B is 12 km from A on a bearing of 062° and C is 15 km from A on a bearing of 158°.

Calculate (i) the distance from B to C, [5]

(ii) $A\hat{C}B$ to the nearest degree, [3]

(iii) the bearing of C from B. [4]

4008/2 N2010 Q10

VARIATION

It is given that $g \propto \frac{m}{r}$ and $g = 1$ when $m = 2$ and $r = 3$. Find the

(a) formula connecting g, m and r, [2]

(b) numerical value of g when $m = 10$ and $r = 3$. [1]

4004/1 J2020 Q17

$\boldsymbol{P}$ varies jointly as $\boldsymbol{Q}$ and inversely as $(\boldsymbol{R} - 3)$. $\boldsymbol{P} = 7$ when $\boldsymbol{Q} = 28$ and $\boldsymbol{R} = 6$.

(a) Form an equation connecting $\boldsymbol{P}$, $\boldsymbol{Q}$ and $\boldsymbol{R}$. [2]

(b) Calculate the value of $\boldsymbol{Q}$ when $\boldsymbol{P} = 6$ and $\boldsymbol{R} = 2$. [2]

4004/1 N2020 Q24

The average expenditure E of a family over a certain period of time is partly constant and partly varies as the number, n, of people in the family.

(i) Find a relationship between E and n using constants h and k. [1]

(ii) The expenditure for 5 people is \$55 and for 3 people is \$45.
Find the value of h and the value of k. [3]

4004/2 N2020 Q6(c)

The number of people, N, who favour a certain type of energy drink varies directly as the population size, S. In a population of 1 000 people, only 40 people were reported to favour that type of energy drink.

(a) Form an equation connecting N and S. [2]

(b) Find the population size, S from which 180 people favour that type of energy drink. [2]

4004/1 J2019 Q14

The table shows some corresponding values of $\boldsymbol{h}$ and $\boldsymbol{V}$ such that $\boldsymbol{V} \propto \boldsymbol{h^3}$.

$\boldsymbol{h}$	1	2	3	...	$\boldsymbol{q}$
$\boldsymbol{V}$	3	24	81	...	648

Find the

(a) equation connecting $\boldsymbol{V}$ and $\boldsymbol{h}$, [2]

(b) value of $\boldsymbol{q}$. [2]

4004/2 J2019 Q16

It is given that $p \propto t^{-3}$ and that $p = 4$ when $t = 2$.

(i) Find a formula connecting p and t. [2]

(ii) Find the value of t when $p = \frac{1}{2}$. [1]

4004/2 N2019 Q6(d)

It is given that y varies directly as the square of $(x - 3)$.

(a) Express y in terms of x and a constant k. [1]

(b) Given that $y = 16$ when $x = 1$, find y when $x = 10$. [2]

4030/1 J2018 Q10

W varies directly as x and inversely as the square root of u. W = 6, when $x = 2$ and $u = 9$.

(i) Express W in terms of x and u. [2]

(ii) Find W when $x = 8$ and $u = 4$. [1]

4030/2 J2018 Q3(b)

The wave length, w, is inversely proportional to its frequency, f. When $f = 90$, $w = 675$. Find

(a) an equation connecting f and w. [2]

(b) the value of f when $w = 500$. [1]

4004/1 N2018 Q8

It is given that y varies inversely as the square root of x and that $y = 2$, $x = 9$. Find

(i) the equation connecting y and x, [2]

(ii) x when $y = \frac{1}{2}$. [2]

4004/2 N2018 Q8(a)

H varies directly as $\sqrt{\text{Q}}$ and H = 51 when Q = 289. Find the

(i) formula connecting H, Q and a constant k. [1]

(ii) value of Q when H = 81. [2]

4030/2 J2017 Q4(a)

M varies directly as the square of r and inversely as the square root of h.

(i) Express M in terms of r, h and a constant k. [1]

(ii) Find the value of k when $r = h = 4$ and $M = 12$. [2]

4030/2 N2017 Q3(b)

If V varies jointly as h and as the square of r,

(a) write down the equation connecting V, r, h and a constant c. [1]

(b) find c if $V = 440, r = 2$ and $h = 35$. [2]

4030/1 J2016 Q11

The mass, m grams, of a solid, is inversely proportional to its volume, $v\ cm^3$.

(i) Find the formula connecting m and v, given that $m = 3.5\ g$ when $v = 4\ cm^3$. [2]

(ii) Find m when $v = 6\ cm^3$. [1]

4030/2 J2016 Q2(c)

Given that u varies jointly as x and as the square of y,

(a) express u in terms of x, y and a constant k, [1]

(b) find k, if $u = 14$ when $x = 1$ and $y = 2$, [2]

(c) find the value of u when $x = 6$ and $y = 3$. [1]

4030/1 N2016 Q17

A workman's weekly income is made up of a fixed weekly wage and overtime wage which varies directly as the number of hours of overtime that he works. If he works 6 hours overtime, his weekly income is \$96. If he works 8 hours overtime, his weekly income is \$103.

Find the workman's fixed weekly wage. [5]

4030/2 N2016 Q9(b)

It is given that y varies directly as the square root of z.

(a) Write down the equation connecting y, z and a constant k. [1]

(b) Find k when $y = 3$ and $z = 4$. [1]

(c) Find y when $z = 16$. [1]

4008/1 J2015 Q12

M is directly proportional to $(d-1)^2$. Given that $M = 12$ when $d = 4$, calculate M when $d = 7$. [3]

4028/2 J2015 Q7(a)

Given that y is inversely proportional to $(x-1)^2$ and that $y = 2$ when $x = 7$,

(a) express y in terms of x, [2]

(b) calculate the values of x when $y = 8$. [2]

4028/1 N2015 Q17

A salary of \$P, of a saleswoman who sells cars of the same type, is partly constant and her commission partly varies as N, the number of cars that she sells in one month. If she sells 7 cars in one month, her salary is \$675. If she sells 10 cars, her salary is \$900.

(a) Express P in terms of N and constants h and k. [1]

(b) Find the value of h and the value of k. [3]

(c) Write down

(i) the equation connecting P and N,

(ii) the saleswoman's salary when she has not sold any car. [2]

(d) Calculate the saleswoman's salary when she sells 9 cars in one month. [3]

(e) Given that her commission is $2\frac{1}{2}\%$ of the price of one car, calculate the price of each car. [3]

4028/2 J2014 Q9

The time, T, hours, varies inversely as the speed, S, kilometres per hour.

(a) Express T in terms of S and constant D. [1]

(b) Calculate the constant D, when $T = 12$ minutes and $S = 15$ km/h. [2]

4008/1 N2014 Q11

It is given that w is inversely proportional to f and when $f = 20, w = 150$.

(a) Find an equation connecting f and w. [2]

(b) Find the value of f when $w = 60$. [1]

4008/1R N2014 Q9

The annual premium, \$$P$, for a funeral insurance scheme varies jointly as the square root of the age, Y, years and the number of dependents, D, of the applicant. If a 25-year-old applicant with 6 dependents pays \$150.00, calculate the **monthly** premium for a 49-year-old applicant with 4 dependents. [5]

4008/2 N2014 Q4(b)

It is given that d varies jointly as e^2 and f. If $d = 5$ when $e = 3$ and $f = 2$, find

(i) the formula for d in terms of e and f,

(ii) the value of d when $e = 2$ and $f = 3$. [4]

4008/2R N2014 Q9(b)

E varies directly as the square of V.

(a) Express E in terms of V and a constant m. [1]

(b) Given that $E = 3$ when $V = 2$ find m. [2]

4028/1 J2013 Q9

The volume, V, of a gas at constant temperature is inversely proportional to its pressure P.

(i) Express V in terms of P and a constant$k$.

(ii) Given that $V = 45$ litres when $P = 600$

Newtons per square metre, find V when $P = 1\,050$ Newtons per square metre. [3]

4028/2 J2013 Q5(c)

The number of revolutions, n, of a wheel over a fixed distance varies inversely as the circumference, C cm, of the wheel.

(a) Write down an equation involving n, C and a constant k. [1]

(b) If the wheel of circumference 80 cm makes 10 revolutions, find the number of revolutions made by the wheel of circumference 200 cm. [3]

4008/1 N2013 Q20

It is given that y varies inversely as $(2x + 3)$ and that $y = 1$ when $x = 1$.

(a) Express y in terms of x. [2]

(b) Find the value of x when $y = 5$. [2]

4008/1 J2012 Q15

The resistance, R newtons, to a train travelling at v km/h, is given by the formula $R = c + dv^2$ where c and d are constants.

Given that $R = 4$ when $v = 20$ and that $R = 10$ when $v = 40$,

find

(i) the value of c and the value of d,

(ii) v when $R = 3$. [5]

4008/2 J2012 Q9(a)

F is inversely proportional to the square of d.

(a) Express F in terms of d and a constant k. [1]

(b) Find

(i) the value of k when $F = 60$ and $d = 3$. [2]

(ii) the value of F when $d = 6$. [1]

4008/1 N2012 Q22

A salesman's salary is partly constant and partly varies directly as the total sales he makes for the month. If sales are \$10 000, his salary is \$550 and if sales are \$15 000, his salary is \$600.

Find his salary if sales are \$25 000. [6]

4008/2 N2012 Q2(b)

(a) A car uses l litres of petrol for every d kilometres travelled. State the type of variation between l and d. [1]

(b) Given that the car uses 5 litres to cover 60 kilometres, find the equation connecting l and d. [2]

4008/4028/1 J2011 Q10

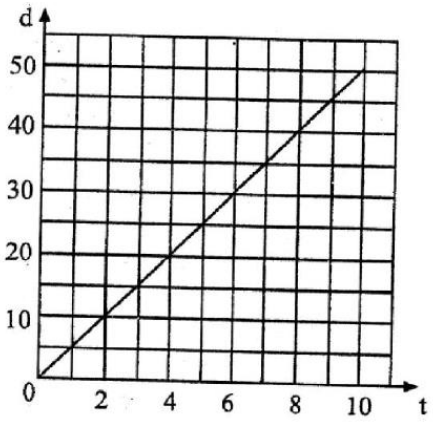
It is given that y varies inversely as the square of $(x - 1)$. When $y = 2$, $x = 2$.

Find the value of y when $x = 4$. [3]

4008/1 N2011 Q8

Given that M is directly proportional to t, and that $M = 27{,}5$ when $t = 55$, find the value of t when $M = 43$. [2]

4008/2 N2011 Q4(c)



The graph shows the relationship between two variables t and d. Use the graph to find the value of

(a) d when $t = 7$, [1]

(b) t when $d = 20$, [1]

(c) k when $t = kd$. [2]

4008/4028/1 J2010 Q19

Two variables R and V are connected by the equation $R = kV + c$, where k and c are constants.

(a) Write down the type of variation between R and V. [1]

(b) If the graph of $R = kV + c$ is drawn with R on the vertical axis, write down, in terms of k and/or c the coordinates of the point where the graph crosses

(i) the vertical axis, [2]

(ii) the horizontal axis. [2]

(c) Make V the subject of the equation $R = kV + c$. [2]

(d) Given that R = 14 when V = 6 and that R = 8 when V = 2,

(i) form a pair of simultaneous equations in k and c, [1]

(ii) **hence** find the numerical value of k and the numerical value of c. [3]

4028/2 J2010 Q4

D is proportional to the cube of n.

(a) Express D in terms of n and a constant k. [1]

(b) Given that $n = 3$ when D = 21,6 find D when $n = 5$. [2]

4008/4028/1 N2010 Q9

It is given that P varies directly as T and inversely as V.

(i) Write down an equation connecting P, V, T and a constant k.

(ii) Given that $P = 2 \times 10^5$ when $V = 1 \times 10^{-3}$ and T = 300, calculate the value of k.

(iii) Calculate P if V = 0,0025 and T = 300. [5]

4008/2 N2010 Q4(a)

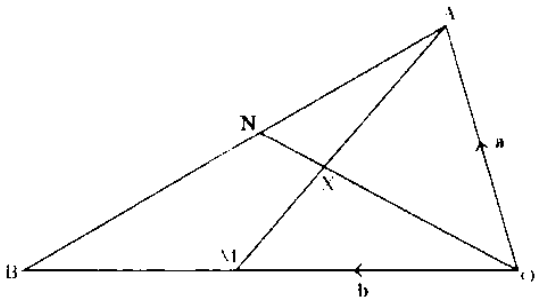
VECTOR GEOMETRY

It is given that $\mathbf{p} = \begin{pmatrix}5\\4\end{pmatrix}$, $\mathbf{q} = \begin{pmatrix}-3\\2\end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix}x\\y\end{pmatrix}$. Find

(a) $|\mathbf{p}|$, leaving the answer in surd form, [1]

(b) the value of x and the value of y if $\mathbf{p} - \mathbf{q} = 2\mathbf{r}$. [2]

4004/1 J2020 Q12



In the diagram, ABO is a triangle in which M is the mid-point of OB and N lies on AB such that AN $= \frac{1}{5}$AB. ON and AM intersect at X.

$\overrightarrow{OA} = \boldsymbol{a}$ and $\overrightarrow{OB} = \boldsymbol{b}$

(a) Express in terms of $\boldsymbol{a}$ and/or $\boldsymbol{b}$

(i) $\overrightarrow{AB}$, [1]

(ii) $\overrightarrow{AN}$, [1]

(iii) $\overrightarrow{ON}$, [2]

(iv) $\overrightarrow{AM}$. [1]

(b) Given that $\overrightarrow{AX} = h\overrightarrow{AM}$, show that $\overrightarrow{OX} = (1-h)\boldsymbol{a} + \frac{1}{2}h\boldsymbol{b}$. [2]

(c) If $\overrightarrow{OX} = k\overrightarrow{ON}$, express $\overrightarrow{OX}$ in terms of $\boldsymbol{a}$, $\boldsymbol{b}$ and k. [1]

(d) Use the results of (b) and (c) to find the numerical values of h and k. [3]

(e) Hence, or otherwise find the ratio of area of triangle OAX to area of triangle OAM. [1]

4004/2 J2020 Q6

Given that OABC is a parallelogram such that $\overrightarrow{OA} = \begin{pmatrix}2\\5\end{pmatrix}$ *and* $\overrightarrow{OC} = \begin{pmatrix}6\\3\end{pmatrix}$, calculate

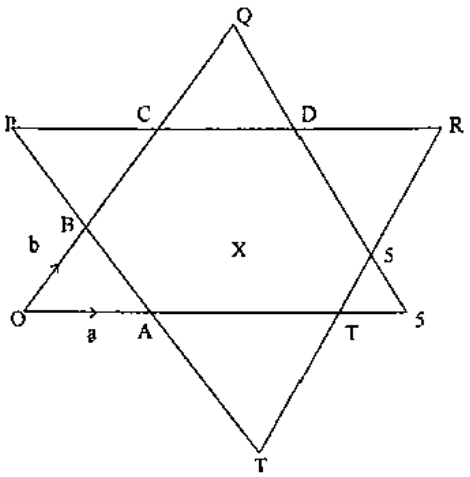
(a) $\overrightarrow{BC}$, [1]

(b) $\left|\overrightarrow{OC}\right|$ leaving your answer in simplest surd form. [3]

4004/1 N2020 Q20

The diagram is a star made up of a regular hexagon ABCDEF, centre X, surrounded by 6 equilateral triangles AOB, BPC, CQD, DRE, ESF and FTA.

$\overrightarrow{OA} = \boldsymbol{a}$ and $\overrightarrow{OB} = \boldsymbol{b}$



(a) Write down the following vectors in terms of $\boldsymbol{a}$ and/or $\boldsymbol{b}$, giving the answers in their simplest form.

(i) $\overrightarrow{OS}$. [1]

(ii) $\overrightarrow{AB}$. [1]

(iii) $\overrightarrow{OR}$. [2]

(iv) $\overrightarrow{CF}$. [2]

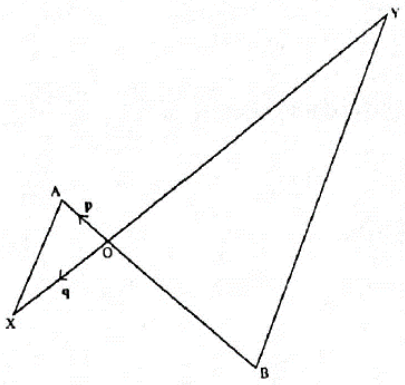
(b) The length of line OA = 5 cm. Find

(i) $|\boldsymbol{a} - \boldsymbol{b}|$, [2]

(ii) the perimeter of triangle OSQ, [2]

(iii) the area of triangle OAB. [2]

4004/2 N2020 Q12



The diagram shows two intersecting straight lines AOB and XOY.

$OA = \boldsymbol{p}$ and $OX = \boldsymbol{q}$.

$\frac{AO}{OB} = \frac{XO}{OY} = \frac{1}{3}$.

(a) Express in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$

(i) AX, [1]

(ii) BY. [1]

(b) State **any two** relationships between the lines AX and YB. [2]

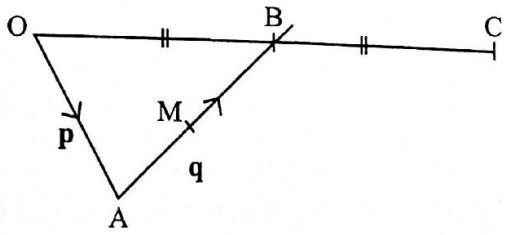
4004/1 J2019 Q23

(a) It is given that $\mathbf{u} = \begin{pmatrix}3\\9\end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix}-3\\1\end{pmatrix}$.

(i) Simplify $\mathbf{u} - 3\mathbf{v}$. [2]

(ii) Evaluate $|\mathbf{u} - 3\mathbf{v}|$. [1]

(b)



In the diagram, $\boldsymbol{OA} = \boldsymbol{p}$, $\boldsymbol{AB} = \boldsymbol{q}$ and M is the midpoint of AB. OB is produced to C such that OB = BC.

Express the following in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$,

(i) **OC**, [1]

(ii) **OM**, [1]

(iii) **AC**. [1]

(iv) OM is produced to a point T (not in the diagram) such that OT = kOM, where k is a constant. Express **OT** in terms of k, $\boldsymbol{p}$ and $\boldsymbol{q}$. [1]

(v) If point T is on AC and is such that AT = hAC, form and simplify another expression for **OT** in terms of h, $\boldsymbol{p}$ and $\boldsymbol{q}$. [1]

(vi) Using your answers in (iv) and (v), find the value of h and the value of k. [3]

(vii) Hence, find the ratio of MT : OT. [1]

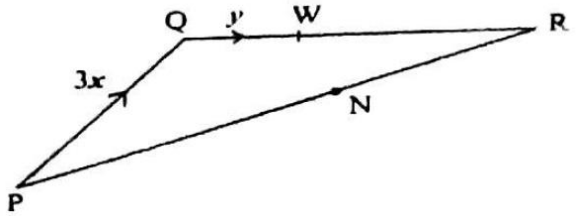
4004/2 J2019 Q12

It is given that $\mathbf{OA} = \begin{pmatrix}-2\\3\end{pmatrix}$ and $\mathbf{OB} = \begin{pmatrix}4\\1\end{pmatrix}$ are position vectors of **A** and **B** relative to an origin O.

(a) Express **AB** in column form. [2]

(b) **P** is a point such that $\mathbf{BP} = \mathbf{OA} + 2\mathbf{OB}$. Find the coordinates of point **P**. [3]

4004/1 N2019 Q20



In the diagram, $\overrightarrow{\boldsymbol{PQ}} = 3\boldsymbol{x}$ and $\overrightarrow{\boldsymbol{QW}} = \boldsymbol{y}$. **N** is a point on **PR** such that **PN** = **2NR**. **QW** is produced to **R** such that **QW : WR** = 1 : 5.

Express the following in terms of $\boldsymbol{x}$ and/or $\boldsymbol{y}$

(i) $\overrightarrow{QR}$, [1]

(ii) $\overrightarrow{PR}$, [1]

(iii) $\overrightarrow{PN}$, [1]

(iv) $\overrightarrow{QN}$. [2]

4004/2 N2019 Q2(b)

It is given that vector $\mathbf{p} = \begin{pmatrix}3\\-4\end{pmatrix}$ and vector $\mathbf{q} = \begin{pmatrix}-2\\x\end{pmatrix}$.

(a) Calculate $\mathbf{p} - \mathbf{q}$ in terms of x. [1]

(b) Find the value of

(i) $|\mathbf{p}|$, the magnitude of vector $\mathbf{p}$. [1]

(ii) x such that $2\mathbf{p} = -3\mathbf{q}$. [2]

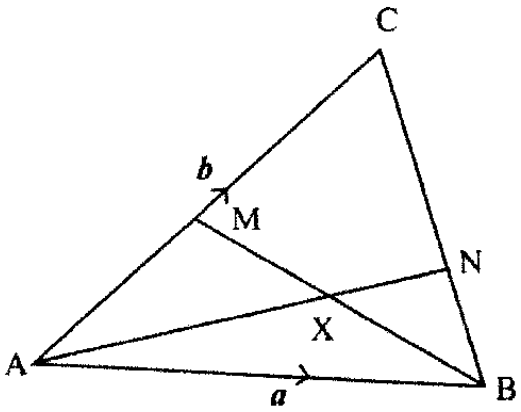
4030/1 J2018 Q17

It is given that vector $p = \begin{pmatrix}0\\-3\end{pmatrix}$ and vector $q = \begin{pmatrix}x\\1\end{pmatrix}$. Find

(a) $p - q$ in terms of x in its simplest form, [1]

(b) the possible values of x given that $|p - q| = 5$. [3]

4004/1 N2018 Q17



In the diagram M is the midpoint of AC. N lies on BC such that BN = $\frac{1}{3}$BC, $\overrightarrow{AB} = \boldsymbol{a}$ and $\overrightarrow{AC} = \boldsymbol{b}$.

Express in terms of $\boldsymbol{a}$ and/or $\boldsymbol{b}$

(i) $\overrightarrow{BC}$ [1]

(ii) $\overrightarrow{BN}$ [1]

(iii) $\overrightarrow{AN}$ [2]

(iv) $\overrightarrow{BM}$ [1]

(b) Given that $\overrightarrow{BX} = h\overrightarrow{BM}$, express $\overrightarrow{AX}$ in terms of $\boldsymbol{a}$, $\boldsymbol{b}$ and h. [2]

(c) Given also that $\overrightarrow{AX} = k\overrightarrow{AN}$, express $\overrightarrow{AX}$ in terms of $\boldsymbol{a}$, $\boldsymbol{b}$ and k. [1]

(d) Using the results of (b) and (c), find the value of h and the value of k. [4]

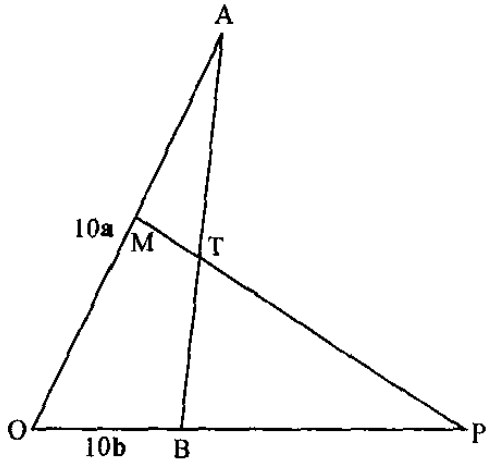
4004/2 N2018 Q9

It is given that O is the origin, $\overrightarrow{\mathrm{OX}} = 2\mathbf{a} + 3\mathbf{b}$ and $\overrightarrow{\mathrm{OY}} = 3\mathbf{a} - 4\mathbf{b}$.

(a) Find $\overrightarrow{\mathrm{XY}}$, [2]

(b) Given also that $\overrightarrow{\mathrm{OX}} = (1-h)\mathbf{a} + k\mathbf{b}$, find the value of h and the value of k. [3]

4030/1 J2017 Q26



In the diagram $\overrightarrow{OA} = 10\boldsymbol{a}$ and $\overrightarrow{OB} = 10\boldsymbol{b}$. M is the mid-point of OA. T is a point on AB such that $\frac{AT}{AB} = \frac{3}{5}$. MTP and OBP are straight lines.

(a) Express, in terms of $\boldsymbol{a}$ and/or $\boldsymbol{b}$,
- (i) $\overrightarrow{AB}$, [1]
- (ii) $\overrightarrow{AT}$, [1]
- (iii) $\overrightarrow{MT}$. [2]

(b) It is given that $\overrightarrow{OP} = k\overrightarrow{OB}$. Express $\overrightarrow{OP}$ in terms of $\boldsymbol{b}$ and k. [1]

(c) It is also given that $\overrightarrow{OP} = \overrightarrow{OM} + h\overrightarrow{MT}$. Show that $\overrightarrow{OP} = (5-h)\boldsymbol{a} + 6h\boldsymbol{b}$. [2]

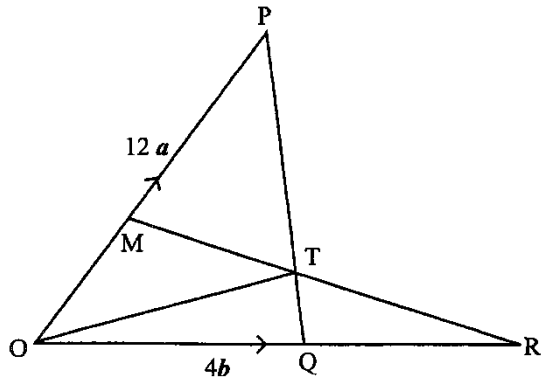
(d) Use the results from (b) and (c) to find the value of h and the value of k. [4]

(e) Hence express $\overrightarrow{OP}$ in terms of $\boldsymbol{b}$. [1]

4030/2 J2017 Q11

If $\mathbf{n} = \begin{pmatrix} -3 \\ 9 \end{pmatrix}$ find $|\mathbf{n}|$, giving the answer in surd form. [2]

4030/1 N2017 Q16(b)



In the diagram, OQR, OMP, PTQ and RTM are straight lines such that OM = $\frac{1}{3}$ OP and PT = $\frac{3}{4}$ PQ.

It is given that $\overrightarrow{OP} = 12\mathbf{a}$ and $\overrightarrow{OQ} = 4\mathbf{b}$.

(a) Express as simply as possible, in terms of $\mathbf{a}$ and/or $\mathbf{b}$
- (i) $\overrightarrow{PQ}$, [1]
- (ii) $\overrightarrow{PT}$, [1]
- (iii) $\overrightarrow{OT}$, [1]
- (iv) $\overrightarrow{MT}$. [2]

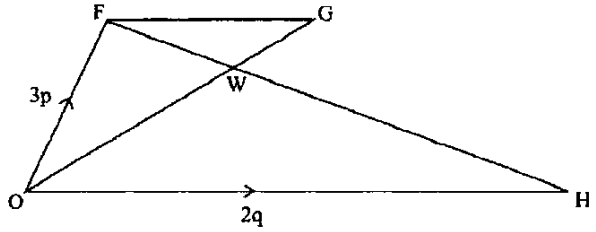
(b) It is given that $\overrightarrow{MR} = h\overrightarrow{MT}$. Express $\overrightarrow{OR}$ in terms of $\mathbf{a}$ and/or $\mathbf{b}$ and a constant h. [2]

(c) (i) It is given that $\overrightarrow{OR} = k\overrightarrow{OQ}$. Express $\overrightarrow{OR}$ in terms of $\mathbf{a}$ and/or $\mathbf{b}$ and a constant k. [1]

(ii) Use the expressions for $\overrightarrow{OR}$ in **(b)** and **(c)(i)** to find the values of h and k. [3]

(d) Write down the numerical value of MT:TR. [1]

4030/2 N2017 Q12



The diagram shows points O, F, G and H such that $\overrightarrow{OF} = 3\boldsymbol{p}$ and $\overrightarrow{OH} = 2\boldsymbol{p}$. FH and OG intersect at W.

(a) Express, in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$, $\overrightarrow{FH}$. [1]

(b) Given that $\overrightarrow{FG} = h\overrightarrow{OH}$, express in terms of $\boldsymbol{p}$, $\boldsymbol{q}$ and h.
- (i) $\overrightarrow{FG}$, [1]
- (ii) $\overrightarrow{OG}$. [1]

(c) Given that $\overrightarrow{FW} = k\overrightarrow{FH}$, express in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$ and k.
- (i) $\overrightarrow{FW}$, [1]
- (ii) $\overrightarrow{OW}$. [2]

(d) Given that OW : OG = 2 : 3, express $\overrightarrow{OW}$ in terms of $\boldsymbol{p}$, $\boldsymbol{q}$ and h. [1]

(e) Use the results of **(c)(ii)** and **(d)** to find the numerical values of h and k. [3]

(f) Hence write down the numerical value of $\frac{FW}{WH}$. [2]

4030/2 J2016 Q7

It is given that $\overrightarrow{OA} = 3\boldsymbol{p} - 2\boldsymbol{q}$ and $\overrightarrow{OB} = \boldsymbol{p} + 7\boldsymbol{q}$.

(a) Find $\overrightarrow{AB}$ in terms of $\boldsymbol{p}$ and $\boldsymbol{q}$. [1]

(b) Given also that $\overrightarrow{AB} = 2m\boldsymbol{p} + (m-n)\boldsymbol{q}$, find the value of m and the value of n. [3]

4030/1 N2016 Q21

Points P$(-3\,;1)$, Q$(3\,;4)$ and R are on a Cartesian plane.

(i) Find $\overrightarrow{PQ}$. [1]

(ii) If $\overrightarrow{PR} = \begin{pmatrix} 2 \\ -6 \end{pmatrix}$, find the coordinates of R. [2]

(iii) Find the equation of the line PQ. [3]

4030/2 N2016 Q3(b)

Given that $\mathbf{a} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$,

(a) express $\mathbf{a} - \mathbf{b}$ as a column vector, [1]

(b) find $|\mathbf{b}|$. [2]

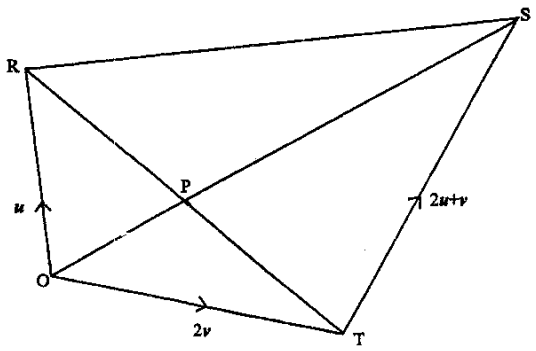
4008/1 J2015 Q6

(a) The point, M, has coordinates $(7\,;-3)$ and $\overrightarrow{RM} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$. Calculate

(i) the coordinates of R,

(ii) $\overrightarrow{MR}$. [3]

(b) The diagram is a quadrilateral ORST in which $\overrightarrow{OR} = \boldsymbol{u}$, $\overrightarrow{OT} = 2\boldsymbol{v}$ and $\overrightarrow{TS} = 2\boldsymbol{u} + \boldsymbol{v}$. Diagonals OS and RT intersect at P.



(i) Express in terms of $\boldsymbol{u}$ and/or $\boldsymbol{v}$.

1. $\overrightarrow{RT}$,
2. $\overrightarrow{OS}$,

(ii) Given that $\overrightarrow{OP} = k\overrightarrow{OS}$, express in terms of k, $\boldsymbol{u}$ and/or $\boldsymbol{v}$

1. $\overrightarrow{OP}$,
2. $\overrightarrow{RP}$ and show that it reduces to $(2k-1)\boldsymbol{u} + 3k\boldsymbol{v}$.

(iii) Given also that $\overrightarrow{RP} = h\overrightarrow{RT}$, express $\overrightarrow{RP}$ in terms of h, $\boldsymbol{u}$ and/or $\boldsymbol{v}$.

(iv) Using the results in **(ii) 2** and **(iii)**, calculate the value of h and the value of k. [9]

4028/2 J2015 Q10

It is given that $\overrightarrow{OP} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$ and $\overrightarrow{OQ} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}$ where O is the origin.

(a) Express $\overrightarrow{PQ}$ as a column vector. [1]

(b) Find

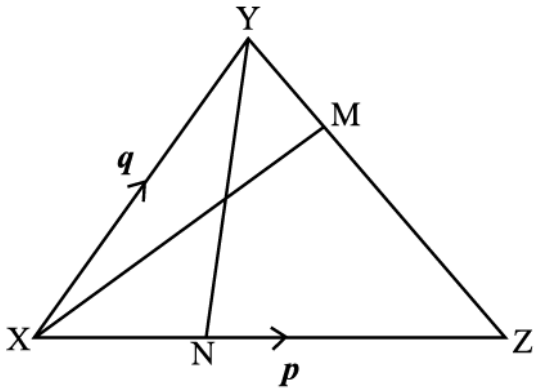
(i) $|\overrightarrow{OQ}|$, [1]

(ii) the co-ordinates of M, the mid-point of PQ. [1]

4028/1 N2015 Q4

(a) If $\boldsymbol{v} = \begin{pmatrix} 8 \\ u \end{pmatrix}$ and $|\boldsymbol{v}|$=17, find the two possible values of u. [2]

(b) In the diagram, $\overrightarrow{XZ} = \boldsymbol{p}$, $\overrightarrow{XY} = \boldsymbol{q}$ and M is a point on YZ such that 3YM = YZ.



(i) 1. Express $\overrightarrow{YZ}$ as simply as possible in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$. [1]

2. Express $\overrightarrow{YM}$ as simply as possible in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$. [1]

3. Express $\overrightarrow{XM}$ as simply as possible in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$. [2]

(ii) Given that N is the point such that $\overrightarrow{XN} = h\overrightarrow{XZ}$, express $\overrightarrow{XN}$ in terms of h and $\boldsymbol{p}$. [1]

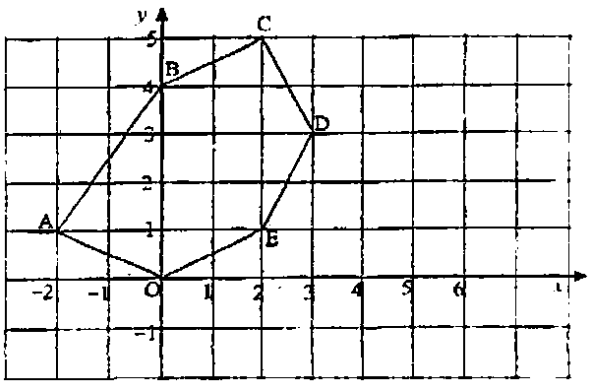
(iii) Given also that $\overrightarrow{XM} = h\boldsymbol{p} + k\boldsymbol{q}$, use the two expressions for $\overrightarrow{XM}$ to find the value of h and the value of k. [3]

(iv) 1. Write down the numerical value of $\frac{XN}{NZ}$. [1]

2. Write the ratio of the area of ΔXYN : area of ΔXYZ in its simplest form. [1]

4028/2 N2015 Q9

In the diagram, OABCDE is a hexagon.



(a) Express as column vectors

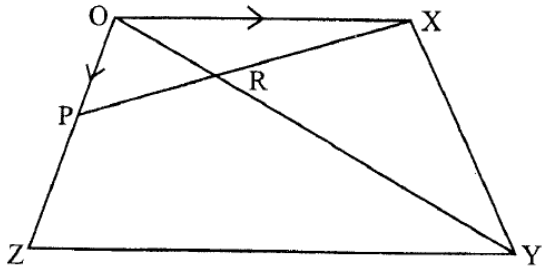
(i) $\overrightarrow{OE}$, [1]

(ii) $\overrightarrow{OA} + \overrightarrow{AD}$, [1]

(b) Describe **fully** the **single** transformation which maps side BC onto side OE. [2]

4008/1 J2014 Q19

In the diagram, OXYZ is a quadrilateral in which P is a point on OZ such that $\overrightarrow{OP} = \begin{pmatrix}-1\\-2\end{pmatrix}$ and $\overrightarrow{OX} = \begin{pmatrix}5\\0\end{pmatrix}$. OY and XP intersect at R.



(a) Find $\overrightarrow{XP}$. [2]

(b) Given that $\overrightarrow{XR} = h\overrightarrow{XP}$,

(i) express $\overrightarrow{XR}$ in terms of h,

(ii) show that $\overrightarrow{OR} = \begin{pmatrix}5-6h\\-2h\end{pmatrix}$. [3]

(c) Given also that $\overrightarrow{OZ} = 3\overrightarrow{OP}$ and $\overrightarrow{ZY} = 2\overrightarrow{OX}$, find $\overrightarrow{OY}$. [1]

(d) If $\overrightarrow{OR} = k\overrightarrow{OY}$

(i) express $\overrightarrow{OR}$ in terms of k,

(ii) use the results of **(b)(ii)** and **(d)(i)** to find the value of h and the value of k. [5]

(e) Write down the numerical value of the ratio $\frac{XR}{RP}$. [1]

4028/2 J2014 Q11

The co-ordinates of A, B and C are $(4\,;2)$, $(0\,;-2)$ and $(-3\,;2)$ respectively.

(a) Express as column vectors

(i) $\overrightarrow{OA}$, [1]

(ii) $-2\overrightarrow{BC}$. [2]

(b) Calculate $\left|\overrightarrow{BC}\right|$. [2]

4008/1 N2014 Q18

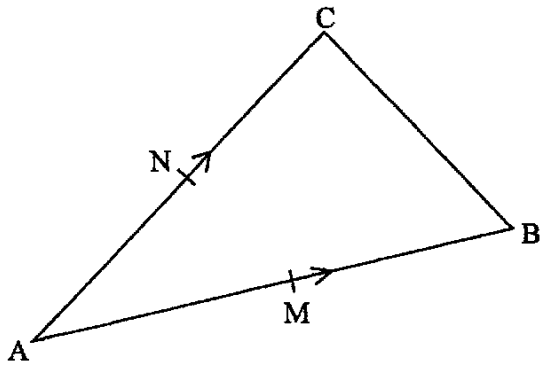
$\overrightarrow{AB} = \begin{pmatrix}14\\6\end{pmatrix}$ and $\overrightarrow{AC} = \begin{pmatrix}12\\8\end{pmatrix}$. M and N are mid-points of AB and AC respectively.

(a) Find

(i) $\overrightarrow{MN}$, [2]

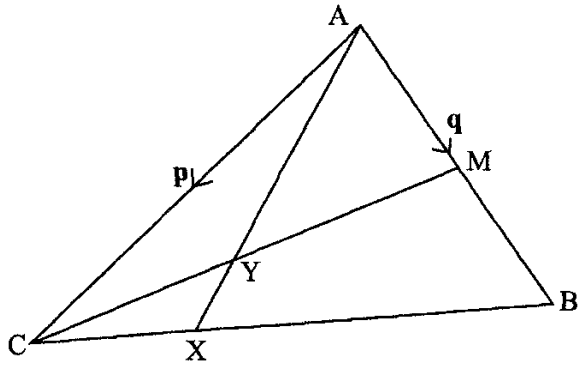
(ii) $\overrightarrow{BC}$. [1]

(b) Explain why MN is parallel to BC. [1]



4008/1R N2014 Q14

In the diagram, ABC is a triangle in which $\overrightarrow{AB} = \mathbf{q}$ and $\overrightarrow{AC} = \mathbf{p}$. M is the midpoint of AB and X is a point on BC such that BX : XC = 4 : 1. CM and AX intersect at Y.



(a) Express, in terms of **p** and/or **q**

(i) $\overrightarrow{BC}$,

(ii) $\overrightarrow{CX}$,

(iii) $\overrightarrow{CM}$,

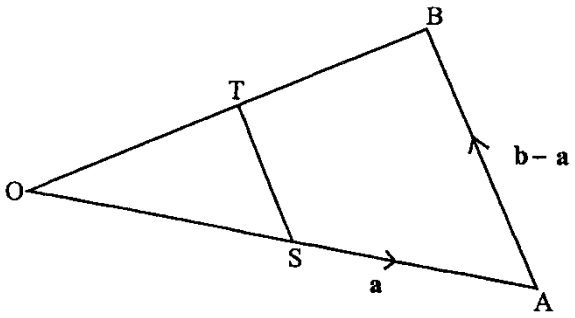
(iv) $\overrightarrow{AX}$. [5]

(b) Given that CY = kCM, express $\overrightarrow{CY}$ in terms of **p**, **q** and k. [1]

(c) Given also that AY = hAX, express $\overrightarrow{CY}$ in terms of **p**, **q** and h. [2]

(d) Using the results of **(b)** and **(c)**, find the value of h and the value of k. Hence express $\overrightarrow{AY}$ in terms of **p** and **q**. [4]

4008/2 N2014 Q12



In the diagram, BT and AS produced meet at O.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ and $\frac{OS}{OA} = \frac{1}{4}$.

(i) Express

1. $\overrightarrow{OB}$ in terms of **a** and/or **b** in its simplest form,
2. $\overrightarrow{OS}$ in terms of **a** and/or **b** in its simplest form.

(ii) It is also given that $\overrightarrow{ST} = k\overrightarrow{AB}$

1. Express $\overrightarrow{OT}$ in terms of **a**, **b** and k in its simplest form,
2. Given that $\overrightarrow{OT} = h\overrightarrow{OB}$, use the results in **(b)(ii)1** to find the numerical value of k.

(iii) Hence, express $\overrightarrow{ST}$ in terms of **a** and **b**.[6]

4008/2R N2014 Q7(b)

Given that $h\begin{pmatrix}3\\5\end{pmatrix} + k\begin{pmatrix}2\\-1\end{pmatrix} = \begin{pmatrix}14\\6\end{pmatrix}$, find the scalars h and k. [4]

4028/1 J2013 Q14

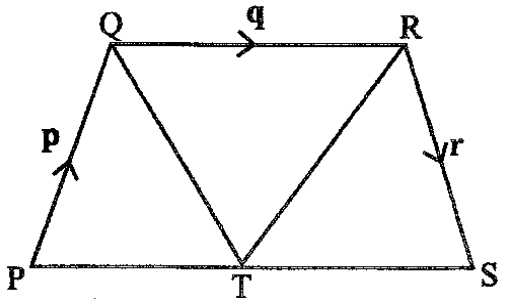
It is given that $\mathbf{a} = \begin{pmatrix}3\\3\end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix}-1\\2\end{pmatrix}$.

Find (i) $\mathbf{a} + \mathbf{b}$,

(ii) $\mathbf{a} - 3\mathbf{b}$,

(iii) $|\mathbf{a} - 3\mathbf{b}|$. [5]

4028/2 J2013 Q3(b)



In the diagram, $\overrightarrow{PQ} = \mathbf{p}$, $\overrightarrow{QR} = \mathbf{q}$ and $\overrightarrow{RS} = \mathbf{r}$.

Express

(i) $\overrightarrow{PS}$ in terms of

1. **p**, **q** and **r**, [1]

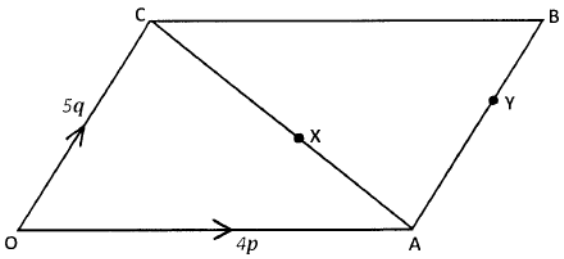
2. **q** only. [2]

(ii) **p** in terms of **q** and **r**. [2]

4008/1 N2013 Q23

(a) If $\mathbf{g} = \begin{pmatrix}-5\\2\end{pmatrix}$ and $\mathbf{h} = \begin{pmatrix}3\\4\end{pmatrix}$, express $\mathbf{g} + 2\mathbf{h}$ in the form $\begin{pmatrix}x\\y\end{pmatrix}$. [2]

(b) In the diagram, OABC is a parallelogram in which $\overrightarrow{OA} = 4\mathbf{p}$ and $\overrightarrow{OC} = 5\mathbf{q}$. X is a point on AC such that AX : XC = 2 : 3.



(i) Express, in terms of **p** and/or **q**

1. $\overrightarrow{AC}$,
2. $\overrightarrow{OX}$ in its simplest terms.

(ii) Y is a point on AB such that $\frac{AY}{AB} = k$, where k is a constant. Express $\overrightarrow{OY}$ in terms of **p**, **q** and k.

(iii) Given that $\overrightarrow{OY} = h\overrightarrow{OX}$, where h is a constant, write down another expression for $\overrightarrow{OY}$ in terms of **p**, **q** and h.

(iv) Using results in **(ii)** and **(iii)**, find the value of h and the value of k.

(v) Express $\frac{\text{the area of } \Delta OAY}{\text{the area of parallelogram OABC}}$, as a fraction in its simplest form. [10]

4008/2 N2013 Q8

A is the point $(0\ ;\ 6)$ and B is the point $(4\ ;\ 2)$.

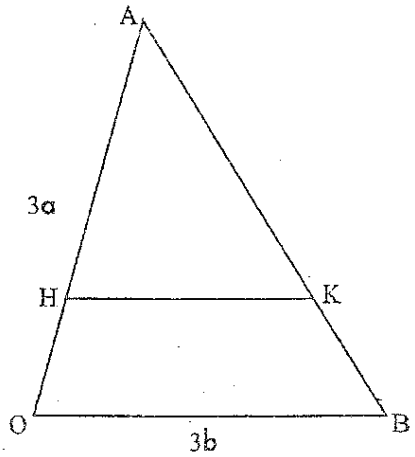
Find

(a) $\overrightarrow{AB}$ in column form, [1]

(b) the gradient of the line AB, [1]

(c) the equation of the line AB. [1]

4008/1 J2012 Q6



In the diagram, OAB is a triangle in which H and K are points on OA and BA respectively such that the ratio OH : HA = 1 : 2 and the ratio BK : KA = 1 : 2, $\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$.

Express in terms of **a** and/or **b**.

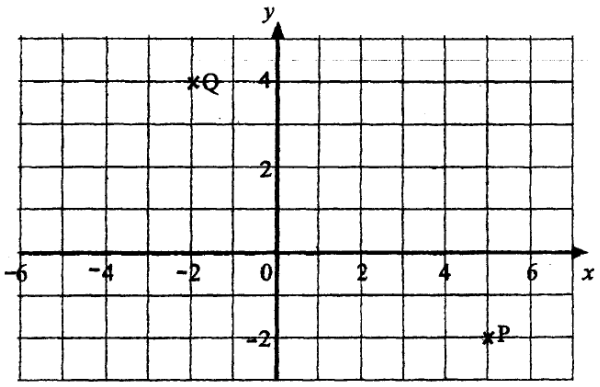
(i) 1. $\overrightarrow{OH}$,

2. $\overrightarrow{BA}$,

3. $\overrightarrow{BK}$,
4. $\overrightarrow{KA}$,
5. $\overrightarrow{HK}$.

(ii) Write down the ratio $\frac{HK}{OB}$. [7]

4008/2 J2012 Q9(b)



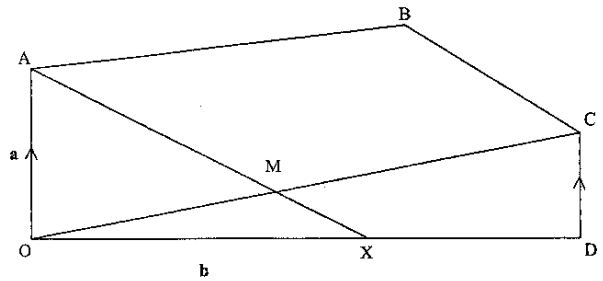
The points P and Q are shown on the grid.

(a) (i) Write down the co-ordinates of P. [1]

(ii) Write $\overrightarrow{PQ}$ as a column vector. [1]

(b) Given $\overrightarrow{QM} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$, draw $\overrightarrow{QM}$ on the grid. [1]

4008/1 N2012 Q3



OABCD is a pentagon such that AB is parallel to OD and DC is parallel to OA. M is the mid-point of OC such that AM produced cuts OD at X.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OD} = \mathbf{b}$ and $\overrightarrow{OD} = 3\overrightarrow{XD}$.

(a) Express the following in terms of **a** and/or **b**,

(i) $\overrightarrow{AD}$,

(ii) $\overrightarrow{OX}$,

(iii) $\overrightarrow{AX}$. [3]

(b) If $\overrightarrow{MX} = k\overrightarrow{AX}$, express $\overrightarrow{MX}$ in terms of **a**, **b** and k. [1]

(c) Given that $\overrightarrow{DC} = h\overrightarrow{OA}$, express in terms of **a**, **b** and h,

(i) $\overrightarrow{OM}$,

(ii) $\overrightarrow{MX}$. [3]

(d) Using your results in **(b)** and **(c)(ii)**, find the value of h and the value of k. [3]

(e) Using your values of h and k, in **(d)**, express in terms of **a** and/or **b**,

(i) $\overrightarrow{MX}$,

(ii) $\overrightarrow{DC}$. [2]

4008/2 N2012 Q10

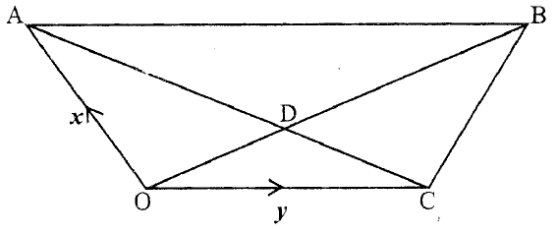
It is given that $\mathbf{p} = \begin{pmatrix} 6 \\ -8 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} m \\ n \end{pmatrix}$.

(a) Express $\mathbf{p} - 3\mathbf{q}$ as a column vector. [1]

(b) Given that $\mathbf{p} + \mathbf{q} = 3\mathbf{r}$, find the value of m and the value of n. [2]

4008/4028/1 J2011 Q15

The diagram shows a trapezium OABC where OC is parallel to AB, with $\overrightarrow{OA} = \boldsymbol{x}$ and $\overrightarrow{OC} = \boldsymbol{y}$. Diagonals OB and AC intersect at D such that AD : DC = 3 : 2.



Express, in terms of $\boldsymbol{x}$ and/or $\boldsymbol{y}$,

(i) (a) $\overrightarrow{AC}$,

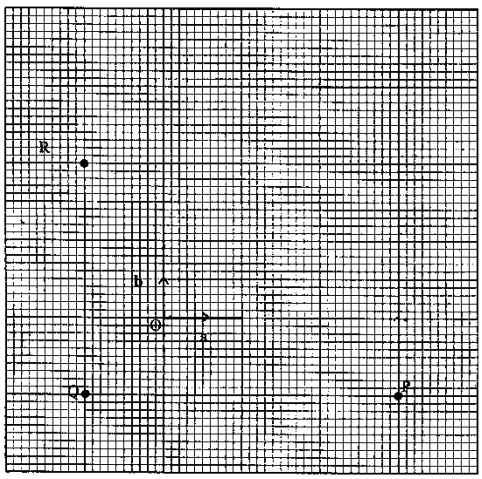
(b) $\overrightarrow{AD}$.

(ii) Given that $\overrightarrow{AB} = k\overrightarrow{OC}$, express $\overrightarrow{OB}$ in terms of k, $\boldsymbol{x}$ and $\boldsymbol{y}$.

(iii) Given also that $\overrightarrow{OB} = h\overrightarrow{OD}$, express $\overrightarrow{OB}$ in terms of h, $\boldsymbol{x}$ and $\boldsymbol{y}$.

(iv) Using results from **(ii)** and **(iii)** above, find the numerical value of h and the numerical value of k. [7]

4008/2 J2011 Q7(b)



In the diagram, O is the origin.

Vectors **a** and **b** are shown in the diagram.

(a) Write down, in terms of **a** and/or **b**.

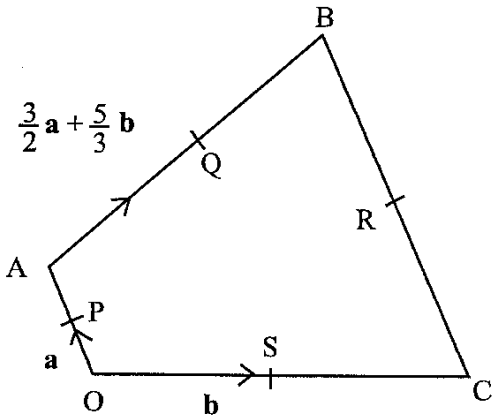
(i) the position vector of the point P. [1]

(ii) $\overrightarrow{PR}$, [1]

(iii) $\overrightarrow{PR} - \overrightarrow{QR}$. [2]

(b) If $|\mathbf{b}| = 4$, write down the value of $|\overrightarrow{QR}|$. [1]

4008/1 N2011 Q21



In the diagram, OABC is a quadrilateral and P, Q, R, and S are the midpoints of OA, AB, BC, and OC respectively. $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{b}$ and $\overrightarrow{AB} = \frac{3}{2}\mathbf{a} + \frac{5}{3}\mathbf{b}$.

Find in terms of **a** and/or **b**

(i) $\overrightarrow{PS}$,

(ii) $\overrightarrow{PQ}$,

(iii) $\overrightarrow{BC}$,

(iv) $\overrightarrow{SR}$.

(v) Using the information in **(ii)** and **(iv)** above or otherwise, state the special name given to quadrilateral PQRS. [8]

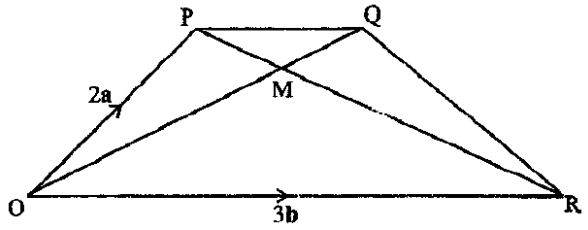
4008/2 N2011 Q11(a)

It is given that $\mathbf{p} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 6 \\ x \end{pmatrix}$. Find

(a) x if **p** is parallel to **q**, [1]

(b) $|\mathbf{p}|$, leaving your answer in surd from. [2]

4008/4028/1 J2010 Q13



In the diagram, PQ is parallel to OR, $PM = \frac{1}{3}PR$, $\overrightarrow{OP} = 2\mathbf{a}$ and $\overrightarrow{OR} = 3\mathbf{b}$.

(a) Express in terms of **a** and/or **b**

(i) $\overrightarrow{PR}$,

(ii) $\overrightarrow{PM}$,

(iii) $\overrightarrow{OM}$. [4]

(b) (i) Given that PQ $= h$OR, write down in terms of h, **a** and /or **b** an expression for

(a) $\overrightarrow{PQ}$,

(b) $\overrightarrow{OQ}$.

(ii) Given also that OQ $= k$OM, write down another expression for $\overrightarrow{OQ}$ in terms of **a**, **b** and k. [3]

(c) Using the two expressions for $\overrightarrow{OQ}$, form an equation and use it to find the value of k and the value of h. [3]

(d) Write down $\overrightarrow{OQ}$ in terms of **a** and **b** only. [1]

(e) Find the ratio $\frac{\text{area of } \Delta OPQ}{\text{area of trapezium OPQR}}$. [1]

4028/2 J2010 Q7

Given that $\overrightarrow{AB} = \begin{pmatrix} 10 \\ -4 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} 2 \\ -8 \end{pmatrix}$,

(a) write down $\overrightarrow{AC}$ as a column vector, [1]

(b) find $|\overrightarrow{BC}|$ leaving your answer in surd form. [2]

4008/4028/1 N2010 Q6