ZIMSEC

ORDINARY LEVEL MATHEMATICS

PAST EXAM PAPERS (2018-2019)

Individual Tuition Centre

Foreword

The **Individual Tuition Centre** was established in 2011 with the sole aim of offering tailor made tutorials for Primary and Secondary students. We have grown to become a force to reckon with in Individual Tutoring and Book Sales.

Tutorials are offered as remedial lessons, crash programs or full time (secondary only).

Due to our quest to continue to improve the academic performance of students, we source, compile and print past exam papers and answer booklets (Primary, Secondary, Cambridge and Zimsec).

While every effort is made to ensure the accuracy and reliability of the suggested answers, the **Individual Tuition Centre** cannot be held liable for any errors that may inadvertently occur. Experienced teachers and examiners contribute in the production of these documents.

We value your feedback. If you have suggestions on how we can improve our services, do not hesitate to contact us.

Salanny Mhlanga --- Principal

Prepared at:

Individual Tuition Centre

Primary, Secondary & Professional tutors

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Suppliers of Past Paper Booklets:

ZIMSEC Grade 7 all subjects

***CHISZ** Entrance tests*

CAMBRIDGE Primary Checkpoint

CAMBRIDGE Form 2 Checkpoint

CAMBRIDGE IGCSE, AS & A' Level

ZIMSEC O' & A' Level

Why students fail Maths

This is a very important question I will briefly address here. The sad reality is that most students who perceive Maths as a difficult subject do not do anything about it. Why bother when "everyone" knows that the subject is difficult? This is counterintuitive! I would expect that students invest more time in the subject.

The **greatest** impediment to mathematical competency is your **attitude** towards the subject. After a few counselling sessions, most students who previously performed poorly in Maths admit that they had a negative attitude towards the subject and consequently did not like the subject. Some did not even attend Maths classes.

1. Never listen to the opinions of people who have previously failed to do well in the subject.

2. **Study** to **understand** and **enjoy** the subject. Do not always do Maths with exams in mind. Remember we **need** Maths in our day to day lives.

3. Do not browse through Maths concepts as if you are reading a newspaper**!** Take your time to grasp the important concepts so that you will be able to apply them in the exam.

4. Do not worry about the New Curriculum, nothing much was changed from the "Old" Curriculum.

5. Develop a strategy for doing well in the subject:

i) **Thoroughly understand** your **directed numbers**. This is arguably the **most important topic** in Maths**!** Knowledge of how to manipulate signs is a must. Students lose a lot of marks here.

ii) **Work without a calculator** and **use it only when necessary**. This is how you improve your algebraic skills such as factorisation, removing brackets and dealing with algebraic fractions.

iii) Understand compulsory topics such as **Locus**, Algebra, Matrices, Sets and General Mathematics.

iv) Choose your Paper 2 Section B questions wisely. Good topics to study and choose from are Triangles and trigonometry, Mensuration of Shapes, Probability and Statistics, Graphs, Quadratics and Linear Programming.

v) Learn to **work with others** and **ask questions** when unsure of anything.

I wish you well in your studies. If you can do well in other subjects, you can also do well in Maths.

Hard work and a **positive attitude** sum it all up**!**

Salanny Mhlanga BSc. (Hons), UZ

Principal (Formerly Head of Mathematics and Natural Sciences)

Individual Tuition Centre

02 April 2020

ZIMSEC

ORDINARY LEVEL MATHEMATICS

About this book

This book was compiled by Salanny Mhlanga, the Director of Studies at Individual Tuition Centre. The book covers Zimsec past exam papers for June and November 2018 – 2019.

All the concepts in these papers are relevant to the New Curriculum. All answers in this booklet were prepared by Salanny himself, a veteran tutor with more than a decade of experience in teaching Mathematics and Physics up to Advanced Level. The answers, therefore, are not in any way linked to Zimsec, it's solely a personal effort. His hope is that many students will develop a positive mindset towards the subject and consequently perform better.

Individual Tuition Centre 01 JUNE 2020

ZIMSEC

ORDINARY LEVEL MATHEMATICS

SECTION A: PAST EXAM PAPERS

Individual Tuition Centre

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Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4030/1

PAPER 1

JUNE 2018 SESSION 2 hours 30 minutes

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.

Answer *all* questions.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Write your answers in the spaces provided on the question paper using **black** or **blue** pens.

If working is needed for any question it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise. Answers in degrees should be given correct to one decimal place unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

This question paper consists of 28 printed pages.

[Turn over

Centre Number	Candidate Number

NEITHER MATHEMATICAL TABLES NOR SLIDE RULES NOR CALCULATORS MAY BE USED IN THIS PAPER

1 (a) Express 3598

(i) as a number in standard form,

(ii) correct to 2 significant figures.

(b) Find the approximate value of $\sqrt{3598}$.

Answer: *(a)* *(i)* _____ [1]

(ii) _____ [1]

(b) _____ [1]

2 **(a)** Find the exact value of

(i) $7{,}03 - 2{,}145$,

(ii) $4{,}32 \times 0{,}11$.

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

Answer *(a)* *(i)* _____ [1]

(ii) _____ [1]

(b) _____ [1]

Centre Number	Candidate Number

3 **(a)** Express the time 00 25 in 12 hour notation.

(b) A goods train left Johannesburg at 20 30 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.

(ii) Find the time at which the train arrived at Beitbridge.

Answer *(a)* _____ [1]

(b) *(i)* _____ [1]

(ii) _____ [1]

Centre Number	Candidate Number

4 Evaluate

(a) $\sqrt[3]{0{,}027}$,

(b) $\left(1\frac{7}{9}\right)^{\frac{1}{2}}$,

(c) $3^0 \times 3^{-2}$.

Answer *(a)* _____ [1]

(b) _____ [1]

(c) _____ [1]

Centre Number	Candidate Number

5 (a) State the number of lines of symmetry of a regular nonagon.

(b) The sum of interior angles of a regular polygon is $3\,960^0$.

Find the number of sides of the regular polygon.

Answer *(a)* _____ [1]

(b) _____ [2]

Centre Number	Candidate Number

6 **(a)** Simplify $1044_8 - 175_8$, giving the answer in base 8.

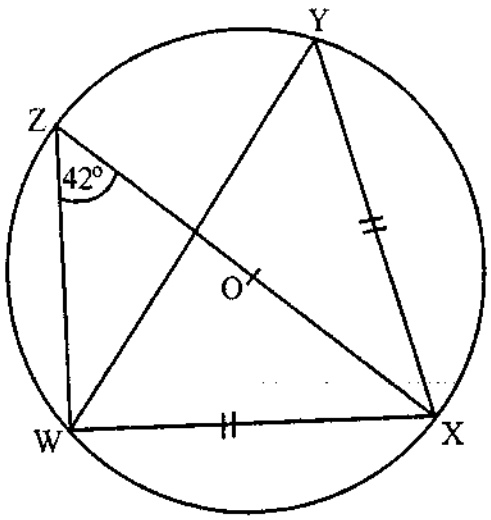
(b) Convert 10111_2 to a number in base 6.

Answer *(a)* _____ [1]

(b) _____ [2]

Centre Number	Candidate Number

7



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

(a) $W\hat{Y}X$,

(b) $Y\hat{W}Z$,

(c) $W\hat{X}Y$.

Answer *(a)* _____ [1]

(b) _____ [1]

(c) _____ [1]

Centre Number	Candidate Number

8 Solve the equations:

(a) $\frac{1}{3}x - 1 = 7$

(b) $4^{2n-3} = 8$

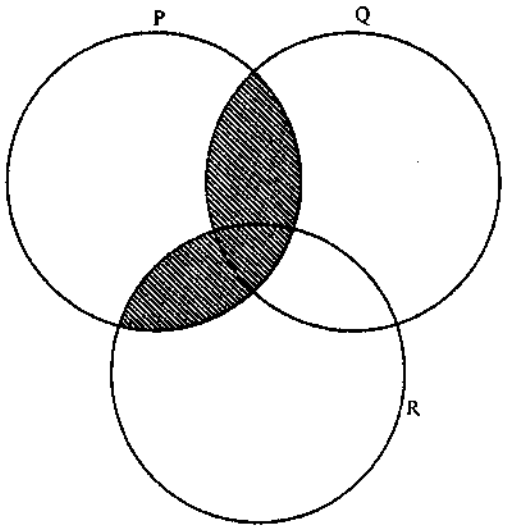
Answer *(a)* $x =$ _____ [1]

(b) $n =$ _____ [2]

Centre Number	Candidate Number

9 **(a)** Three sets A, B and C are such that $A \sqsubset B$ and $C \sqsubset A$. In the answer space, draw the Venn diagram to show the relationship between sets A, B and C.

(b)



In the diagram, three sets P, Q and R are intersecting. Use set notation to describe the shaded region.

Answer *(a)* [2]

(b) _____ [1]

Centre Number	Candidate Number

10 It is given that y varies directly as the square of $(x - 3)$.

(a) Express y in terms of x and a constant k.

(b) Given that $y = 16$ when $x = 1$, find y when $x = 10$.

Answer *(a)* _____ [1]

(b) _____ [2]

Centre Number	Candidate Number

11 Solve the simultaneous equations:

$$x + y = 5\frac{1}{2}$$

$$x - 2y = 2\frac{1}{2}$$

Answer x = _____

y = _____ [3]

Centre Number	Candidate Number

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

(a) Find the gradient of the straight line.

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

Answer *(a)* _____ [1]

(b) _____(_____;_____)_____[2]

13 Simplify

$$\frac{3x^2}{x^2 - 5x} \div \frac{x}{x^2 - 25}.$$

Answer _____ [3]

Centre Number	Candidate Number

14 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°.

(b) Make C the subject of the formula.

Answer *(a)* F = _____ [1]

(b) C = _____ [2]

Centre Number	Candidate Number

15 (a) Expand and simplify,

$$-3(x-7)+5(2-4x).$$

(b) 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.

Answer *(a)* _____ [2]

(b) _____ [2]

Centre Number	Candidate Number

16 **(a)** Factorise completely

(i) $x^3 - x$,

(ii) $x^2 + 2x + 1$.

(b) Hence or otherwise find the Highest Common Factor (HCF) of $x^3 - x$ and $x^2 + 2x + 1$.

Answer *(a)* *(i)* _____ [2]

(ii) _____ [1]

(b) _____ [1]

Centre Number	Candidate Number

17 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.

(b) Find the value of

(i) $|\mathbf{p}|$, the magnitude of vector $\mathbf{p}$.

(ii) x such that $2\mathbf{p} = -3\mathbf{q}$.

Answer *(a)* $\mathbf{p} - \mathbf{q} =$ _____ [1]

(b) *(i)* $|\mathbf{p}|$ _____ [1]

(ii) $x =$ _____ [2]

Centre Number	Candidate Number

18 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.

(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.

Answer *(a)* _____ [1]

(b) _____ [3]

Centre Number	Candidate Number

19 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.

(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.

Answer *(a)* _____ [2]

(b) _____ [2]

20 **(a)** **(i)** Solve the inequality

$2(x-3) < 7.$

(ii) Write down the largest perfect square that satisfies the inequality $2(x-3) < 7$.

(b) 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.

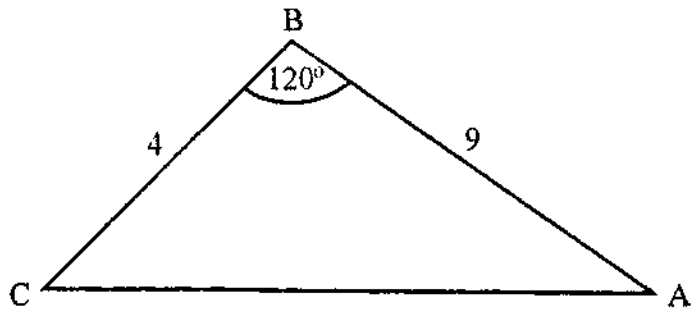
Answer *(a)* *(i)* _____ [2]

(ii) _____ [1]

(b) _____ [2]

Centre Number	Candidate Number

21



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,

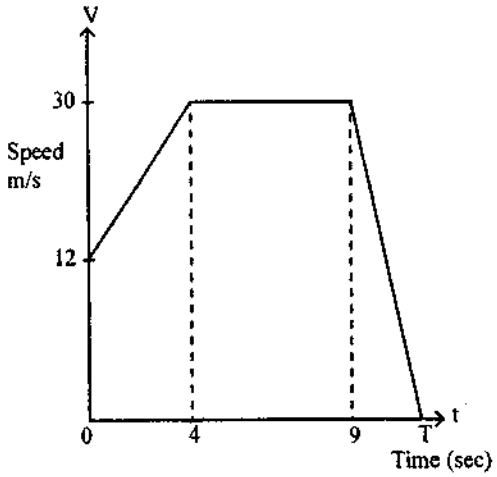
(b) length of AC leaving the answer in surd form.

Answer *(a)* _____ cm^2 [2]

(b) _____ cm [3]

Centre Number	Candidate Number

22



The diagram is the 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 $t = 4$,

(b) distance travelled from $t = 0$ to $t = 9$,

(c) value of T, the total time taken for the whole journey.

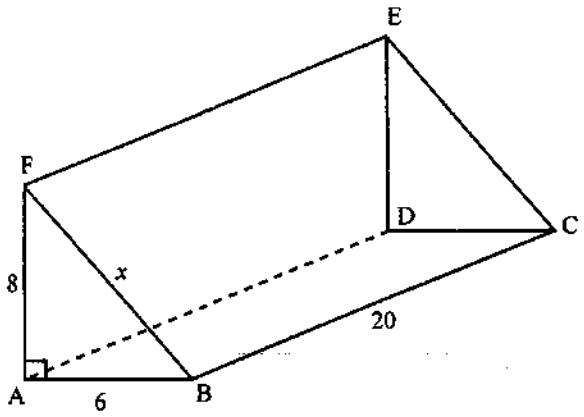
Answer *(a)* _____ [1]

(b) _____ [2]

(c) _____ [2]

Centre Number	Candidate Number

23



In the diagram, ABCDEF is a solid triangular prism. AB = 6 cm, BC = 20 cm, AF = 8 cm, FB = x cm and $\widehat{BAF} = 90°$.

(a) Find x.

(b) Calculate the total surface area of the prism.

Answer *(a)* _____ [2]

(b) _____ [3]

Centre Number	Candidate Number

24 **(a)** Evaluate

(i) $\log_3 45 - \log_3 5$,

(ii) $\frac{\log\ 0{,}2}{\log\ 5}$.

(b) Express as a logarithm of a single number,

$3 \log 2 + \frac{1}{2} \log\ 81$.

Answer *(a)* *(i)* _____ [2]

(ii) _____ [2]

(b) _____ [2]

Centre Number	Candidate Number

25 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,

(ii) q,

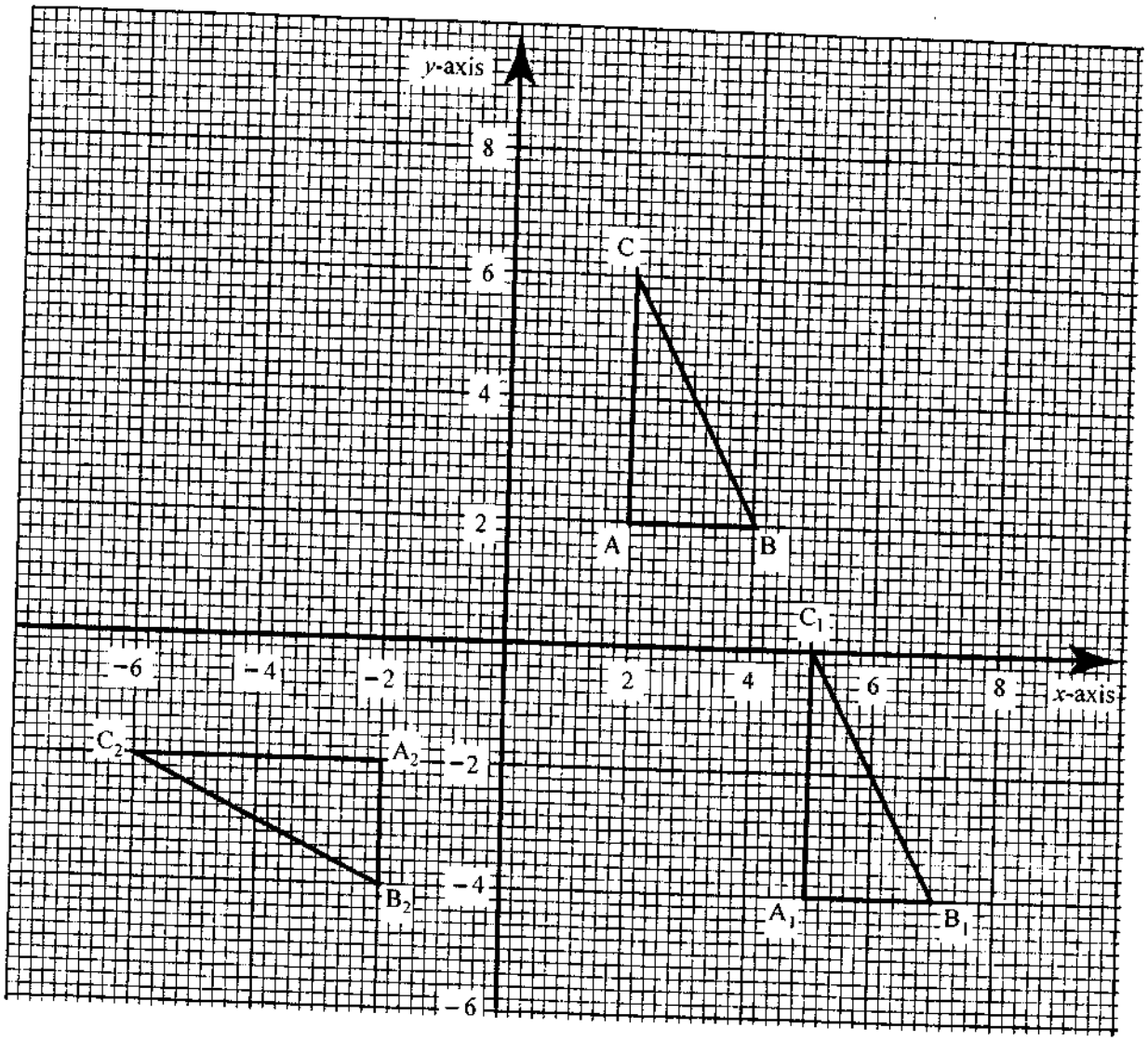
(iii) r.

Answer *(i)* _____ [2]

(ii) _____ [2]

(iii) _____ [2]

26



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.

Answer (a) _____

_____

_____ [3]

Centre Number	Candidate Number

26 **(b)** Triangle ABC is mapped onto triangle $A_2B_2C_2$ by a reflection.

Find the

(i) equation of the axis of reflection,

(ii) matrix that represents this reflection.

(b) *(i)* _____ [1]

(ii) _____ [2]

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4030/2

PAPER 2

JUNE 2018 SESSION 2 hours 30 minutes

Candidates answer on the question paper.
Additional materials: Geometrical instruments
Mathematical tables/ Electronic calculator

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.
Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Answer *all* questions in Section A and any *three* from Section B.
Write your answers in the spaces provided on the question paper using **black** or **blue** pens.
If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise. Answers in degrees should be given correct to one decimal place.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Mathematical tables or Electronic calculators may be used to evaluate explicit numerical expressions.

This question paper consists of 26 printed pages and 2 blank pages.

[Turn over

Centre Number	Candidate Number

Section A [64 marks]

Answer *all* the questions in this section.

1 **(a)** Simplify $0,8 + 7,2 \div 0,24$.

Answer: *(a)* _____ [2]

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

Calculate the cost price.

Answer: *(b)* _____ [2]

Centre Number	Candidate Number

1 **(c)** It is given that $f(k) = 2k^2 - 8$.

Calculate

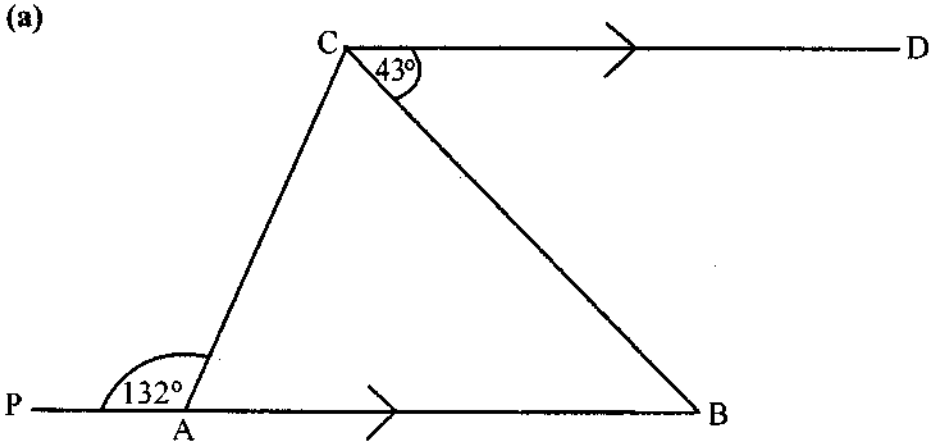
(i) $f(-3)$,

(ii) the values of k for which $f(k) = 0$.

Answer: *(i)* _____ [2]

(ii) _____ or _____ [2]

2 **(a)**



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 $A\hat{C}B$.

Answer: *(a)* _____ [2]

Centre Number	Candidate Number

2 **(b)** Factorise completely

(i) $4a^2b - 20ab^2$,

(ii) $3a^2 + 7a - 6$.

Answer: *(i)* _____ [1]

(ii) _____ [2]

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

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

(ii) Make f the subject of the formula.

Answer: *(i)* _____ [2]

(ii) _____ [3]

3 **(a)** 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.

Answer: *(a)* *apples* \$ _____

bananas \$ _____ [4]

(b) 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.

(ii) Find W when $x = 8$ and $u = 4$.

Answer: *(i)* _____ [2]

(ii) _____ [1]

3 (c) Matrix $\mathbf{A} = \begin{pmatrix} 4 & 2 \\ 3 & 1 \end{pmatrix}$ and matrix $\mathbf{B} = \begin{pmatrix} 2 & 0 \\ 1 & -3 \end{pmatrix}$.

Calculate

(i) $\mathbf{A} - 2\mathbf{B}$,

(ii) $\mathbf{AB}$,

(iii) $\mathbf{A}^{-1}$, the inverse of matrix **A**.

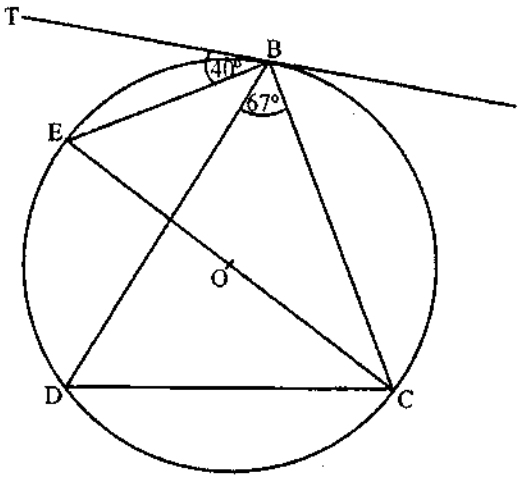
Answer: *(i)* _____ [2]

(ii) _____ [2]

(iii) _____ [2]

Centre Number	Candidate Number

4 **(a)**



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) $E\hat{B}D$,

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

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

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

Answer *(a)* *(i)* _____ [1]

(ii) _____ [1]

(iii) _____ [1]

(iv) _____ [1]

4 **(b)** 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

$\mathbf{A} = \{x: -2 \leq x < 2\}$ and

$\mathbf{B} = \{x: -1 \leq x \leq 3\}$.

(i) List the elements of 1. **A**,

2. $\mathbf{A}' \cup \mathbf{B}'$. where A'is the complement of set **A**.

(ii) Find $n(\mathbf{A} \cap \mathbf{B})$.

Answer (b) *(i)* 1. _____ [2]

2. _____ [2]

(ii) _____ [1]

4 (c) 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.

(ii) State the name of the polygon.

Answer: *(i)* _____ [2]

(ii) _____ [1]

Centre Number	Candidate Number

5 **(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.

Answer: *(a)* _____ [4]

Centre Number	Candidate Number

5 **(b)** Three men working at the same rate can dig a trench, 5m long, in 4 hours.

Calculate the time that two men working at the same rate would take to dig a similar trench, 5m long.

Answer: *(b)* _____ [2]

(c) Find the value of n given that

$$111_n = 7_{10}.$$

Answer: *(c)* _____ [3]

Centre Number	Candidate Number

6 **Answer the whole of this question on page 13.**

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

All constructions should be done on a single diagram. Line PQ has been drawn on page 13.

(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]

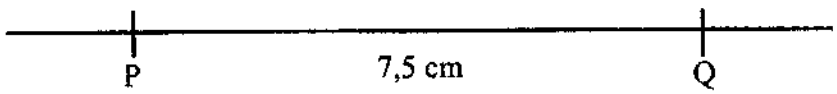
(ii) Mark and label the points X and Y on the circle which are equidistant from Q and R. [2]

(iii) Write down the special name given to quadrilateral PRYQ. [1]

DO NOT WRITE IN THIS SPACE

Centre Number	Candidate Number

6 Answer the whole of question 6 on this page.



Answer *(a)* *(i)* On the diagram [4]

(ii) On the diagram [2]

(iii) On the diagram [1]

(b) *(i)* 1. _____ [1]

2. _____ [1]

(ii) on the diagram [2]

(iii) _____ [1]

Centre Number	Candidate Number

SECTION B [36 marks]

Answer any *three* questions in this section.

Each question carries 12 marks.

7 **(a)** 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,

(ii) total internal curved surface area of the container.

$$\textbf{\textit{Take}}\ \pi = \frac{22}{7}$$

Answer *(i)* _____ [3]

(ii) _____ [3]

Centre Number	Candidate Number

7 **(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.

(ii) $x =$ _____ or _____ [4]

8 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		m	5,5	7	7,5	7	n	3	−0,5

(a) Calculate the value of

(i) m,

(ii) n.

Answer (i) $m =$ _____ [1]

(ii) $n =$ _____ [1]

Answer this part of the question on the grid on page 17.

(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

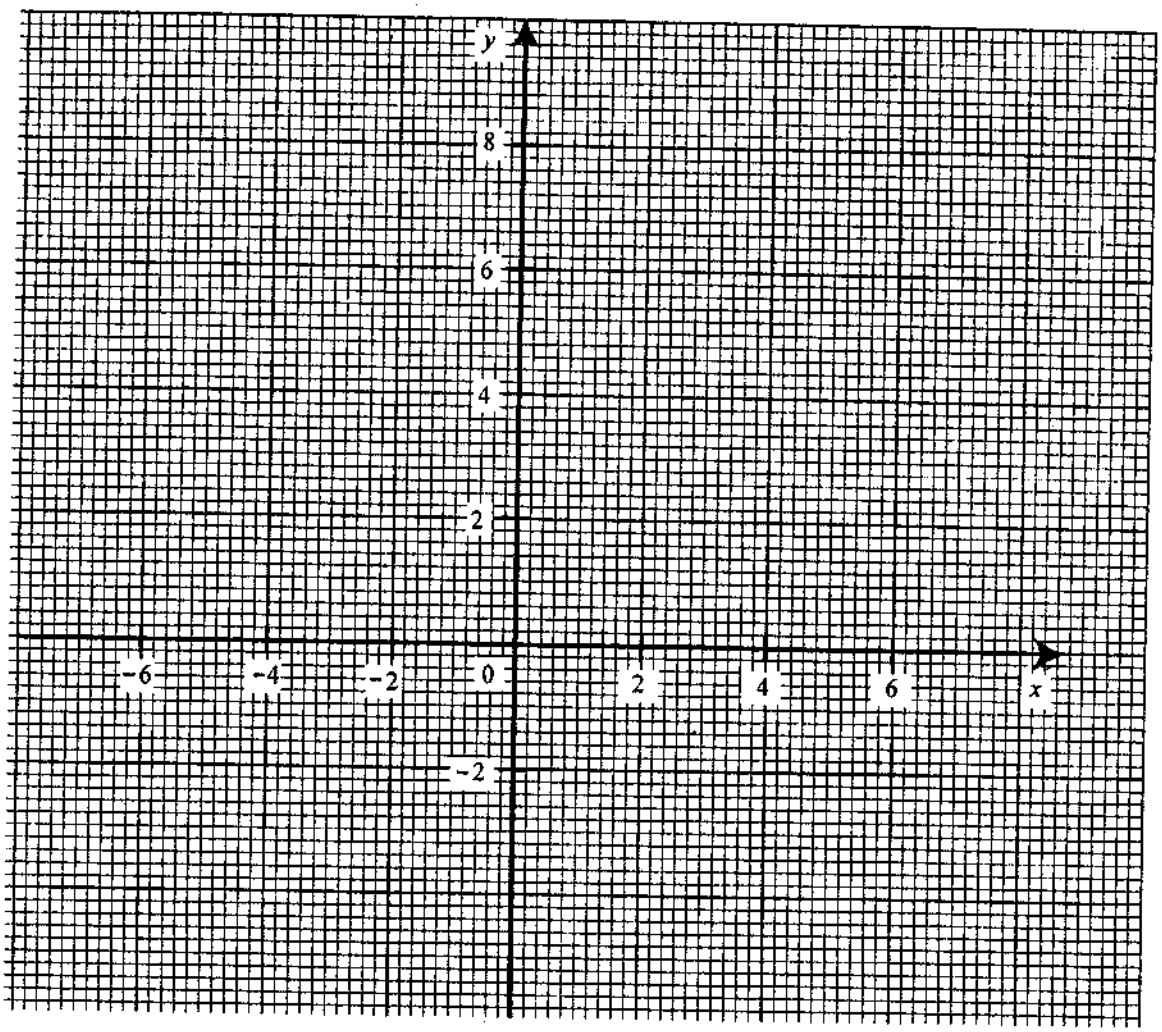
(i) find the equation of the line of symmetry of the curve, [1]

(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]

Centre Number	Candidate Number

8



Answer (b) *(i)* On the graph [4]

(ii) On the graph [1]

(c) *(i)* _____ [1]

(ii) $x =$ _____ or _____ [2]

(iii) _____ [2]

9 **(a)** 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,

(ii) distance P is north of X.

Answer: *(i)* _____ [2]

(ii) _____ [2]

9 **(b)** Joseph cycles at a speed of 5 metres per second. Calculate the time, in hours, he takes to cycle a distance of 18 km.

Answer (b) _____ hr [2]

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

Answer (c) _____ [2]

9 (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 invested.

Answer (d) _____ [4]

10 Answer the whole of this question on the grid on page 21.

(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 $A_1\ B_1\ C_1$ 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]

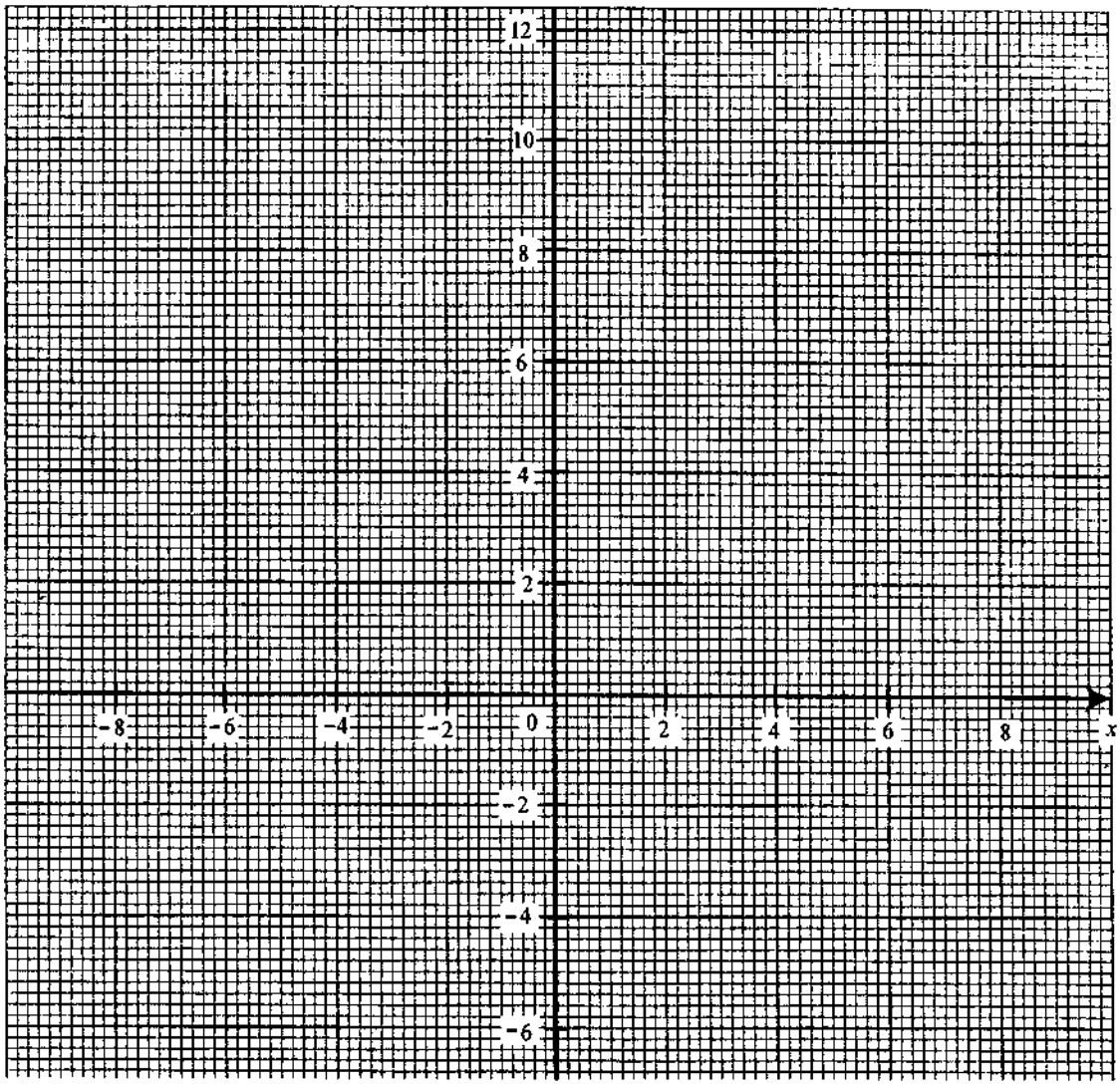
(iv) Transformation R represents a rotation 90° clockwise about the origin.

Draw and label the 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]

10 Answer the whole of question 10 on this page.



Answer (a) *(i)* On the graph [1]

(ii) On the graph [1]

(iii) On the graph [2]

(iv) On the graph [3]

(b) *(i)* _____

_____

_____ [3]

(ii)

[2]

Centre Number	Candidate Number

11 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 pupil (f)	4	8	5	6	7

(a) **(i)** State the modal class.

Answer *(a)* *(i)* _____ [1]

11 (a) (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.

(iii) Hence or otherwise calculate, an estimate of the mean of the distribution.

Answer *(a)* *(ii)* p = _____

q = _____

r = _____

S = _____ [4]

(iii) mean _____ [2]

Centre Number	Candidate Number

11 (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,

(ii) both pupils got marks that are more that 20.

Answer (b) (i) _____ [3]

(ii) _____ [2]

Centre Number	Candidate Number

12 Answer the whole of this question on the grid on **page 26**.

(a) Draw the graphs of these inequalities by shading the **unwanted** region.

(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,

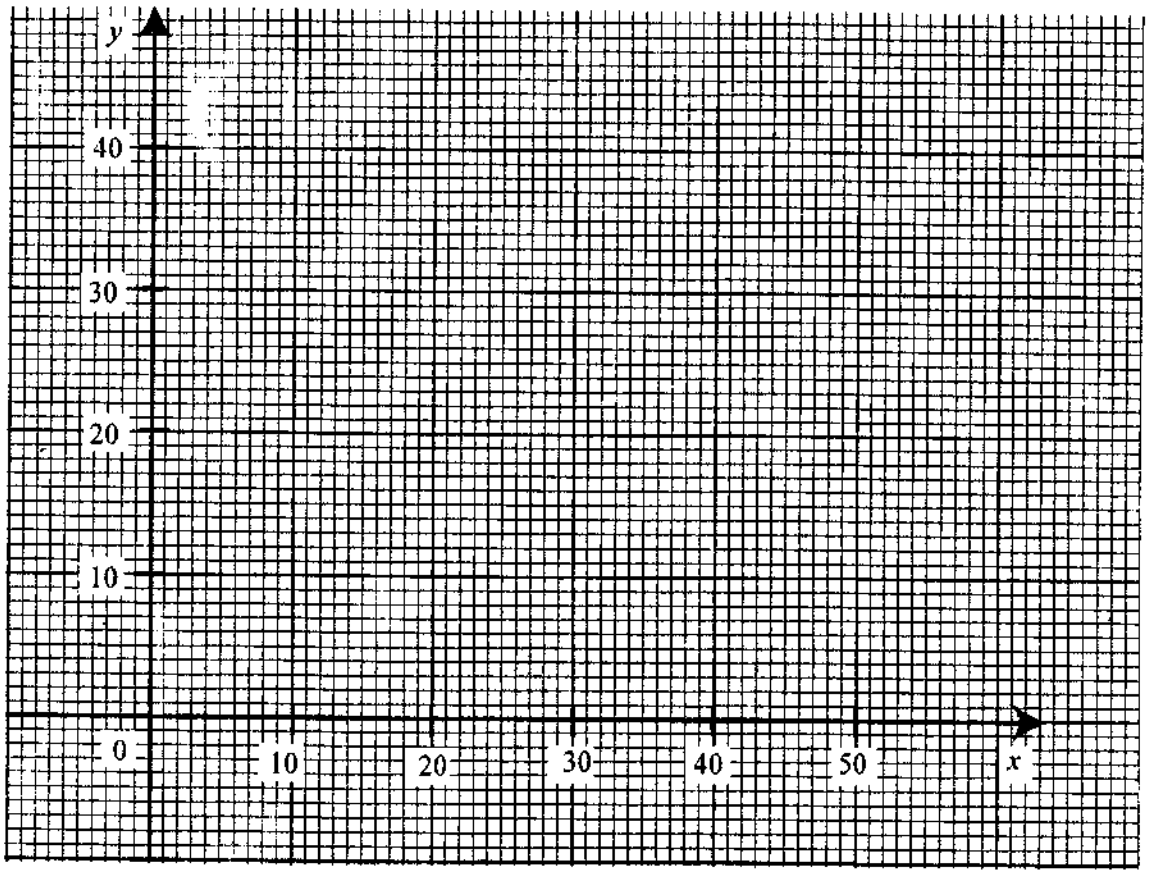
(i) find the coordinates of a point that gives a maximum value of $x + y$, [2]

(ii) state the maximum value of $x + y$. [1]

DO NOT WRITE IN THIS SPACE

Centre Number	Candidate Number

12 (a) Answer the whole of question 12 on this page.



Answer *(a)* *(i)* On the graph [2]

(ii) On the graph [2]

(iii) On the graph [2]

(iv) On the graph [2]

(b) On the graph [1]

(c) *(i)* _____ [2]

(ii) _____ [1]

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4004/1

PAPER 1

NOVEMBER 2018 SESSION **2 hours 30 minutes**

Additional materials:
Candidates answer on the question paper
Geometrical Instruments

Allow candidates 5 minutes to count pages before the examination.
This booklet should not be punched or stapled and pages should not be removed.

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and candidate number in the spaces at the top of this page.

Write your centre and candidate number in the box on the top right corner of every page of this paper.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Answer **all** questions.

Write your answers in the spaces provided on the question paper using **black** or **blue** pens.

If working is needed for any question, it must be shown in the space below that question. Omission of essential working will result in loss of marks.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be bought into the examination room

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question

This question paper consists of 20 printed pages and 0 blank page(s).

Candidate Name	Centre Number	Candidate Number

Answer all questions.

NEITHER MATHEMATICAL TABLES NOR SLIDE RULES NOR CALCULATORS MAY BE USED IN THIS PAPER.

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

Answer (a) ..... **[1]**

b) Express

i) $\frac{6}{25}$ as a decimal fraction,

(b)(i) ..... **[1]**

ii) 0,125 in standard form.

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

2. The following is a list of real numbers:

$\frac{3}{7}$; 11; $\sqrt{\frac{3}{2}}$; 121; –19; π; $\sqrt{64}$.

Choose from the list

a) a square number,

Answer (a) ..... **[1]**

b) irrational numbers.

(b) ..... **[2]**

3. a) Express $4 \times 5^3 + 3 \times 5^2 + 2$ as a number in base 5.

Answer: (a) ..... **[1]**

b) Evaluate

i) $10111_2 + 1010_2$ giving the answer in base 2.

(b)(i) ..... [1]

ii) $512^7 - 435^7$ giving the answer in base 7.

(b)(ii) ..... [1]

4. a) Express 00 45 in 12 hour notation.

Answer (a) ..... [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.

(b) ..... [1]

c) Convert 5 km^2 to hectares.

(c) ..... [1]

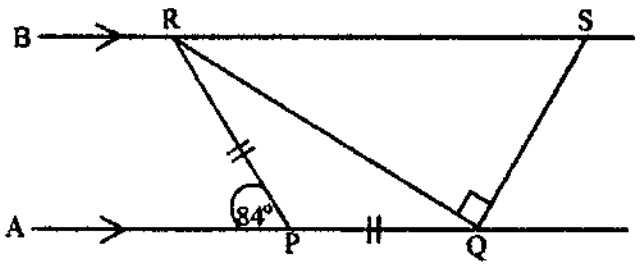
5. a) Express $6,07 \times 10^4$ in ordinary form.

Answer (a) ..... [1]

b) Evaluate $2,53 \times 10^1 + 6,1 \times 10^{-1}$, giving the answer in standard form.

(b) ..... [2]

6.



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) $P\hat{R}Q$,

Answer (a) ..... [1]

b) $Q\hat{R}B$,

(b) ..... [1]

c) $Q\hat{S}R$.

(c) ..... [1]

7. Solve the simultaneous equations:

$2x + 3y = 11$

$3x - 5y = -12$

Answer .....

..... **[3]**

8. The wave length, w, is inversely proportional to its frequency, f.

When $f = 90$, $w = 675$.

Find

a) an equation connecting f and w,

Answer (a) ..... **[2]**

b) the value of f when $w = 500$.

(b) ..... **[1]**

9. a) Write 45,3981 correct to 4 significant figures.

Answer (a) ..... **[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.

(b) ..... **[2]**

10. a) Factorise $3x^2 - 15x$ completely.

Answer (a) ..... **[1]**

b) Find the Highest Common Factor (H.C.F.) of

$8kl^2m$, $28k^2l^3m$ *and* $36l^2mn$.

(b) ..... **[2]**

11. The points A(6; 2) and B(8; 5) lie on a straight line.

Find the

a) gradient of the line AB,

Answer (a) ..... **[1]**

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

(b) ..... **[2]**

12. Simplify $\frac{2a+6}{a-3} \div \frac{a+3}{a^2-2a-3}$.

Answer ..... **[3]**

13. a) Express the ratio 3,5 kg : 800 g in its simplest form.

Answer (a) ..... **[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.

(b) ..... tonnes **[2]**

14. a) Solve the inequality

$4 - 5x < 2x + 8$.

Answer (a) ..... **[2]**

b) Write down the smallest integer that satisfies the inequality

$4 - 5x < 2x + 8$.

(b) ..... **[1]**

15. If $\log a = 3$ and $\log b = 7$,

calculate

a) $\log ab$,

Answer (a) ..... **[1]**

b) $\log \frac{1}{b}$,

(b) ..... **[1]**

c) $\log \sqrt[3]{a}$.

(c) ..... **[2]**

16. a) If a function $f(x) = (x + 4)(2x - 1)$,

find $f(3)$.

Answer (a) ..... **[2]**

b) Solve the equation

$$\frac{3m}{4} - \frac{m}{3} = 2\frac{1}{2}.$$

(b) ..... **[2]**

17. 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,

Answer (a) ..... **[1]**

b) the possible values of x given that $|p - q| = 5$.

(b) ..... **[3]**

18. a) State the special name given to a **regular** polygon with 4 sides.

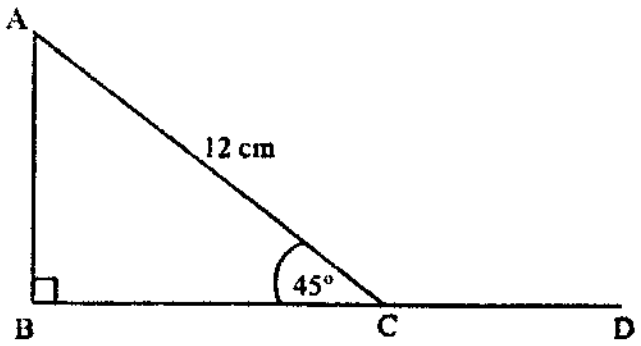
Answer (a) ..... **[1]**

b) The angles of a hexagon are 115°, 89°, $x°$, $x°$, $x°$ and $x°$.

Find the value of x.

(b) ..... **[3]**

19.



In the diagram, triangle **ABC** is right angled at **B**, **BCD** is a straight line, **AC** = 12 cm and $B\hat{C}A = 45°$.

$[Sin\ 45° = \frac{\sqrt{2}}{2},\ Cos\ 45° = \frac{\sqrt{2}}{2}]$

Using as much of the information given **above** as is necessary,

calculate

a) BC, leaving the answer in surd form,

Answer (a) ..... **[2]**

b) Sin $A\hat{C}D$ leaving the answer in surd form,

(b) ..... **[1]**

c) tan $A\hat{C}D$.

(c) ..... **[2]**

20. 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,

Answer (a)(i) ..... **[1]**

ii) the median height.

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

b) Calculate an estimate of the mean height of the trees.

(b) ..... **[3]**

21. 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,

Answer (a) ..... **[2]**

b) neither of them scores,

(b) ..... **[2]**

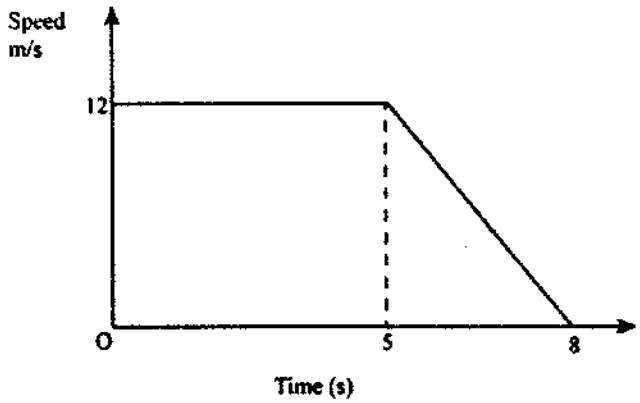
c) only one of them scores.

(c) ..... **[2]**

22. a) Convert a speed of 12 m/s to a speed in km/h.

Answer (a) ..... **[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

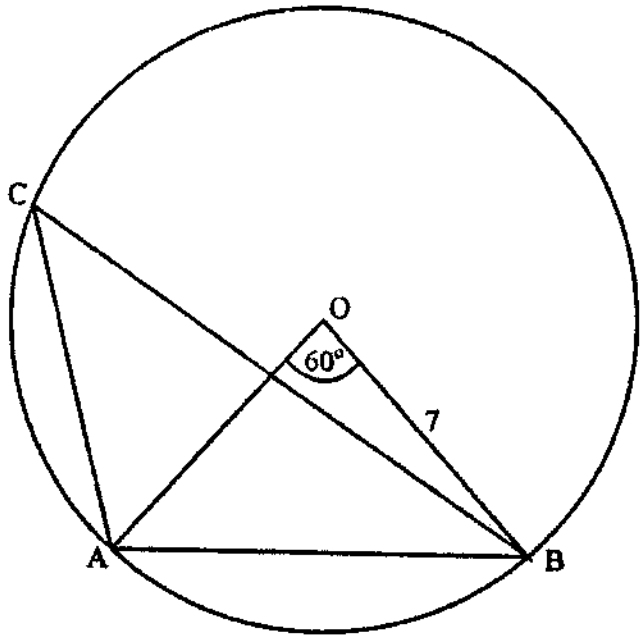
i) total distance covered in the 8 seconds,

(b)(i) ..... **[2]**

ii) acceleration of the athlete in the last 3 seconds.

(b)(ii) ..... **[2]**

23.



In the diagram points **A, B** and **C** are on the circumference of circle centre **O, OB** = 7cm and $A\hat{O}B = 60°$.

In this question take π to be $\frac{22}{7}$.

Calculate

a) $A\hat{C}B$,

Answer (a) ..... **[1]**

b) $O\hat{A}B$,

(b) ..... **[1]**

c) the length of minor arc **AB**,

(c) ..... **[2]**

d) the area of the minor sector **AOB**.

(d) ..... **[2]**

24. 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}.

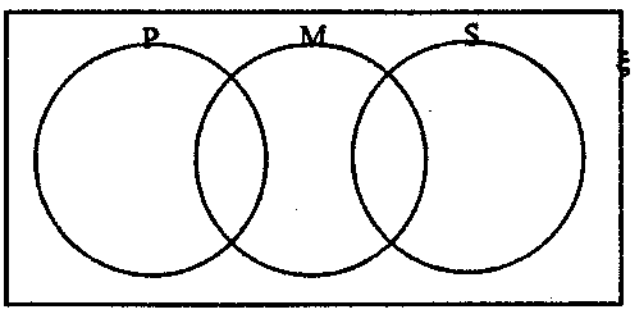
a) List all elements of set **P**.

Answer (a) ..... **[2]**

b) Write down $n(P \cap S \cap M)$.

(b) ..... **[1]**

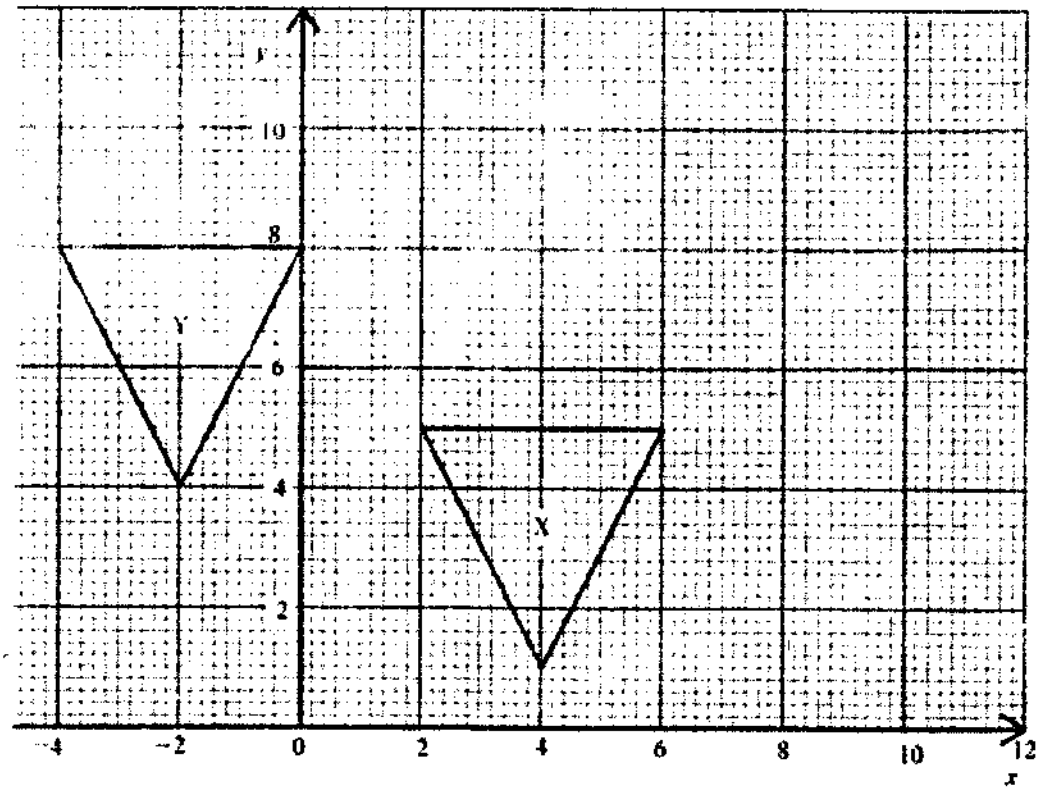
c) Complete the Venn Diagram by inserting elements in the correct regions



(c) ..... on the diagram **[3]**

Candidate Name	Centre Number	Candidate Number

25.



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.

Answer (a) .....

..... **[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.

(b)(i) ..... **[2]**

ii) Draw and label triangle Z.

(b)(ii) ..... on the grid **[3]**

Total marks: 100

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4004/2

PAPER 2

NOVEMBER 2018 SESSION **2 hours 30 minutes**

Additional materials:
Mathematical tables
Electronic Calculator

Allow candidates 5 minutes to count pages before the examination.
This booklet should not be punched or stapled and pages should not be removed.

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and candidate number in the spaces at the top of this page.

Write your centre and candidate number in the box on the top right corner of every page of this paper.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Answer **all** questions in Section A and **any four** from Section B.

Write your answers in the spaces provided on the question paper using **black** or **blue** pens.

If working is needed for any question, it must be shown in the space below that question. Omission of essential working will result in loss of marks.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Answers in degrees should be given correct to one decimal place.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question

Mathematical tables and calculators may be used to evaluate explicit numerical expressions.

This question paper consists of 20 printed pages and 0 blank page(s).

Candidate Name	Centre Number	Candidate Number

SECTION A (52 Marks)

Answer **all** questions in this section.

1. Simplify

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

Answer (a)(i) ..... **[2]**

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

(a)(ii) ..... **[2]**

b) Given that $P = \frac{1}{2}[a + d(a + d)]$,

evaluate P when $a = \frac{1}{2}$ and $d = 1$.

(b) ..... **[2]**

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

(c) ..... **[3]**

2. 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),

Answer (a)(i) ..... **[2]**

ii) Value Added Tax on a twenty-litre bucket of floor polish.

(a)(ii) .....**[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 sanitiser
Three 5 kg boxes of channel blocks

Calculate the total discount the school got.

(b) ..... **[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.

(c) ..... **[3]**

3. a) 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.

Answer (a)(i) ..... **[3]**

ii) Illustrate the answer on a number line.

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

b) Make x the subject of the formula

$$R = \sqrt{\frac{ax - p}{Q + bx}}$$

(b) ..... **[4]**

c) Factorise completely $2m^3n^2 + 3m^2n - 2m$.

(c) ..... **[2]**

Candidate Name	Centre Number	Candidate Number

4. Answer the whole of this question below

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.

Answer (a) on diagram ..... **[4]**

b) Construct the locus of points 4 cm from A.

(b) on diagram ..... **[1]**

c) Bisect $B\hat{C}A$

(c) on diagram ..... **[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.

(d) on diagram ..... **[2]**

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

(f) .....

.....

..... **[1]**

5. a) It is given that the universal set $\xi = \{x : 1 \leq x \leq 10,\ x \text{ is an integer.}\}$, has subsets **A** and **B** such that
A = {perfect square numbers} and
B = {multiples of 4}

i) List all elements of set **A**,

Answer (a)(i) ..... **[2]**

ii) List all elements of set $A \cap B$,

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

iii) Find $n(A \cup B)$

(a)(iii) ..... **[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

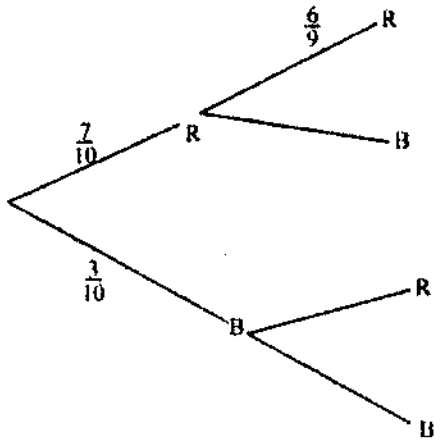
(b)(i) ..... [2]

ii) Write in set notation the relationship between set **P** and set **R**.

(b)(ii) ..... [1]

c) 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.



(c)(i) ..... [2]

ii) Find the probability that both buttons are red.

(c)(ii) ..... [2]

iii) Find the probability that at least one of the buttons is red.

(c)(iii) ..... [2]

SECTION B (48 Marks)
Answer **any four** questions from this section.
Each question carries 12 marks.

6. 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

Calculate an estimate of the mean age of the vehicles.

Answer (a) ..... **[3]**

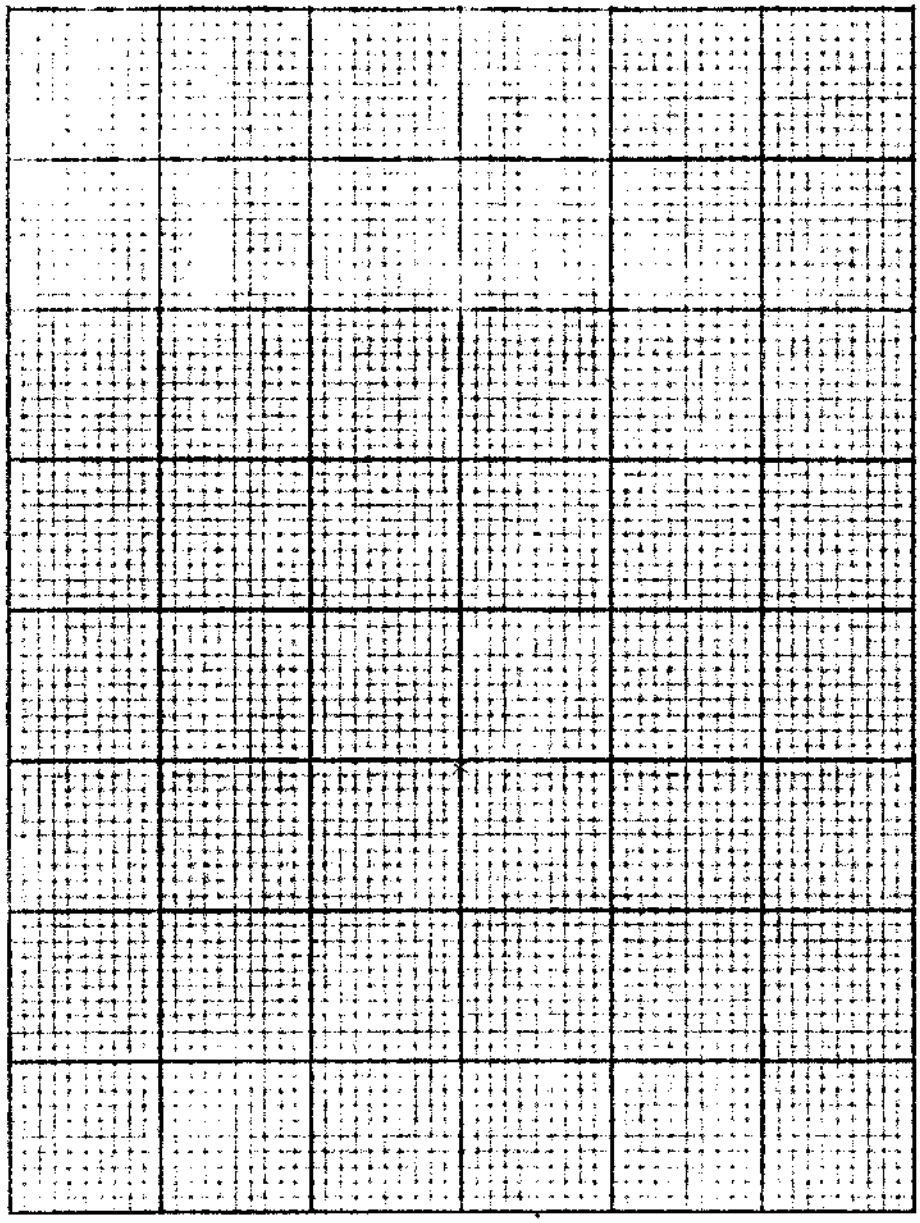
b) The same information of the survey is displayed in the following cumulative frequency table.

Age (x years)	$x < 5$	$x < 10$	$x < 15$	$x < 20$	$x < 25$
Cumulative frequency	10	22	n	110	120

i) Find the value of n.

(b)(i) ..... **[1]**

ii) Draw a cumulative frequency curve on the grid using a scale of 2 cm to 5 years on the age axis and 2 cm to 20 on the cumulative frequency axis.



[4]

c) Use the graph to find the

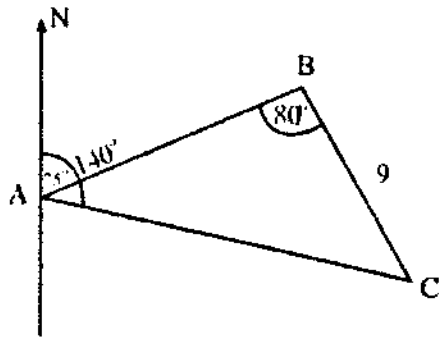
i) median age,

(c)(i) ..... [2]

ii) upper quartile.

(c)(ii) ..... [2]

7.



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 $A\hat{B}C = 80°$.

a) i) Calculate $B\hat{A}C$

Answer (a)(i) ..... **[1]**

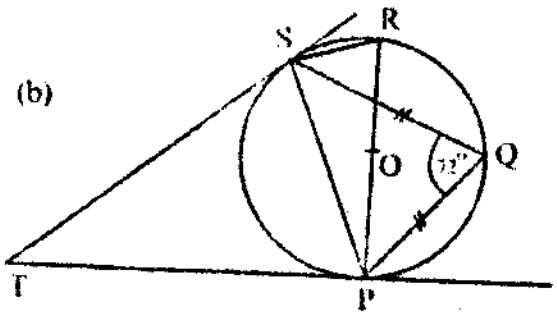
ii) Calculate the distance from A to C

(a)(ii) ..... **[2]**

iii) Calculate the shortest distance from B to AC

(a)(iii) ..... **[2]**

b)



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) $P\hat{S}Q$,

(b)(i) ..... **[2]**

ii) $S\hat{R}P$,

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

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

(b)(iii) ..... **[2]**

iv) $P\hat{T}S$.

(b)(iv) ..... **[2]**

8. It is given that y varies inversely as the square root of x and that when $y = 2$, $x = 9$.
Find,

a) i) the equation connecting y and x,

Answer (a)(i) ..... **[2]**

ii) x when $y = \frac{1}{2}$.

(a)(ii) ..... **[2]**

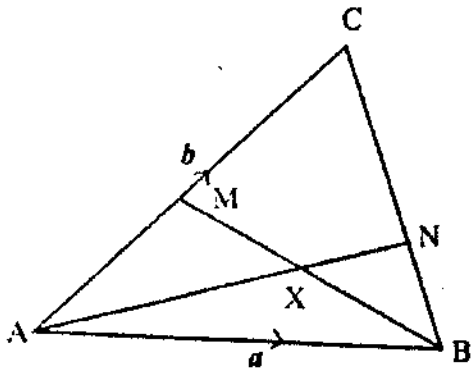
b) i) Show that $\log (3x + 1) + \log (x - 3) = 1$ reduces to $3x^2 - 8x - 13 = 0$.

(b)(i) ..... **[3]**

ii) Hence solve the equation $3x^2 - 8x - 13 = 0$, giving your answers correct to one decimal place.

(b)(ii) ..... **[5]**

9.



In the diagram M is the midpoint of AC. N lies on BC such that BN = $\frac{1}{3}$ BC,

$\vec{AB} = a$ *and* $\vec{AC} = b$

Express in terms of a and/or b

i) $\vec{BC}$

Answer (a)(i) ..... **[1]**

ii) $\vec{BN}$

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

iii) $\vec{AN}$

(a)(iii) ..... **[2]**

iv) $\vec{BM}$

(a)(iv) ..... **[1]**

b) Given that $B\vec{X} = hB\vec{M}$, express $A\vec{X}$ in terms of a, b *and* h.

(b) ..... **[2]**

c) Given also, that
$A\vec{X} = kA\vec{N}$, express $A\vec{X}$ in terms of a, b *and* k.

(c) ..... **[1]**

d) Using the results (b) and (c), find the value of h and the value of k.

(d) ..... **[4]**

10. The following is a table of values for the function $y = 2x + 3 - x^2$

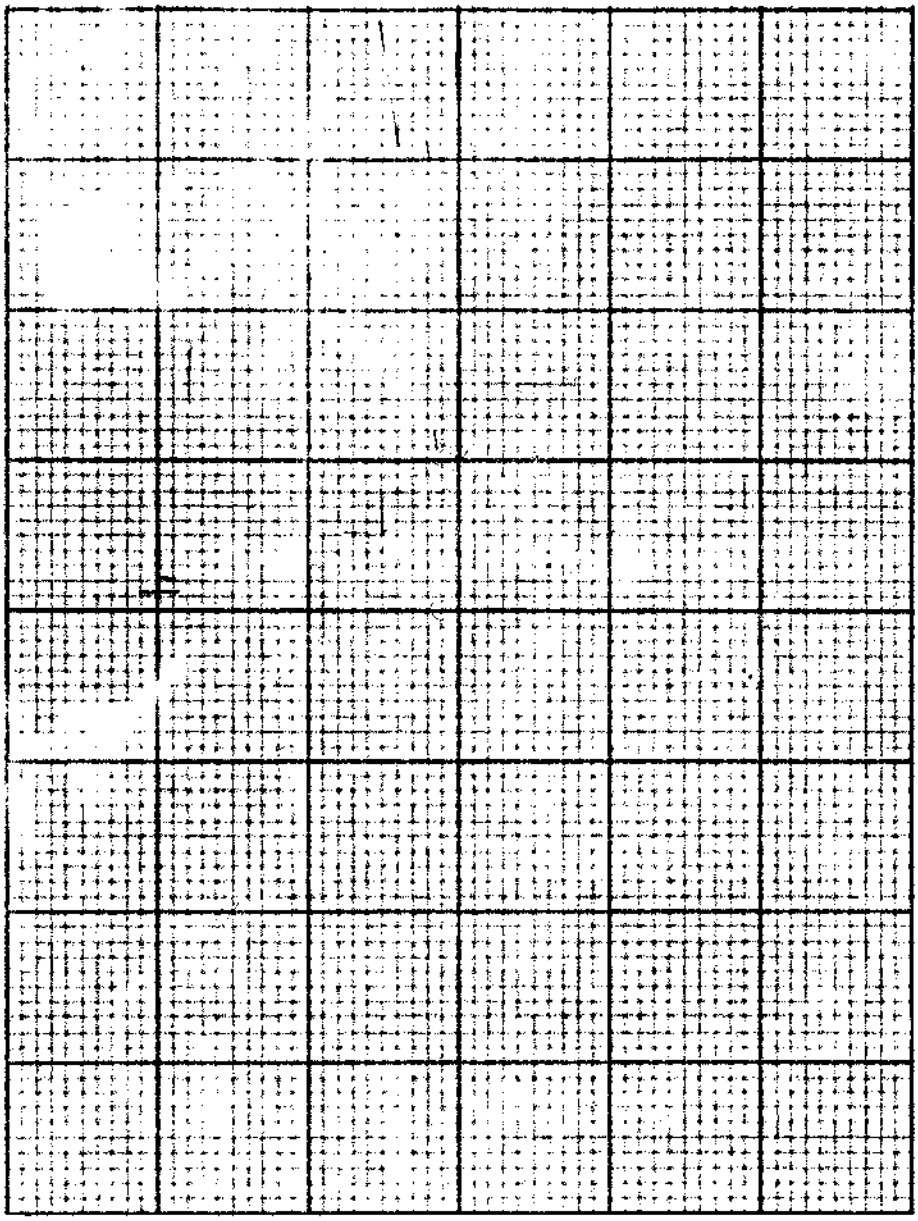
x	-2	-1	0	1	2	3	4
y	-5	p	3	q	3	0	-5

Find the value of p and the value of q.

(a) .....

..... **[2]**

b) Answer this part of the question on the grid below.
Use a scale of 2cm 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]**

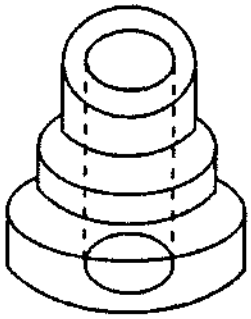
c) Use the graph to find an estimate of the

i) solution to the equation $-x^2 + 2x + 3 = -x$, **[2]**

ii) area bounded by the curve, the lines, $x = 0$, $x = 1$ *and* $y = -x$.

..... (unit)² **[3]**

11. a)



The diagram shows a solid aluminium alloy casting for a pulley 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 aluminium used to make the casting,

Answer (a)(i) ..... **[4]**

ii) mass, in grammes, of the casting if the density of the alloy is 2,8 g / cm^3,

(a)(ii) ..... **[2]**

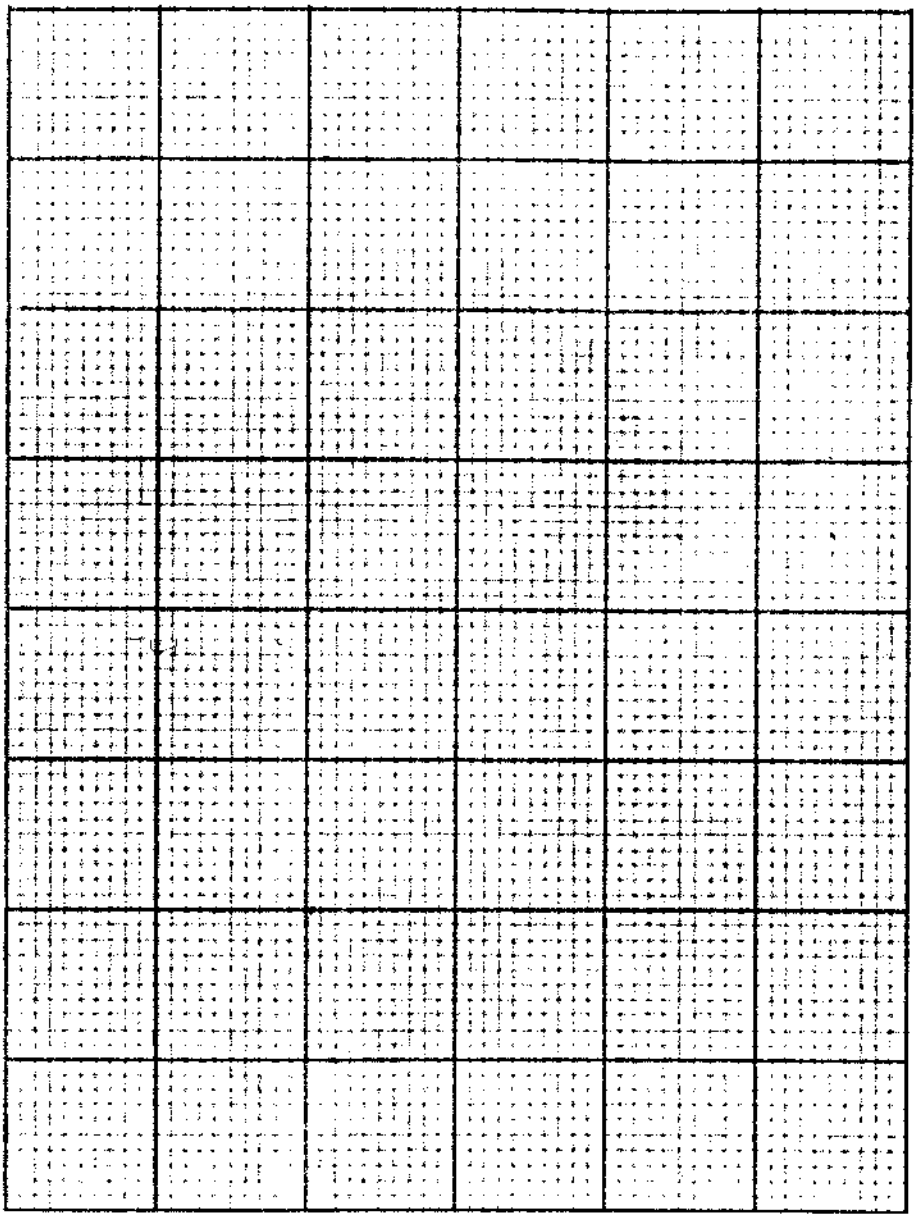
iii) total price of the casting if the alloy costs $7,50 per gramme.

(a)(iii) ..... **[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.

(b) ..... **[4]**

12. Answer the whole of this question on the grid below using a scale for $-4 \leq x \leq 6$ and $-8 \leq y \leq 4$ of 2cm to 2 units on both axes.



Triangle P has vertices at (1; 2), (1; 4) and (2; 4)
Draw and label triangle P.

Answer (a) on graph ..... **[1]**

b) Triangle P is mapped onto triangle Q by an enlargement of factor -2 centre the origin.
Draw and label triangle Q.

(b) on graph ..... **[2]**

c) Triangle P is mapped onto triangle R by a translation through $\begin{pmatrix} -3 \\ -5 \end{pmatrix}$.
Draw and label triangle R.

(c) on graph ..... **[2]**

d) Draw triangle N the image of a triangle P under a transformation represented by the matrix $\begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}$.

(d) on graph ..... **[3]**

e) Triangle S has vertices (2;2), (2;4) and (4;4).

i) Draw and label triangle S.

(e)(i) on graph ..... **[1]**

ii) Describe fully the single transformation which maps triangle P onto triangle S.

(e)(ii) .....

.....

..... **[3]**

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4004/1

PAPER 1

JUNE 2019 SESSION 2 hours 30 minutes

Candidates answer on the question paper
Additional materials:
Geometrical Instruments

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

Time 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Write your centre and candidate number in the box on the top right corner of every page of this paper.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.
Answer **all** questions.
Write your answers in the spaces provided on the question paper using **black** or **blue** pens.
If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.
Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

This question paper consists of 25 printed pages and 3 blank pages.

[Turn over

Candidate Name | Centre Number | Candidate Number

Answer all questions.

NEITHER MATHEMATICAL TABLES NOR SLIDE RULES NOR CALCULATORS MAY BE USED IN THIS PAPER.

1. Express

a) $\frac{12}{25}$ as a decimal fraction,

Answer(a) ..... [1]

b) $\frac{2}{5}$ as a percentage,

Answer(b) ..... [1]

c) 0, 0375 as a fraction in its lowest terms.

Answer(c) ..... [1]

2. Write down the next term in each of the following sequences.

a) 1 ; 4 ; 9 ; 16 ; 25 ; 36 ; ___

Answer(a) ..... [1]

b) $\sqrt{2}$; $\sqrt{3}$; $\sqrt{5}$; $\sqrt{7}$; $\sqrt{11}$; ___

Answer(b) ..... [1]

c) 16 ; 8 ; 4 ; 2 ; 1 ; ___

Answer(c) ..... [1]

3. 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.

Answer .....

.....

..... [3]

4. a) Convert

i) 434_5 to base ten,

Answer (a)(i) ..... **[1]**

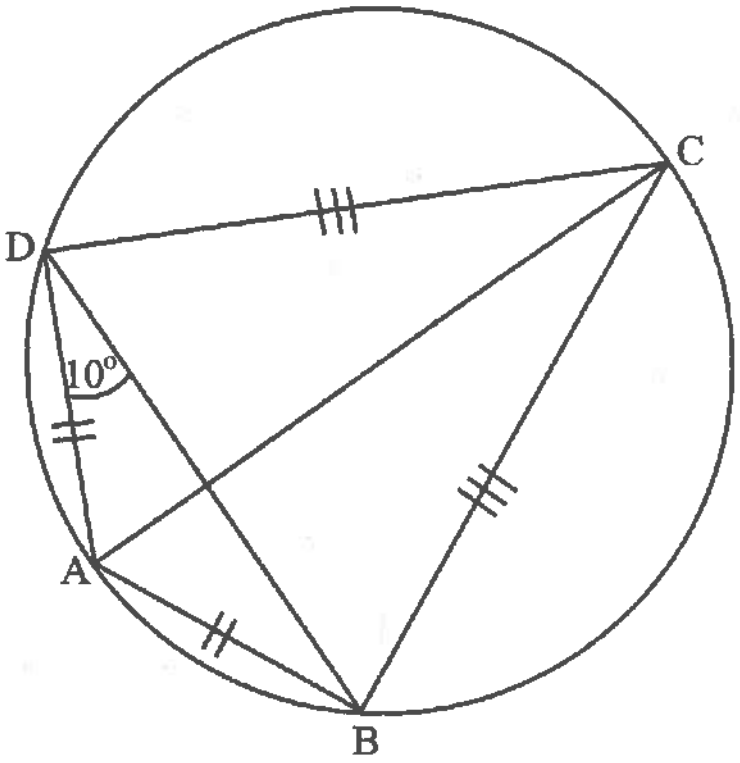
ii) 75_{10} to base two.

Answer (a)(ii) ..... **[1]**

b) Evaluate $377_8 + 411_8$ leaving the answer in base 8.

Answer(b) ..... **[1]**

5.



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.

Answer(a) ..... **[1]**

b) Find

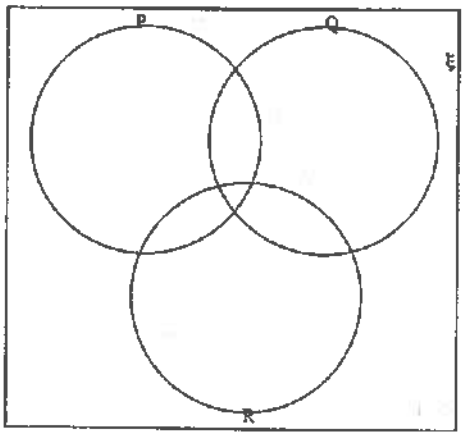
i) $A\hat{C}D$,

Answer (b)(i) ..... **[1]**

ii) $A\hat{D}C$.

Answer (b)(ii) ..... **[1]**

6.



The Venn diagram shows the universal set ξ and subsets P, Q and R.

In the Venn diagram shade the set $(P' \cap R) \cup (R' \cap Q)$.

Answer in the diagram ..... [3]

7. a) Convert 647 cents to dollars.

Answer(a) ..... [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.

Answer(b) ..... [2]

8. Solve the simultaneous equations:

$$5x - 2y = 26$$
$$3x + 4y = 0$$

Answer .....

..... [3]

9. The sides of a parallelogram are of lengths 10cm and 8cm. 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.

$[\tan\ 30° = 0,577;\ \cos\ 30° = 0,866;\ \sin\ 30° = 0,5]$

Answer ..... [3]

10. 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.

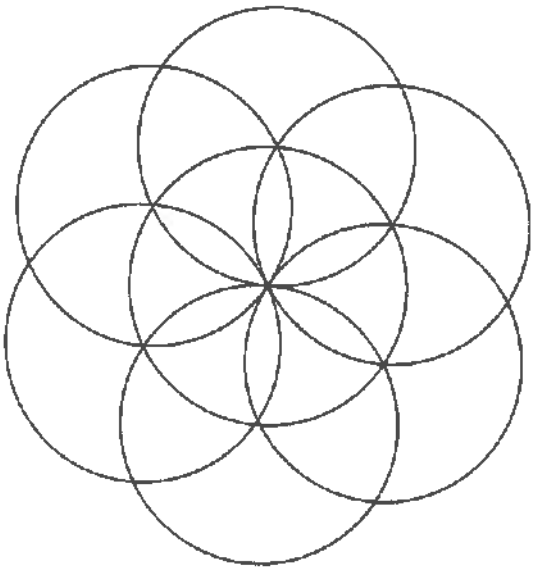
a) Calculate the probability of picking a yellow sweet.

Answer(a) ..... **[1]**

b) Two sweets are picked at random from the box.
Calculate the probability that the sweets are of the same colour.

Answer(b) ..... **[2]**

11.



In the diagram, all the circles are of equal radii.

State the

a) total number of circles,

Answer(a) ..... **[1]**

b) number of lines of symmetry,

Answer(b) ..... **[1]**

c) order of rotational symmetry.

Answer(c) ..... **[1]**

12. It is given that $\log 6 = 0,7781$ *and* $\log 5 = 0,6990$.

Calculate

a) $\log 30$,

Answer(a) ..... [2]

b) $\log 1\ 200\ 000$.

Answer(b) ..... [2]

13. a) Calculate the size of one exterior angle of an 18 sided regular polygon.

Answer(a) ..... [2]

b) Calculate the sum of the interior angles of a heptagon (7 sided polygon).

Answer(b) ..... [2]

14. The number of people , N , who favour a certain type of energy drink varies directly as the population size S . In a population of 1000 people, only 40 people were reported to favour that type of energy drink.

a) Form an equation connecting N and S .

Answer(a) ..... [2]

b) Find the population size, S from which 180 people favour that type of energy drink.

Answer(b) ..... [2]

15. In a rectangle ABCD, AB = 12 cm and BC = 5 cm.

Express as a common fraction,

a) $tanA\hat{C}D$,

Answer(a) ..... **[1]**

b) $cosD\hat{A}C$,

Answer(b) ..... **[2]**

c) $sinB\hat{D}C$,

Answer(c) ..... **[1]**

16. 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,

Answer(a) ..... [1]

b) median mass,

Answer(b) ..... [1]

c) mean mass.

Answer(c) ..... [2]

17. a) Factorise completely

i) $p^2 - 4$,

Answer (a)(i) ..... [1]

ii) $2p^2 + 7p + 6$.

Answer (a)(ii) ..... [2]

b) Hence or otherwise find the Highest Common Factor (H.C.F.) of $p^2 - 4$ and $2p^2 + 7p + 6$.

Answer(b) ..... [1]

18. 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,

Answer(a) ..... **[2]**

b) volume of the cone in terms of π.

[$volume\ of\ cone = \frac{1}{3}\pi r^2 h$]

Answer(b) ..... **[2]**

19. It is given that $f(x) = 3x^2 - 2x - 8$.

Find

a) $f(-4)$,

Answer(a) ..... [1]

b) the values of x for which $f(x) = 0$.

Answer(b) .....
..... [3]

20. Solve the equations:

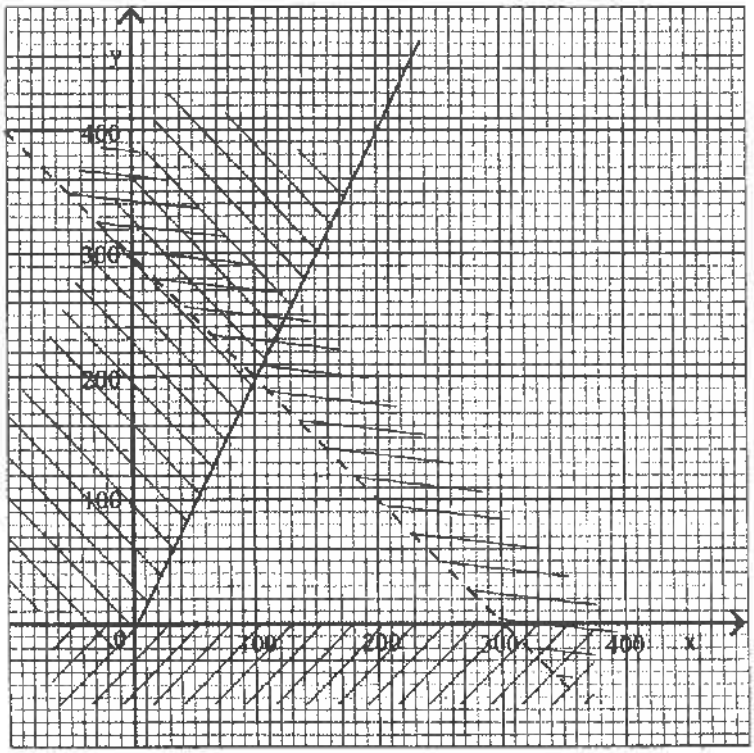
a) $x^{\frac{2}{3}} = 4$

Answer(a) .....
..... [2]

b) $\dfrac{2}{x-2} = \dfrac{3}{x+2}$

Answer(b) ..... [2]

21.



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.

Answer(a) .....

..... [2]

b) Find the maximum value of $x + y$, given that x and y are integers that satisfy the three inequalities.

Answer(b) ..... [2]

22. a) Express in standard form

i) 618 000,

Answer (a)(i) ..... **[1]**

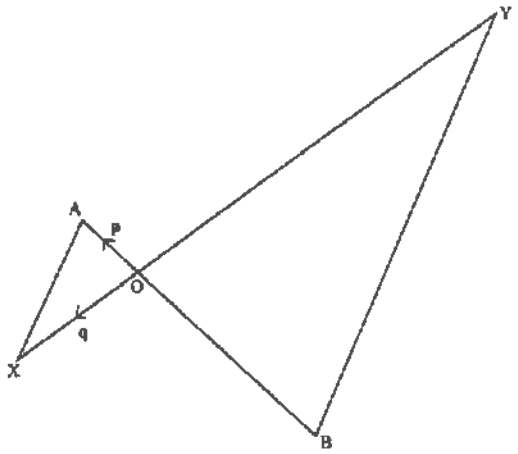
ii) 0,000 423.

Answer (a)(ii) ..... **[1]**

b) Evaluate $(8,\ 76 \times 10^{-2}) + (7,\ 89 \times 10^{-2})$, leaving the answer in standard form.

Answer(b) ..... **[2]**

23.



The diagram shows two intersecting straight lines AOB and XOY.

$OA = p$ and $OX = q$.

$\frac{AO}{OB} = \frac{XO}{OY} = \frac{1}{3}$.

a) express in terms of p and/ or q

i) AX,

Answer (a)(i) ..... [1]

ii) BY.

Answer (a)(ii) ..... [1]

b) State **any two** relationships between the lines AX and YB.

Answer(b) .....

.....

.....

..... **[2]**

24. 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.

Answer(a) ..... **[1]**

b) Find the distance from Moyo village to Ncube village, leaving the answer in surd form.

Use as much of the information given below as is necessary.

[cos 40° = 0,77 sin 40° = 0,64 tan 40° = 0,84]

Answer(b) ..... **[3]**

25. Two similar bottles are of heights 8 cm and 16 cm.

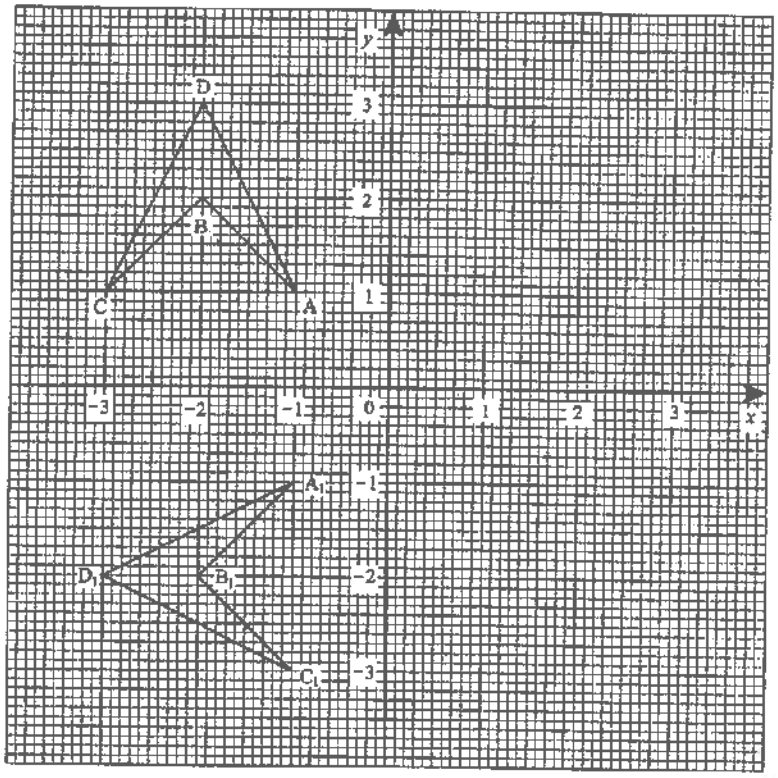
a) The bases of the similar bottles are also similar. The surface area of the base of the smaller bottle is 1,44 cm^2.
Find the surface area of the base of the bigger bottle.

Answer(a) ..... **[2]**

b) Find the volume of the smaller bottle if the volume of the bigger bottle is 16 cm^3.

Answer(b) ..... **[2]**

26.



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 $A_1B_1C_1D_1$.

Answer(a) .....

.....

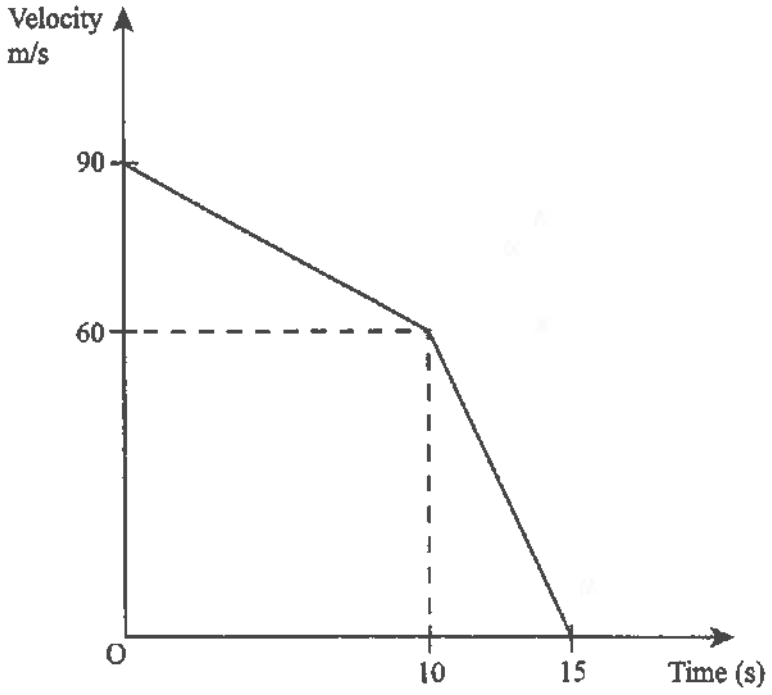
.....

..... [3]

b) Point A_2 (1; –2) is the image of A under a translation.

Find the translation vector.

Answer(b) ..... [2]

27. 

The diagram is the 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,

Answer(a) ..... [2]

b) average velocity of the object during the 15 seconds,

Answer(b) ..... [2]

c) deceleration of the object during the last five seconds.

Answer(c) ..... [2]

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Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4004/2

PAPER 2

JUNE 2019 SESSION 2 hours 30 minutes

Candidates answer on the question paper

Additional materials:
Mathematical tables
Electronic Calculator
Geometrical Instruments
Graph paper (if needed)

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

Time 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Write your centre and candidate number in the box on the top right corner of every page of this paper.
Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.
Answer **all** questions in Section A and **any four** from Section B.
Write your answers in the spaces provided on the question paper using **black** or **blue** pens.
If working is needed for any question, it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.
Answers in degrees should be given correct to one decimal place.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Mathematical tables and calculators may be used to evaluate explicit numerical expressions.

This question paper consists of 30 printed pages and 2 blank pages.

Candidate Name | Centre Number | Candidate Number

SECTION A (52 Marks)

Answer **all** questions in this section

1. a) Write down the next term in the sequence below.

$$\frac{1}{3} ; \frac{2}{4} ; \frac{3}{5} ; \frac{4}{6} ; \ldots$$

Answer(a) ..... **[1]**

b) Express 10 as a **sum** of **two** different prime numbers.

Answer(b) ..... **[1]**

c) i) Increase \$105 by 12%.

Answer (c)(i) ..... **[2]**

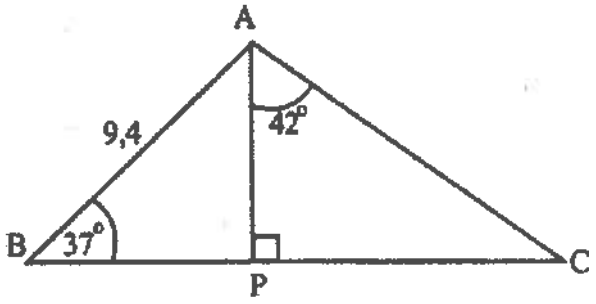
ii) Tendai and Chipo share \$105,00 in the ratio 4 : 3 in that order.
Find Tendai's share and Chipo's share.

Answer (c)(ii) ..... [3]

2. a) Sin $\theta = \cos 40°$.
Find the 2 possible values of θ if $0° < \theta < 180°$.

Answer(a) ..... [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 $P\hat{A}C = 42°$.

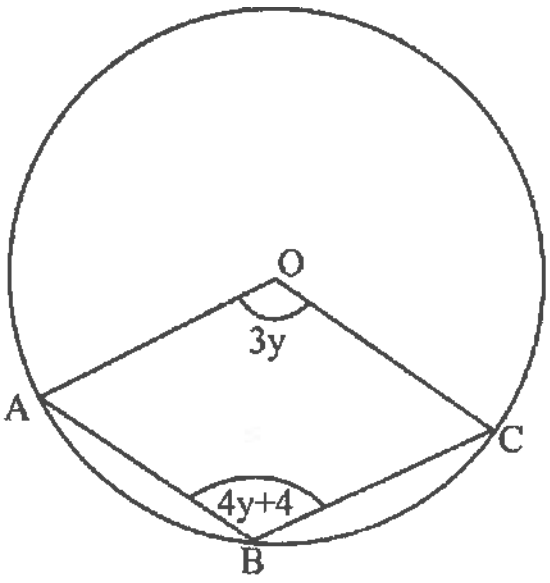
i) Calculate the length of **AP**.

Answer (b)(i) ..... [2]

ii) Calculate the length of **AC**.

Answer (b)(ii) ..... [2]

c)



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 $A\hat{O}C$.

Answer (c)(i) ..... **[1]**

ii) Find the value of y.

Answer (c)(ii) ..... **[3]**

3. a) Tariro bought US \$7,00 for 91,70 Pula from a bank.

i) **Find the exchange rate in the form US \$1 : mPula.**

Answer (a)(i) ..... **[1]**

ii) **The bank charged 1% commission for the transaction.**
Calculate the amount of money Tariro received.

Answer (a)(ii) ..... **[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.

Answer(b)_ ..... **[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.

Answer(c) ..... [2]

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

Answer(d) ..... [3]

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

Answer(a) ..... [3]

b) 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 $f(x) = g(x)$,

Answer (b)(i) .....
..... [3]

ii) value of x given that $h(x) = 0{,}25$.

Answer (b)(ii) ..... [3]

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

Answer(c) ..... [3]

Candidate Name	Centre Number	Candidate Number

10

5. **Answer the whole of this question on the plain space below.**
User 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 on the blank space on **page 10** the

i) triangle ABC ,

Answer (a)(i) on the diagram ..... **[3]**

ii) bisector of $A\hat{B}C$,

Answer (a)(ii) on the diagram ..... **[2]**

iii) perpendicular bisector of side BC.

Answer (a)(iii) on the diagram ..... **[2]**

b) Point D is on the same side of AB as C and is such that AD = 7 cm and $B\hat{A}D = 45°$.

i) Construct $B\hat{A}D$.

Answer (b)(i) on the diagram ..... **[2]**

ii) Mark and label point D.

Answer (b)(ii) on the diagram ..... **[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]

Answer (b)(iii)on the diagram .....

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SECTION B (48 Marks)

Answer **any four** questions from this section.

Each question carries **12 marks.**

6. a) 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) $n(P \cap Q)$.

Answer **(a)(i)** ..... **[1]**

ii) $n(P \cup Q)$.

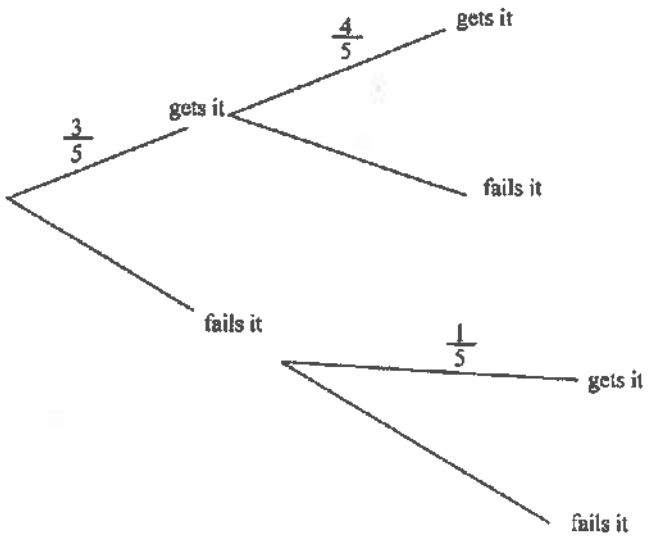
Answer **(a)(ii)** ..... **[1]**

b) In a test the probability that a learner gets the first question correct is $\frac{3}{5}$

If the 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.



Answer **(b)(i)** on the diagram [3]

ii) Hence or otherwise find the probability that the learner who answers two questions, gets both questions correct.

Answer **(b)(ii)** ..... [2]

iii) Hence or otherwise find the probability that the learner, who answers two questions, gets none of the two questions correct.

Answer **(b)(iii)** ..... **[2]**

iv) Hence or otherwise find the probability that the learner, who answers two questions, gets only one of the questions correct.

Answer **(b)(iv)** ..... **[3]**

7. a) i) Solve the following inequalities giving the answer in the form $a \leq x < b$ where a and b are constants to be found:
$5x - 13 \leq x - 6 < 9 + 4x$

Answer (a)(i) ..... [3]

ii) Illustrate the solution on a number line.

Answer (a)(ii) ..... [1]

iii) Write down the smallest integer value of x that satisfies the inequalities.

Answer (a)(iii) ..... [1]

b) 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 $A\hat{C}B$.

Answer (b)(i) ..... [1]

ii) Given that $sinA\hat{C}B = \frac{9}{16}$ form an equation in x.

Answer (b)(ii) ..... [1]

iii) Solve the equation in (b)(ii).

Answer (b)(iii) ..... [2]

iv) Hence find the length of side AC.

Answer (b)(iv) ..... [1]

v) Hence, calculate the length of side BC.

Answer(b)(v) ..... [2]

8. 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

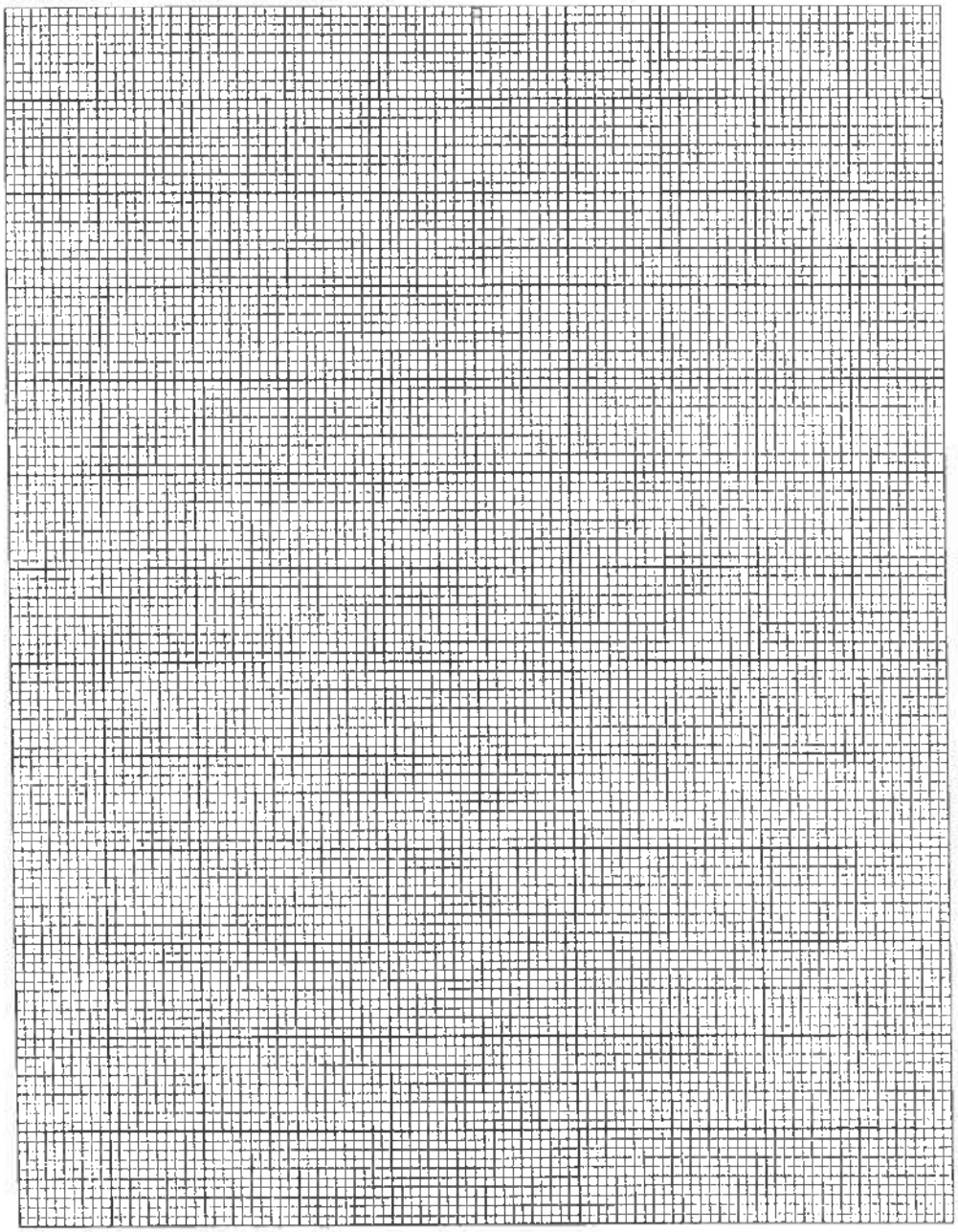
i) p,

Answer (a)(i) ..... [1]

ii) q.

Answer (a)(ii) ..... [1]

Answer parts (b) and (c) of the question on the grid.



b) i) Draw the graph of $y = x^2 - 4x$ on the grid provided using a scale of 2 cm to 1 unit on the x axis and 2 cm to 2 units on the y axis.

Answer (b)(i) on the graph ..... [4]

ii) On the same grid draw the graph of $y = 3 - x$.

Answer (b)(ii) on the graph ..... **[2]**

c) Use the graph to

i) solve the equation $x^2 - 4x = 3 - x$,

Answer (c)(i) ..... **[2]**

ii) find the equation of the line of symmetry of the curve $y = x^2 - 4x$.

Answer (c)(ii) ..... **[2]**

Candidate Name | Centre Number | Candidate Number

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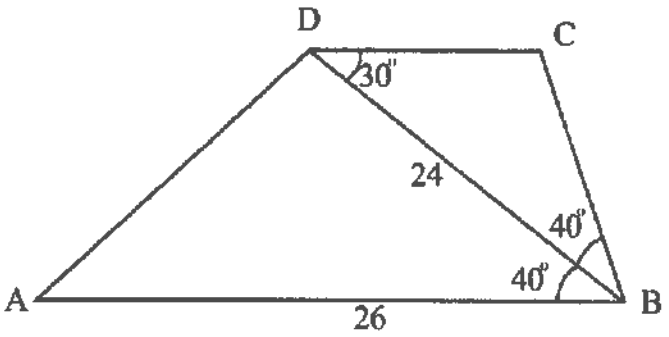
9.



In the diagram, ABCD is a quadrilateral in which BD is a diagonal. AB = 26cm, BD = 24cm, $A\hat{B}D = C\hat{B}D = 40°$ and $C\hat{D}B = 30°$.

Calculate the

a) area of triangle ABD,

Answer(a) ..... [2]

b) length of AD,

Answer(b) ..... [4]

c) length of BC,

Answer(c) ..... [4]

d) shortest distance from C to BD.

Answer(d) ..... [2]

10. 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,

Answer (a)(i) ..... [1]

ii) class that contains the median height,

Answer (a)(ii) ..... [1]

iii) class that contains the lower quartile.

Answer (a)(iii) ..... [1]

b) Calculate an estimate of the mean height of the learners.

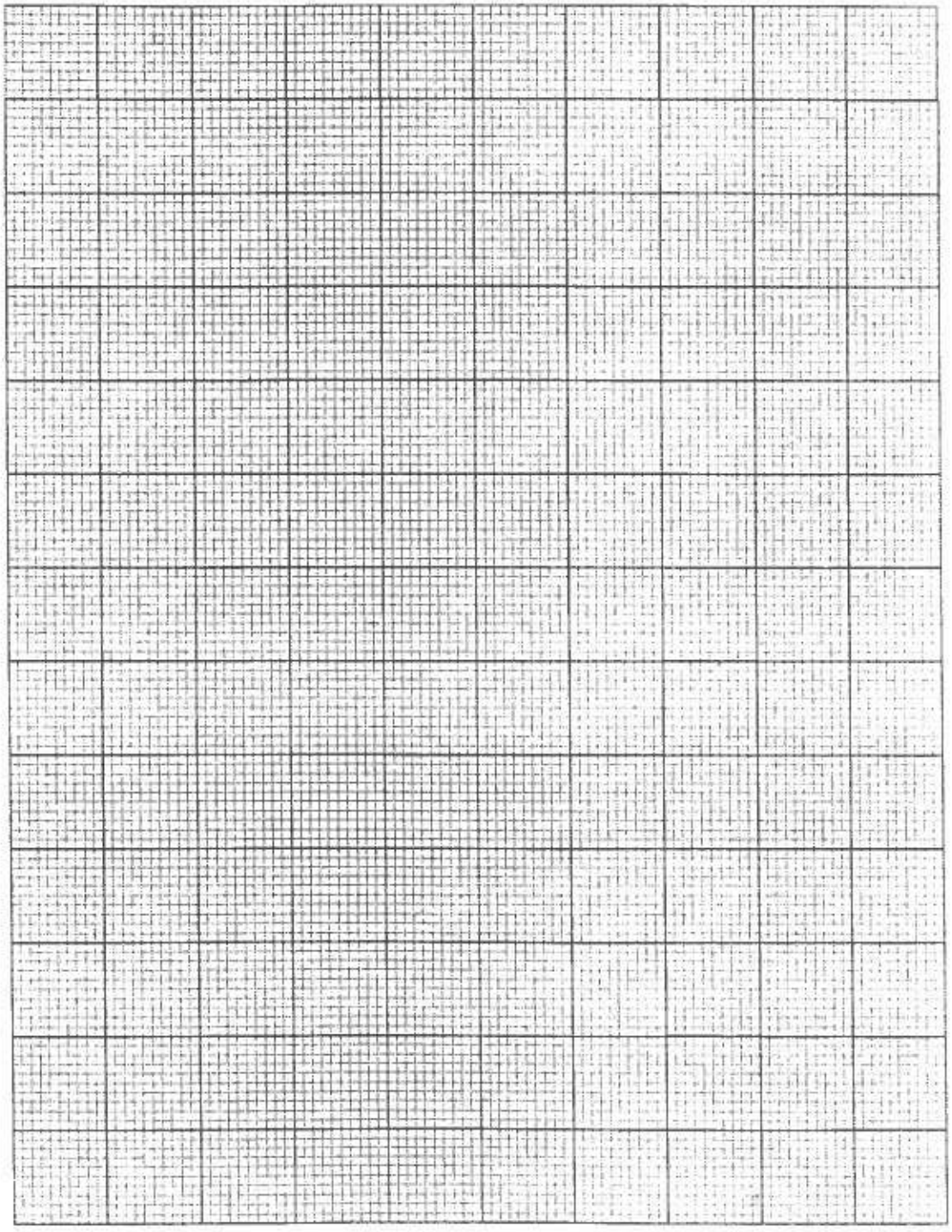
Answer(b) ..... [3]

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.

Answer(c) ..... [3]

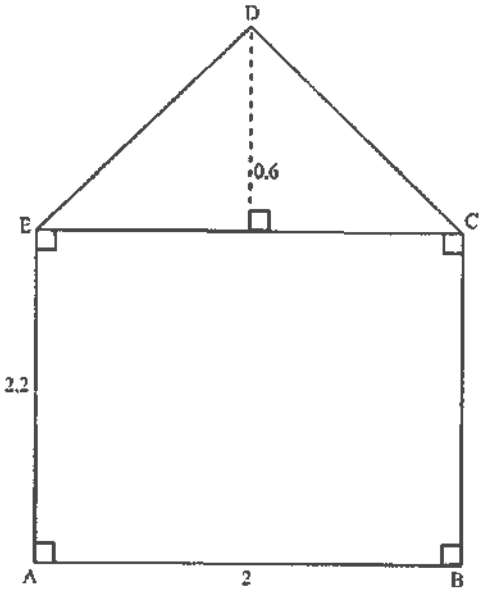
d) **Answer this part of the question on the grid.**
Using a scale of 2 cm to 5 units on the Height axis and 2 cm to 0,5 units on the Frequency Density axis, draw a histogram to show the information.



Answer (d) On the graph ..... [3]

Candidate Name | Centre Number | Candidate Number

11.



The diagram shows the cross-section of a garden shed. The cross-section ABCDE is made up of a rectangle measuring $2m$ by $2{,}2m$ and an isosceles triangle with a perpendicular height of $0{,}6m$ and a base of $2m$.

a) Calculate the area of the cross-section.

Answer(a) ..... [3]

b) If the shed is $3m$ long, calculate the volume of the shed.

Answer(b) ..... [2]

c) It is given that $23m^2$ of the surface area of the shed need to be painted and that one tin of paint covers an area of $4,5m^2$.

Calculate the number of tins of paint that have to be bought to cover the $23m^2$.

Answer(c) ..... [2]

d) i) Calculate the length of the edge DE.

Answer (d)(i) ..... [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.

Answer (d)(ii) ..... [3]

12. a) It is given that $\mathbf{u} = \begin{pmatrix} 3 \\ 9 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$

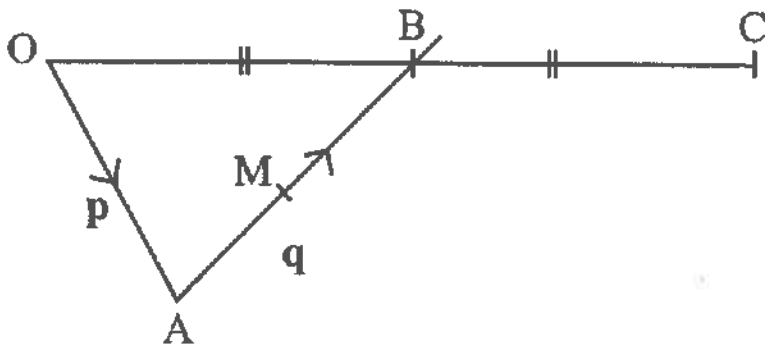
i) Simplify $\mathbf{u} - 3\mathbf{v}$.

Answer (a)(i) ..... [2]

ii) Evaluate $|\mathbf{u} - 3\mathbf{v}|$.

Answer (a)(ii) ..... [1]

b)



In the diagram, $OA = \boldsymbol{p}$, $AB = \boldsymbol{q}$ 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,**

Answer (b)(i) ..... [1]

ii) **OM,**

Answer (b)(ii) ..... [1]

iii) **AC.**

Answer (b)(iii) ..... [1]

iv) OM is produced to a point T (not in the diagram) such that OT = k OM, where k is a constant.

Express **OT** in terms of k, $\boldsymbol{p}$ and $\boldsymbol{q}$.

Answer (b)(iv) ..... [1]

v) If point T is on AC and is such that AT = h AC, form and simplify another expression for **OT** in terms of h, $\boldsymbol{p}$ and $\boldsymbol{q}$.

Answer(b)(v) ..... [1]

vi) Using your answers in (iv), and (v), find the value of h and the value of k.

Answer (b)(vi) .....
..... [3]

vii) Hence, find the ratio of MT : OT.

Answer (b)(vii) ..... [1]

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4004/1

PAPER 1

NOVEMBER 2019 SESSION 2 hours 30 minutes

Candidates answer on the question paper

Additional materials:
Mathematical Instruments

Allow candidates 5 minutes to count pages before the examination.
This booklet should not be punched or stapled and pages should not be removed.

Time 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces at the top of this page.
Write your centre and candidate number in the box on the top right corner of every page of this paper.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Answer **all** questions.
Write your answers in the spaces provided on the question paper using **black** or **blue** pens.
If working is needed for any question, it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
Decimal answers which are not exact should be given to three significant figures unless stated otherwise.
Mathematical tables, slide rules and calculators should **not** be brought into the examination room

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

This question paper consists of 27 printed pages and 1 blank page.

Answer all questions

NEITHER MATHEMATICAL TABLES NOR SLIDE RULES NOR CALCULATORS MAY BE USED IN THIS PAPER

1. Express

(a) $2460\ cm^3$ in litres,

Answer(a) ..... [1]

(b) 1 hectare as a percentage of $0{,}25\ km^2$.

Answer(b) ..... [2]

2. (a) Evaluate $(-8)^{\frac{2}{3}}$.

Answer(a) ..... [1]

(b) Simplify $\sqrt{147}+\sqrt{108}$. Leave the answer in the form $m\sqrt{n}$ where m and n are integers.

Answer(b) ..... [2]

3. Solve the simultaneous equations:

$$3x - y = 2$$
$$5x - 2y = 0$$

Answer .....
..... [3]

4. It is given that $q = -6$, $r = -1$ and $t = 2$.
Evaluate

(a) $\frac{q\,r}{t}$,

Answer(a) ..... [1]

(b) $q\,t - r$,

Answer(b) ..... [1]

(c) $(q + r)^t$.

Answer(c) ..... [1]

5. **(a)** State the order of rotational symmetry of a rhombus.

Answer(a) ..... [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.

Answer(b) ..... [2]

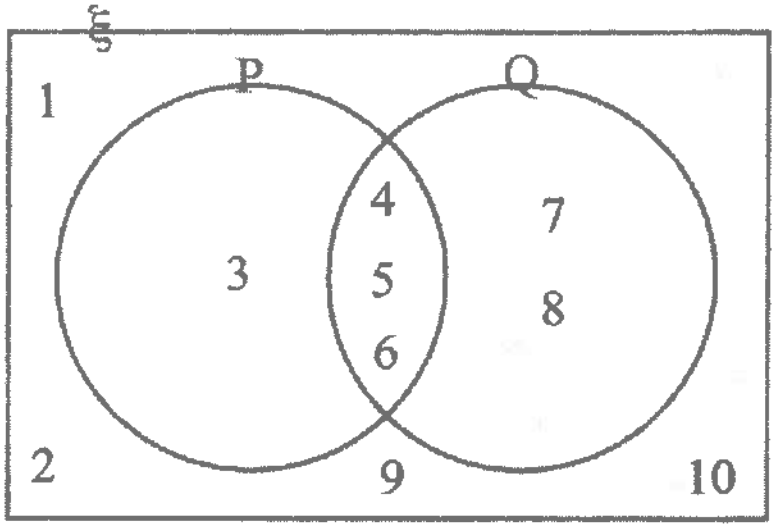
6. (a) Calculate $\frac{2}{3}$ of 54 km.

Answer(a) ..... [1]

(b) Kin, Munashe and Chipo shared sweets in the ratio 5: 3 : 7.
Calculate the total number of sweets shared if Chipo got 35 sweets.

Answer(b) ..... [2]

7. (a)



The Venn diagram consists of the universal set ξ, and subsets **P** and **Q** with their respective elements.

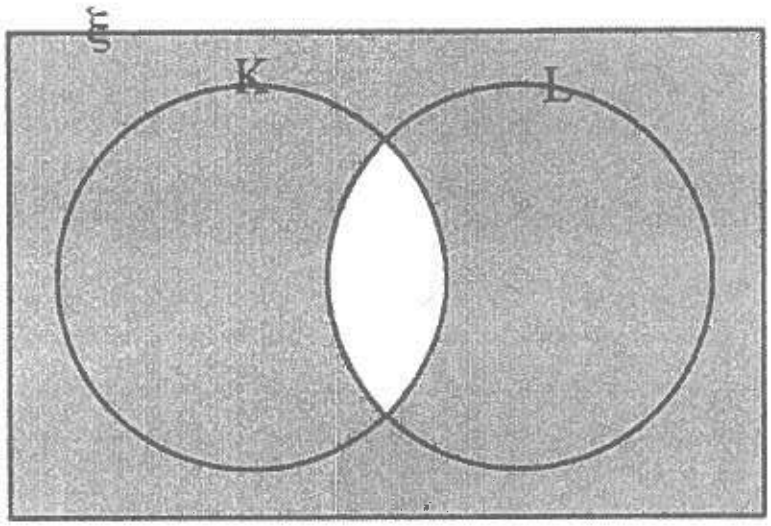
(i) List the element of $P' \cap Q$.

Answer (a)(i) ..... [1]

(ii) Find $n(P \cup Q)'$.

Answer (a)(ii).....[1]

(b)



The Venn diagram consists of the universal ξ, and subset **K** and **L**.
Describe the shaded region in set notation.

Answer(b) ..... [1]

8. Factorise completely

(a) $x^2 - \frac{1}{4}$,

Answer(a) ..... [1]

(b) $x(x-2) - 2xy + 4y$.

Answer(b) ..... [2]

9. **(a)** Express 2214_5 in powers of 5.

Answer(a) ..... [1]

(b) Find n given that $101_n = 37_{10}$.

Answer(b) ..... [2]

10. **(a)** **P** is a 2 × 3 matrix, **Q** is a 3 × 1 matrix and **PQ** = **H**.
State the order of matrix **H**.

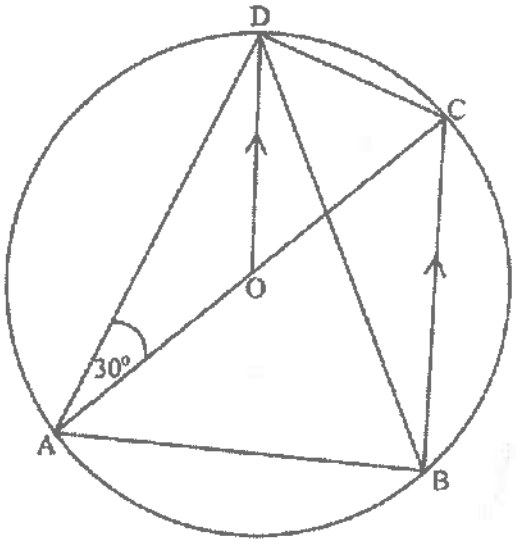
Answer(a) ..... [1]

(b) Matrix $A = \begin{pmatrix} 2 & 1 \\ 3 & -3 \end{pmatrix}$

Find A^2.

Answer(b) ..... [2]

11.



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) $O\hat{D}B$.

Answer(a) ..... [1]

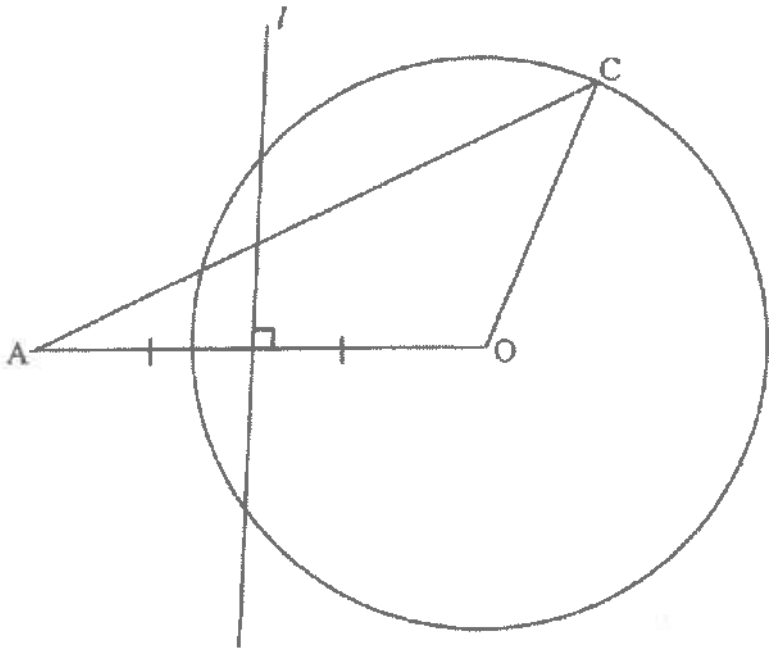
(b) $A\hat{B}D$.

Answer(b) ..... [1]

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

Answer(c) ..... [1]

12.



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

(a) Describe fully the locus represented on the diagram by the

(i) circle,

Answer (a)(i) .....

.....

..... [1]

(ii) line l.

Answer (a)(ii) .....

.....

..... [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.

Answer (b) On the diagram ..... [1]

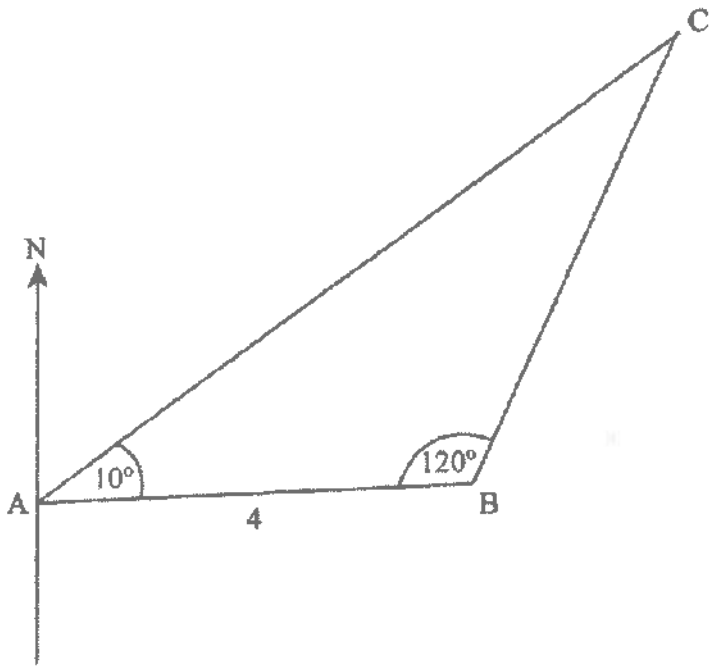
13. (a) Convert US $5,40 to South African Rands.
Use an exchange rate of US $1 to 12 Rands,

Answer(a) ..... [1]

(b) A farmer borrowed $2000 at a simple interest rate of 20% per annum.
Calculate the total amount payable after 2 years.

Answer(b) ..... [3]

14.



In the diagram **A**, **B** and **C** are points on level ground.
Point **B** is 4km due east of **A**. $B\hat{A}C = 10°$ and $A\hat{B}C = 120°$

(a) State the bearing of **B** from **C**.

Answer(a) ..... [1]

(b) Using as much of the information given below as is necessary to calculate **BC**.

[sin 10° = 0,2 cos 10° = 1,0 tan 10° = 0,2]

[sin 50° = 0,8 cos 50° = 0,6 tan 50° = 1,2]

Answer(b) ..... [3]

15. (a) Evaluate $log_3 \frac{1}{243}$

Answer(a) ..... [2]

(b) Solve the equation $\text{Log}_3 81 = (2x - 1)$.

Answer(b) ..... [2]

16.

h	1	2	3	...	q
V	3	24	81	...	648

The table shows some corresponding values of h and V such that $V \propto h^3$.
Find the

(a) equation connecting V and h,

Answer(a) ..... [2]

(b) value of q.

Answer(b) ..... [2]

17. Point A (4; 2) is mapped onto A_1, by a transformation representedby matrix $\begin{pmatrix} 1 & 0 \\ -3 & 1 \end{pmatrix}$.

(a) Calculate the coordinates of point A_1.

Answer(a) ..... [1]

(b) Describe fully the transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ -3 & 1 \end{pmatrix}$.

Answer(b) .....

.....

..... [3]

18. **(a)** Solve the inequality

$$3x - 6 \leq 2x - 3 < 4x + 1.$$

Answer(a) ..... [3]

(b) Illustrate the solution in (a) on a number line.

Answer(b)

..... [1]

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

(a) Find g when $h = 20$.

Answer(a) ..... [2]

(b) Express h in terms of g.

Answer(b) ..... [3]

20. It is given that $\boldsymbol{OA} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $\boldsymbol{OB} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ are position vectors of **A** and **B** relative to an origin **O**.

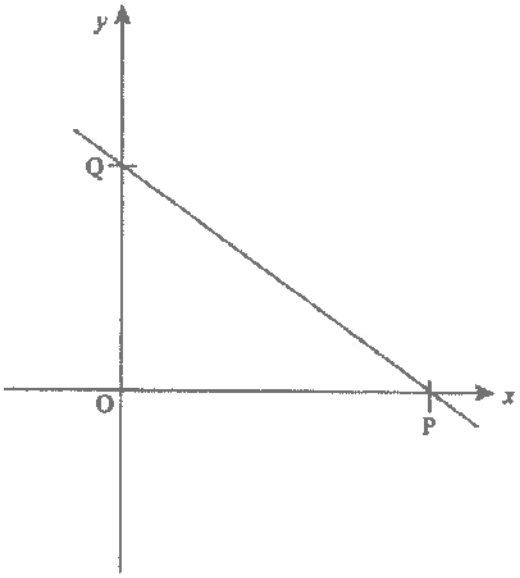
(a) Express **AB** in column form.

Answer(a) ..... [2]

(b) **P** is a point such that **BP** = **OA** + 2**OB**.
Find the coordinates of point **P**.

Answer(b) ..... [3]

21.



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,

Answer (a)(i) ..... [1]

(ii) Q.

Answer (a)(ii) ..... [1]

(b) Calculate the

(i) gradient of line $3x + 4y = 12$.

Answer (b)(i) ..... [1]

(ii) length of line **PQ**.

Answer (b)(ii) ..... [2]

22.

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

The table shows the heights of 30 plants in a school garden.

(a) **(i)** State the modal class height.

Answer (a(i)) ..... [1]

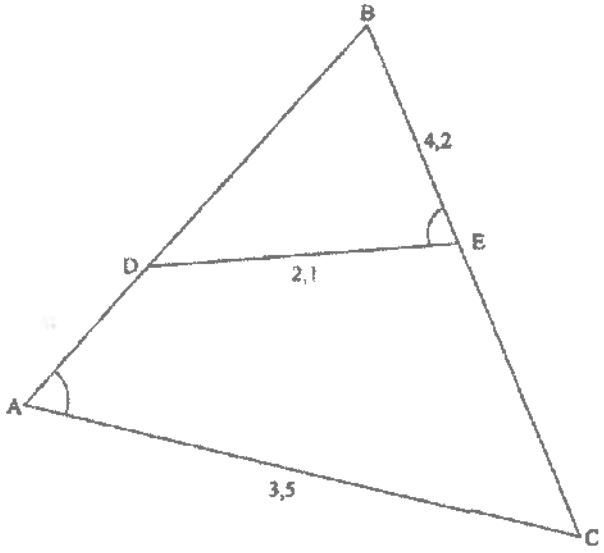
(ii) Estimate the mean height of the plants.

Answer (a)(ii) ..... [3]

(b) A plant is chosen at random from the garden.
Find the probability that its height is more than 40cm but less or equal to 60cm.

Answer(b) ..... [1]

23.



The diagram shows triangle **ABC** in which point **D** and **E** are on **BA** and **BC** respectively **AC** = 3,5cm, **BE** = 4, 2cm, **DE** = 2,1cm and $B\hat{A}C = B\hat{E}D$.

(a) Name the triangle which is similar to triangle **ABC**.

Answer(a) ..... [1]

(b) Calculate

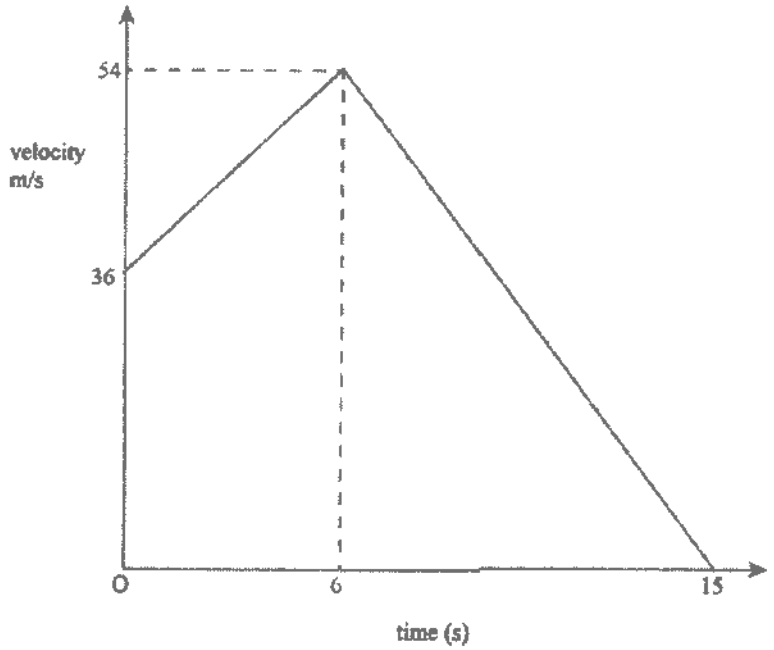
i) **AB,**

Answer (b)(i) ..... [2]

(ii) the area of triangle ABC, given that the area of triangle **BDE** is $22,5cm^2$.

Answer (b)(ii) ..... [3]

24.



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,

Answer(a) ..... [2]

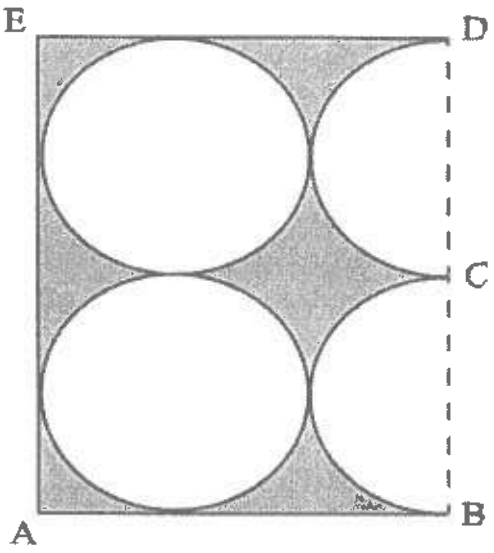
(b) velocity after 10 seconds,

Answer(b) ..... [2]

(c) average speed of the object for the 15 seconds.

Answer(c) ..... [3]

25



[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 = 14cm and **ED** = 10,5cm.
Calculate the

(a) circumference of one of the circular discs,

Answer(a) ..... [2]

(b) perimeter of **ABCDE**,

Answer(b) ..... [2]

(c) area of the shaded part.

Answer(c) ..... [3]

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Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4004/2

PAPER 2

NOVEMBER 2019 SESSION 2 hours 30 minutes

Candidates answer on the question paper

Additional materials:
Mathematical Instruments
Mathematical Tables
Electronic Calculator

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

Time 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces at the top of this page.
Write your Centre and Candidate number in the box on the top right corner of every page of this paper.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Answer **all questions** in Section A and **any four questions** from Section B.
Write your answers in the spaces provided on the question paper using **black** or **blue** pens.
If working is needed for any question, it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.
Decimal answers in degrees should be given correct to one decimal place.
Mathematical tables and Electronic calculators may be used to evaluate explicit numerical expressions.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

This question paper consists of 31 printed pages and 1 blank page.

Candidate Name | Centre Number | Candidate Number

SECTION A (52 Marks)

Answer **all** questions in this section

1. **(a)** Simplify $4 - \left(1\frac{3}{4} + 1\frac{2}{3}\right)$

Answer(a) ..... [1]

(b) 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.

Answer(b) ..... [2]

(c) 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 2928 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.

Answer (c)(i) ..... [2]

(ii) Calculate the cost per day of an Executive room.

Answer (c)(ii) ..... [3]

2. **(a)** Matrix A = $\begin{pmatrix} x+2 & 14 \\ 3 & 3 \end{pmatrix}$. The determinant of Matrix A is less than 7.

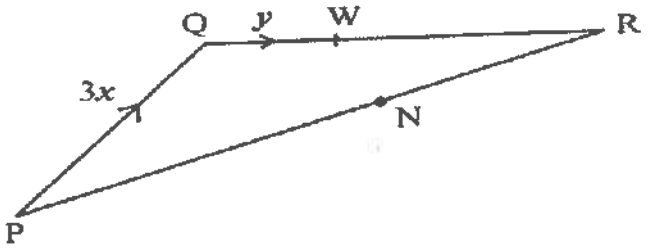
(i) Find the largest integer value of x.

Answer (a)(i) ..... [3]

(ii) Find A^{-1}, the inverse of matrix A using the value of x in **(a)(i)**.

Answer (a)(ii) ..... [2]

(b)



In the diagram $\overrightarrow{PQ} = 3x$ and $\overrightarrow{QW} = y$. 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 x and /or y

(i) $\vec{QR}$,

Answer (b)(i) ..... [1]

(ii) $\vec{PR}$,

Answer (b)(ii) ..... [1]

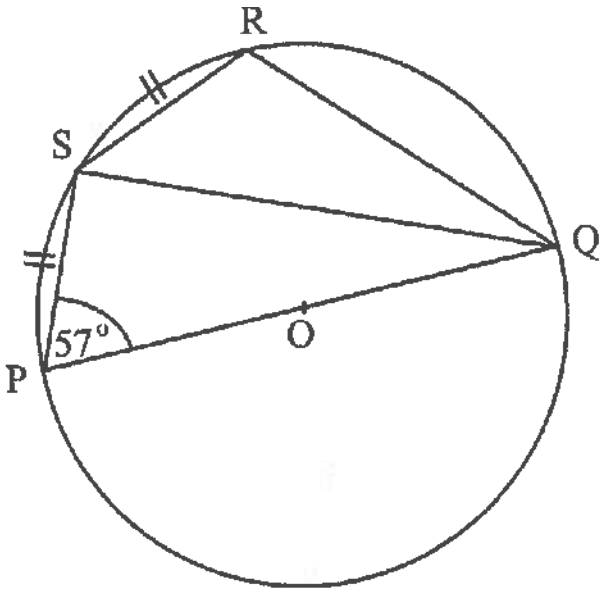
(iii) $\vec{PN}$,

Answer(b)(iii) ..... [1]

(iv) $\vec{QN}$.

Answer (b)(iv) ..... [2]

3. (a)



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 $S\hat{Q}R$.

Answer (a)(i) ..... [1]

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

Answer (a)(ii) ..... [1]

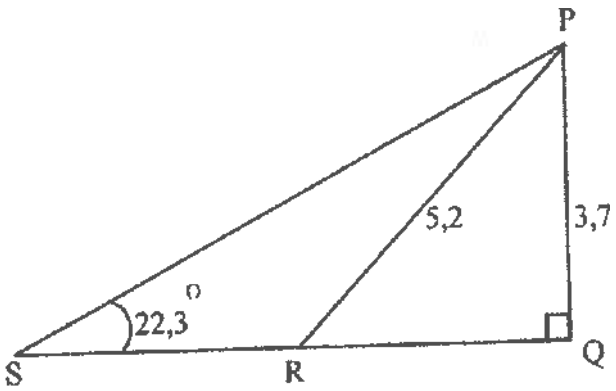
(iii) Find $Q\hat{R}S$.

Answer (a)(iii) ..... [1]

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

Answer (a)(iv) ..... [2]

(b)



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**,

Answer (b)(i) ..... [2]

(ii) $S\hat{P}R$.

Answer (b)(ii) ..... [2]

(iii) $Q\hat{P}R$.

Answer (b)(iii) ..... [2]

4. (a) A sweet shop sells cylindrical sweets each of diameter 3,8 cm and length 4,9 cm.

In this question take π to be $\frac{22}{7}$

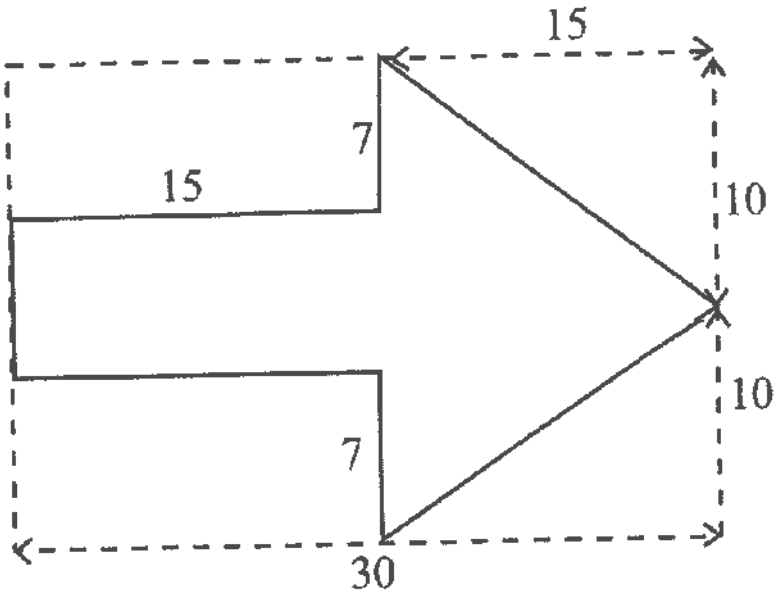
(i) Calculate the volume of one sweet.

Answer (a)(i) ..... [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.

Answer (a)(ii) ..... [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,

Answer (b)(i) ..... [3]

(ii) perimeter of the arrow.

Answer (b)(ii) ..... [4]

5. Answer the whole of this question on the blank space below.

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 .

Answer (a)(i) On diagram [6]

(ii) Construct the bisector of $A\hat{B}C$.

Answer (a)(ii) On Diagram [2]

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

Answer(b) .....

..... [2]

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

Answer(c) ..... [1]

Candidate Name	Centre Number	Candidate Number

SECTION B (48 Marks)

Answer **any four** questions from this section.

Each question carries **12** marks.

6. **(a)** Solve the equation

$$3^{k} = \frac{81^2 \times 3^5}{3^{11}}$$

Answer(a) ..... [2]

(b) Factorise completely

i) $6y^2 - 10y + 4$.

Answer (b)(i) ..... [2]

(ii) $ax + b + a + bx$.

Answer (c)(ii) ..... [2]

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

Answer(c) ..... [3]

(d) It is given that $p \propto t^{-3}$ and that $p = 4$ when $t = 2$.

(i) Find a formula connecting p and t.

Answer (d)(i) ..... [2]

(ii) Find the value of t when $p = \frac{1}{2}$.

Answer (d)(ii) [1]

Candidate Name	Centre Number	Candidate Number

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

Answer(a) ..... [3]

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

DATE	Details	CR	DR	BALANCE
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*,

Answer (b)(i) ..... [1]

(ii) Y,

Answer (b)(ii) ..... [1]

(iii) Z.

Answer (b)(iii) ..... [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,

Answer (c)(i) ..... [2]

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

Answer (c)(ii) ..... [3]

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

Answer (c)(iii) ..... [1]

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

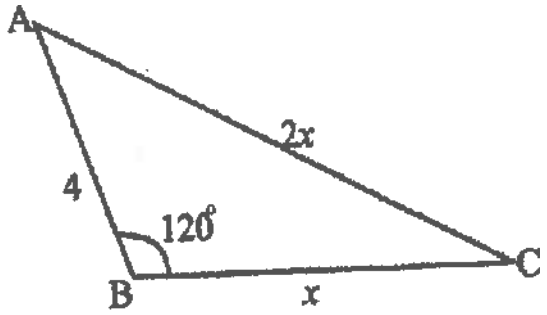
(i) Find the value of A when $b = 1,5$ and $h = 0,8$.

Answer (a)(i) ..... [2]

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

Answer (a)(ii) ..... [2]

(b)



In the diagram, ABC is a triangle in which AB = 4 cm, BC = x cm, AC = $2x$ cm and $A\hat{B}C = 120°$.

(i) Form an equation in x and show that it reduces to $3x^2 - 4x - 16 = 0$.

Answer (b)(i)

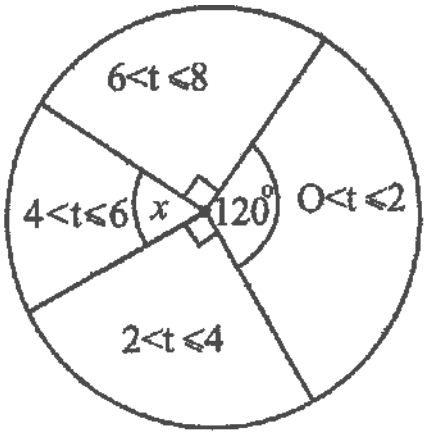
..... [3]

(ii) Solve the equation $3x^2 - 4x - 16 = 0$, giving the answers correct to 3 significant figures.

Answer (b)(ii) .....

..... [5]

9.



The pie chart represents the time, t, hours spent by 240 people on charity work.

(a) Find the value of x.

Answer(a) ..... [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,

Answer (b)(i) ..... [1]

.....

(ii) q,

Answer (b)(ii) ..... [1]

(iii) r.

Answer (b)(iii) ..... [1]

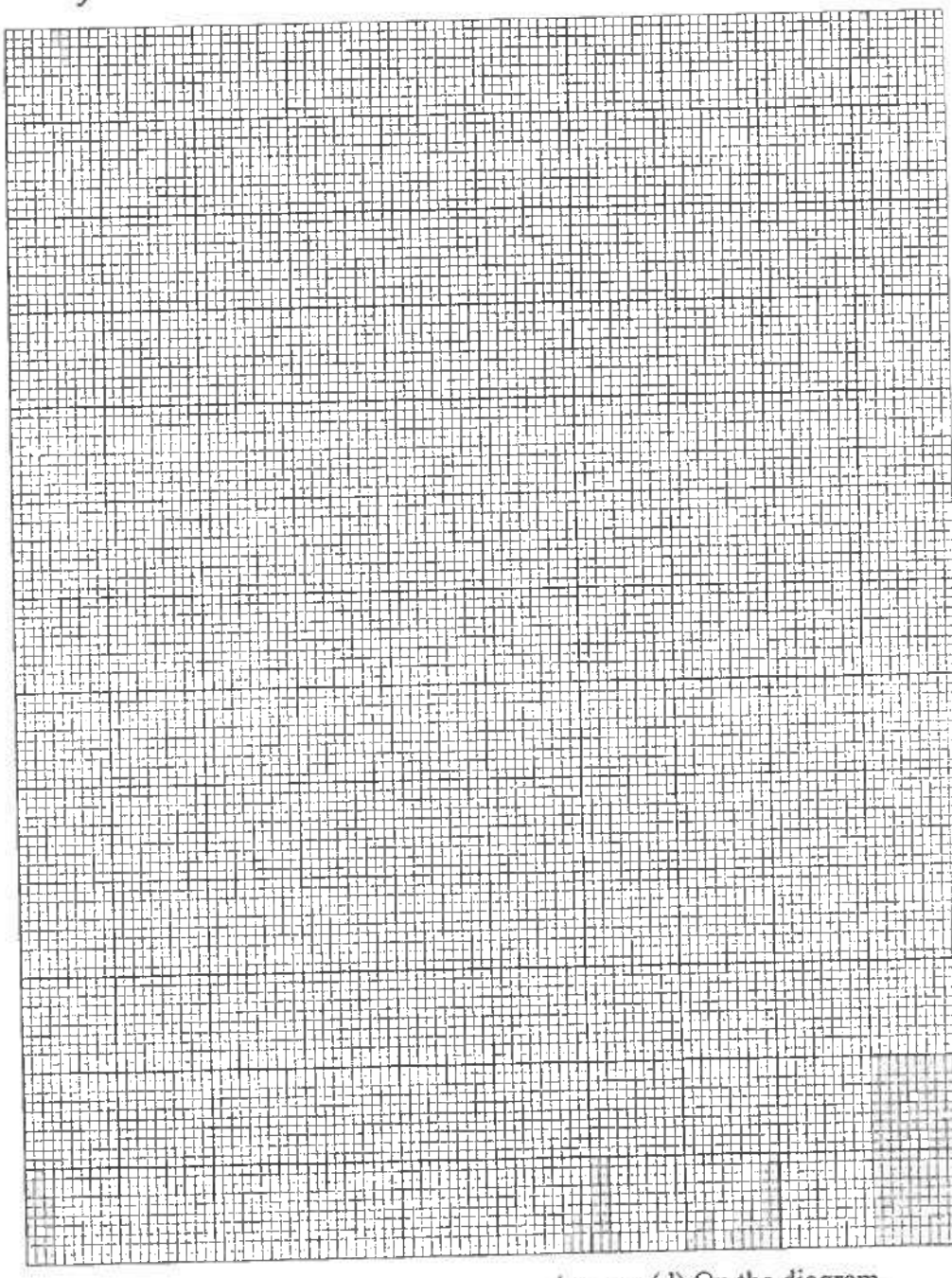
(c) Calculate an estimate of the mean time spent on charity work.

Answer(c) ..... [3]

(d) Two people chosen at random from the whole group, find the probability that they both spent more than 4 hours doing charity work.

Answer (e) .....[2]

(e) Draw a frequency polygon on the grid below 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.



Answer (d) On the diagram ..... [3]

10.

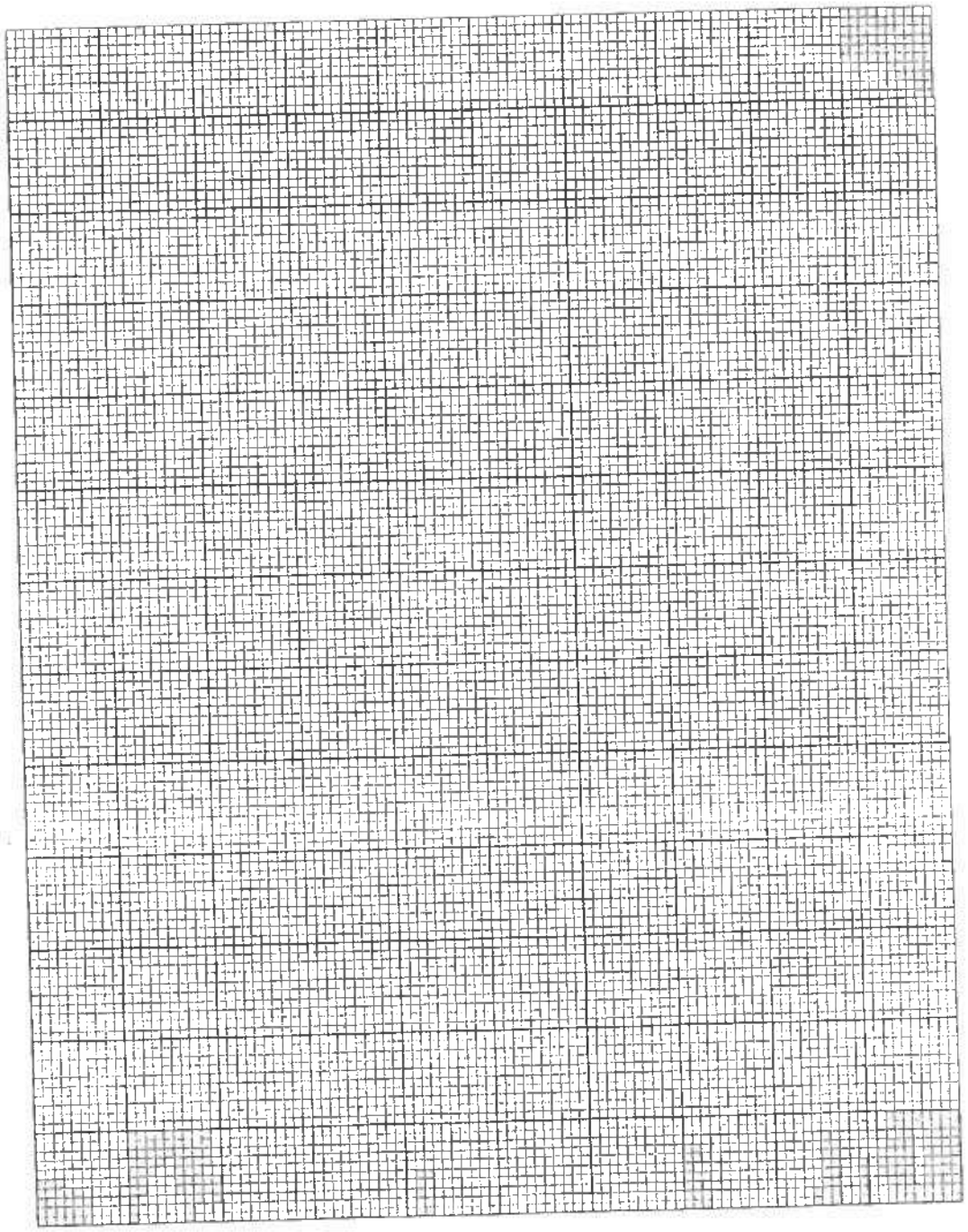
The following is a table of values for the function $f(x) = x^3 - 4x^2 + 4$

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.

Answer(a) ..... [1]

(b) Draw the graph of $f(x) = x^3 - 4x^2 + 4$ on the grid on page 24. Use a scale of 2 cm to 1 unit on both axes.



Answer (b) on graph [4]

(c) Use the graph to find the

(i) coordinates of the minimum turning point of the graph,

Answer (c)(i) ..... [1]

(ii) roots of the equation $x^3 - 4x^2 + 4 = 0$

Answer (c)(ii) .....

.....

..... [3]

(iii) area bounded by the graph, x-axis, and the lines $x = 2$ and $x = 3$,

Answer (c)(iii) ..... [2]

(iv) the range of values of x for which $f(x) < -4$.

Answer (c)(iv) ..... [1]

11. **(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.

Answer(a) ..... [1]

(b) Beans require 2 bags of fertilisers per hectare while peas require 4 bags of fertilisers per hectare. The department has 16 bags of fertilisers for this project.

Write down another inequality in x and y and show that it reduces to $x + 2y \leq 8$.

Answer (b)

..... [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.

Answer(c) .....

..... [2]

(d) Answer this part of the question on the grid on **page 28**. Use a scale of 2 cm to 2 units on both axes.

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.

Answer (d) On diagram ..... [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 realised.

Answer (e)(i) .....

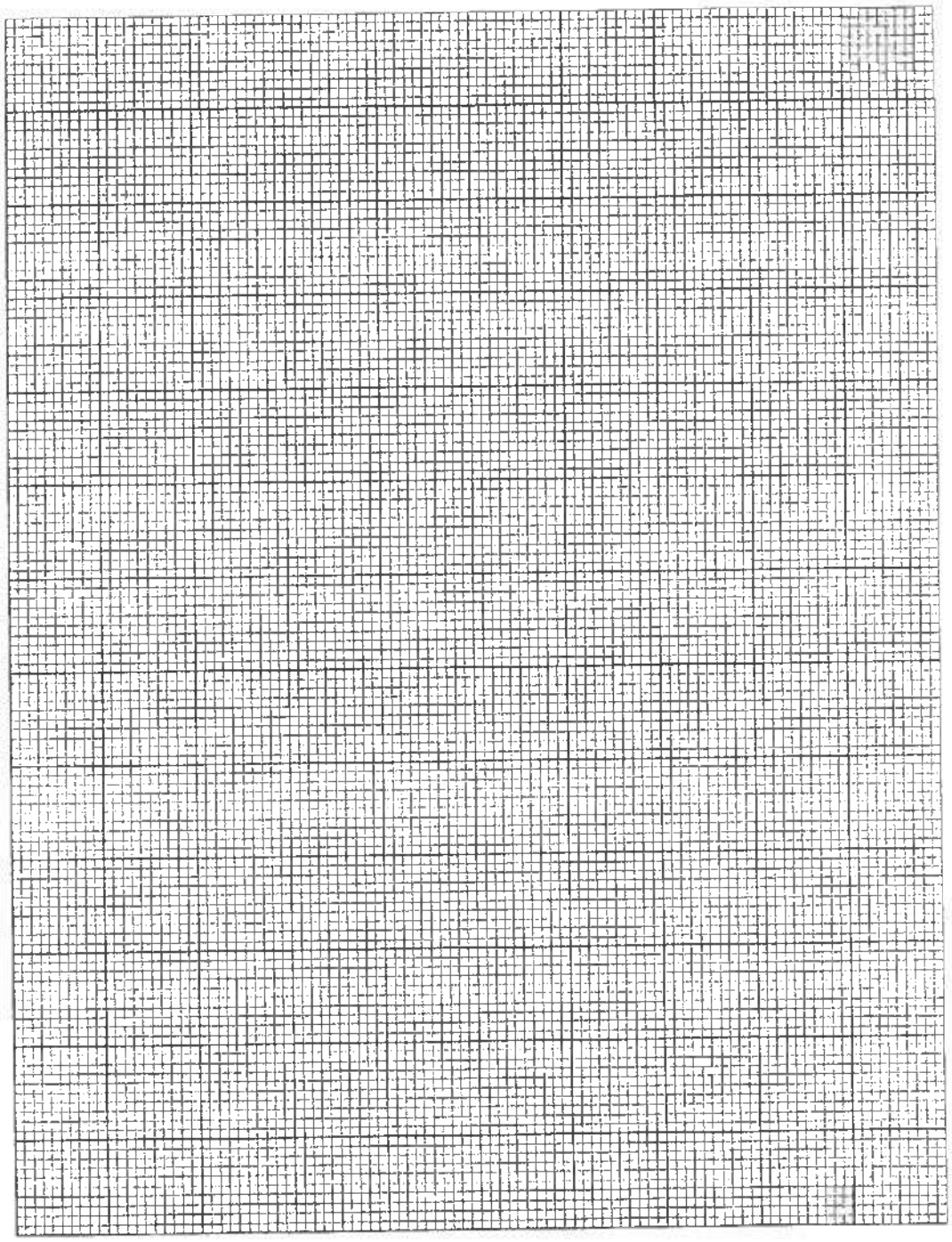
..... [2]

(ii) Find the expected maximum profit that may be realised.

Answer (e)(ii) ..... [1]

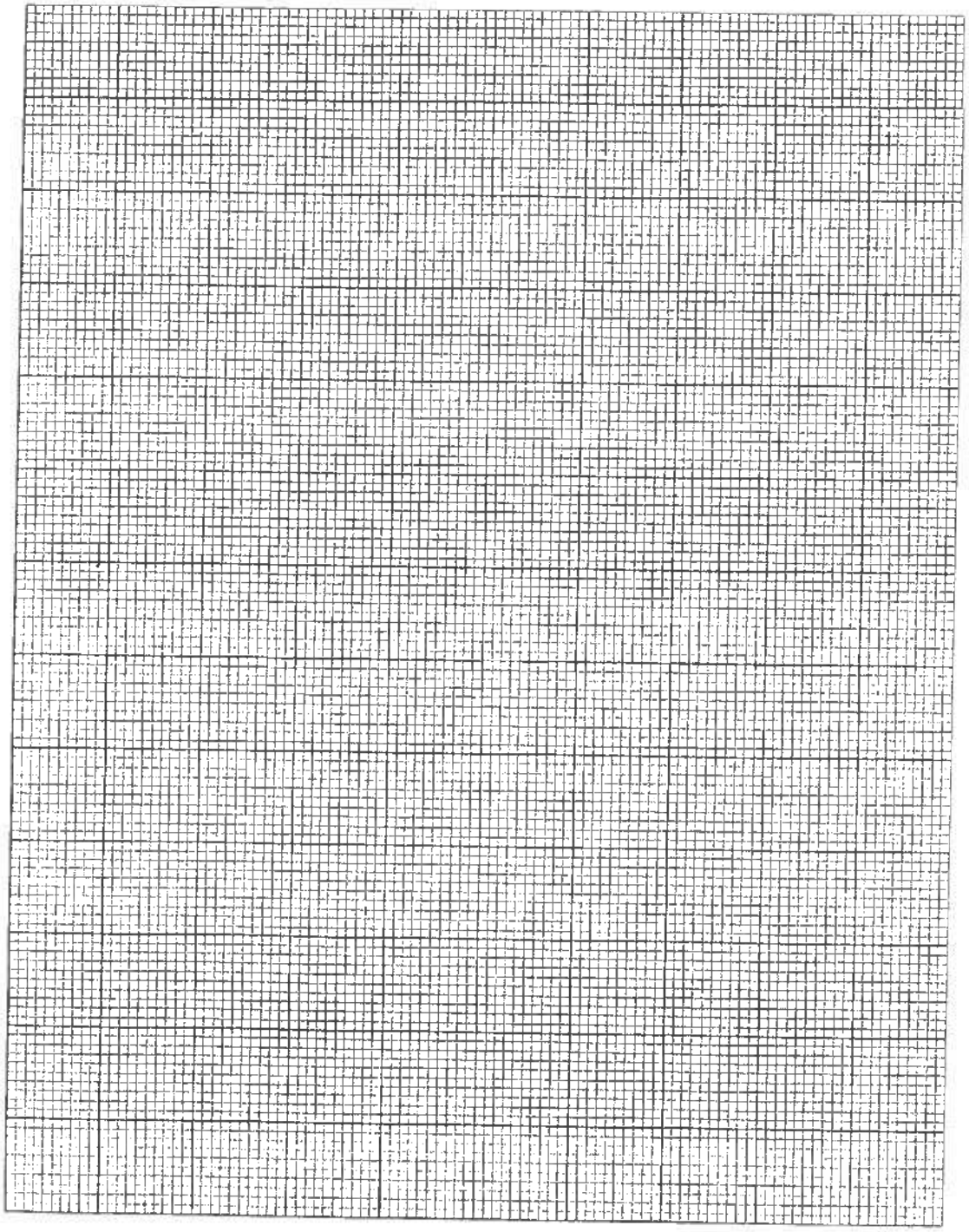
Candidate Name | Centre Number | Candidate Number

28



Candidate Name	Centre Number	Candidate Number

12. Answer some parts of this question on this grid below. Use a scale of of 2 cm to 2 units on both axes.



Candidate Name | Centre Number | Candidate Number

30

(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,

Answer (a)(i) on the graph ..... [1]

(ii) triangle B,

Answer (a)(ii) on the graph ..... [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.

Answer (b) on the graph ..... [3]

(c) Point (– 2; 2) is translated onto (6; – 2).

Find the translation vector.

Answer(c) ..... [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.

Answer(d) .....

.....

..... [3]

(e) Describe fully the single transformation that maps triangle A onto triangle B.

Answer
(c) .....

.....

..... [3]

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ZIMSEC

ORDINARY LEVEL MATHEMATICS

SECTION B: SUGGESTED ANSWERS

Individual Tuition Centre

Zimsec Ordinary Level Mathematics

June 2018 Paper 1 Suggested Answers

Individual Tuition Centre

1. a) i) 3.598×10^3 ii) 3600 b) 60

2. a) i) 4.885 ii) 0.4752 b) $4\frac{5}{24}$

3. a) 12.25 am b) i) Friday ii) 00 15

4. a) 0.3 b) $\frac{4}{3}$ c) $\frac{1}{9}$

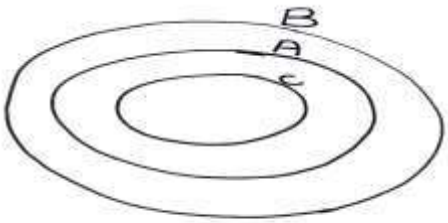
5. a) 9 b) 24

6. a) 647 b) 35_6

7. a) 42° b) 48° c) 96°

8. a) 24 b) $2^{2(2n-3)} = 2^3$ gives n = $\frac{9}{4}$

9. a) Diagram



9. $(\boldsymbol{P} \cap \boldsymbol{Q}) \cup (\boldsymbol{P} \cap \boldsymbol{R})$ or equivalent.

10. a) $y = k(x = 3)^2$ b) k = 4 , y = 196

11. $x = 4\frac{1}{2}$ y = 1

12. a) $-\frac{3}{2}$ b) (0 ; 6)

13. $\frac{3x^2}{x(x-5)} \times \frac{(x-5)(x+5)}{x} = 3(x-5)$

14. a) 86 b) $\frac{5(F-32)}{9}$

15. a) $-23x + 21 \quad or \quad 31 - 23x$

b) 3.35 x 6 = 20.1 cm

16. a) i) $x(x+1)(x-1)$ ii) $(x+1)^2$

b) $(x+1)$

17. a) $\begin{pmatrix} 5 \\ -4-x \end{pmatrix}$ b) i) 5

ii) $\begin{pmatrix} 6 \\ -8 \end{pmatrix} = \begin{pmatrix} 6 \\ -3x \end{pmatrix}$ $x = \frac{8}{3}$

18. a) 13 b) $\frac{x+76}{7} = 13 \quad x = 15$

19. a) $\frac{1}{2}$

b) Question is not clear. 1 is both a perfect square and a factor of 21. Refer to similar questions.

20. a) i) $x < \frac{13}{2}$ ii) 4

b) Scale factor = $\frac{3}{2}$ Volume factor = $\frac{27}{8}$

Mass = $\frac{27}{8} \times 40 = 135\ g$

21. a) 15.66 cm^2 b) $\sqrt{133}$ cm

22. a) $\frac{18}{4} = 4.5\ m/s^2$

b) Area under the graph = 234 m.

c) $\frac{30}{T-9} = 6\ (Deceleration)\ so\ T = 14\ s$

23. a) 10 cm b) Add areas of 5 faces: 624 cm^2

24. a) i) $\log_3 9 = 2$ ii) -1

b) $\log 23 + \log 81^{\frac{1}{2}} = \log(8 \times 9) = \log 72$.

25. i) p = 5 ii) q = -7 ii) r = 9

26. a) Translation of vector $\begin{pmatrix} 3 \\ -6 \end{pmatrix}$

b) i) $y = -x$ ii) $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$

Zimsec Ordinary Level Mathematics

June 2018 Paper 2 Suggested Answers

1. a) 30.8 (Bodmas)

b) $\frac{90}{100}C = 45 \ so \ \ C = \$50$

c) i) 10 ii) $2(k+2)(k-2) = 0$

$k = 2 \ or \ -2$

2. a) 89° b) i) 4ab(a – 5b) ii) (3a – 2)(a + 3)

c) **i)** 30 **ii)** $f^2p = 2(H - mp)$ so $f = \sqrt{\frac{2(H-mp)}{p}}$

3. $a)$ $\$a = cost \ of \ apples \ per \ kg$

$\$b = cost \ of \ bananas \ per \ kg$

$So \ 3a + 7b = 16 \ and \ 4a + 5b = 17$

$Giving \ a = 3 \ \ b = 1$

b) i) $W = \frac{9x}{\sqrt{u}}$ $ii) \ 36$

c) i) $\begin{pmatrix} 0 & 2 \\ 1 & 7 \end{pmatrix}$ ii) $\begin{pmatrix} 10 & -6 \\ 7 & -3 \end{pmatrix}$ iii)$-\frac{1}{2}\begin{pmatrix} 1 & -2 \\ -3 & 4 \end{pmatrix}$

4. a) i) 23° ii) 40° iii) 70° iv) 70°

b) ξ = $\{-3; \ -2; \ -1; \ 0; \ 1; \ 2; \ 3\}$

i) **1.** $A = \{-2; \ -1; \ 0; \ 1\} \ B = \{-1; \ 0; \ 1; \ 2; \ 3\}$

2. A' U B' = $\{-3; \ -2; \ 2; \ 3\}$

ii) $n(A \cap B) = 3$

b) i) $180(n-2) = 360 \ \ggg \ n = 4$

$ii) \ quadrilateral$

5. a) $Amount \ shared \ = \ A$

$\frac{2}{3}A + \frac{3}{4}\left(\frac{1}{3}A\right) = \frac{11}{12}A \ leaving \ \frac{1}{12}A$

$So \ \frac{1}{12}A = 3 \ and \ A = \$36$. What a question!

b) $3 \times 4 = 2 \times t \ ie \ \ t = 6 \ hours.$

c) $1 \times \boldsymbol{n^2} + 1 \times \boldsymbol{n^1} + 1 \times \boldsymbol{n^0} = \boldsymbol{7}$

$n^2 + n - 6 = 0 \ i.e \ \ (n + 3(n-2) = 0$

$\boldsymbol{n = 2} \ \ \boldsymbol{N.B} \ n \neq -3 \ as \ \boldsymbol{n} \ can't \ be \ negative.$

6. See attached diagram (locus).

7. a) i) V =Πr2h = $\frac{22}{7} \times 0.375^2 \times 1.5 = 0.663m^3$

ii) Area = 2Πrh =2 × $\frac{22}{7} \times 0.375 \times 1.5 = 3.54m^2$

b) i) Multiply every term by $3x(x+2)$

You get $3(x+2) - 3x = x(x+2)$

So $x^2 + 2x - 6 = 0$

ii) $x = \frac{-2 \pm \sqrt{4 - \ 4(1)(-6)}}{2} = \frac{-2 \ \pm \ \sqrt{28}}{2}$

$x = 1.65 \ or \ -3.65$

8. See attached diagram.

9. a) Show the points on a diagram.

i) $\frac{\boldsymbol{XY}}{\boldsymbol{Sin100}} = \frac{\boldsymbol{200}}{\boldsymbol{Sin54}} \ \ggg XY = 243 \ m.$

ii) $Sin \ 26 = \frac{d}{200} \ggg d = 87.7 \ m.$

b) $\frac{18\,000}{5} = 3\,600s = 1 \ hour.$ c) $285

d) $Amount = P. \ \ Interest \ earned = I$

$P + I = 555$ i.e $P + \frac{PRT}{100} = 555$

So $P\left(1 + \frac{RT}{100}\right) = 555$

$giving \ P\left(1 + \frac{12 \times \frac{11}{12}}{100}\right) = 555$

$i.e \ 1.11P = 555$ and $P = \$500.$

Interesting one!

10. See attached diagram.

11. a) i) $S < x \leq 10$

ii) $p = -40 \ \ q = 17.5 \ \ r = 10 \ \ S = 22$

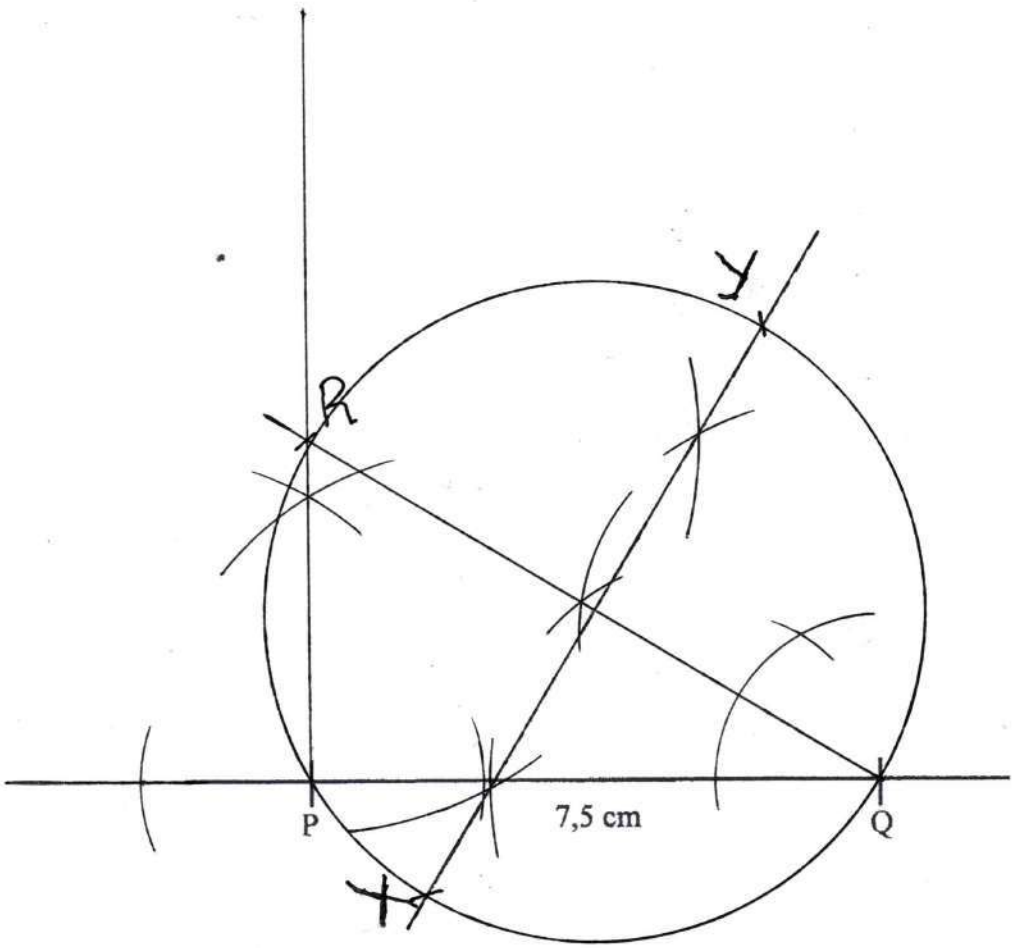
iii) Mean = 12.5 + $\frac{22}{30} = 13\frac{7}{30}$

b) i) $\frac{5}{30} \times \frac{12}{29} + \frac{12}{30} \times \frac{5}{29} = \frac{4}{29}$ ii) $\frac{7}{30} \times \frac{6}{29} = \frac{7}{145}$

12. See attached diagram.

Centre Number		Candidate Number	
X	X	X	X

6 Answer the whole of question 6 on this page.



Answer

(a) *(i)* On the diagram [4]

(ii) On the diagram [2]

(iii) On the diagram [1]

(b) *(i)* 1. 4,3 ± 0,1 cm [1]

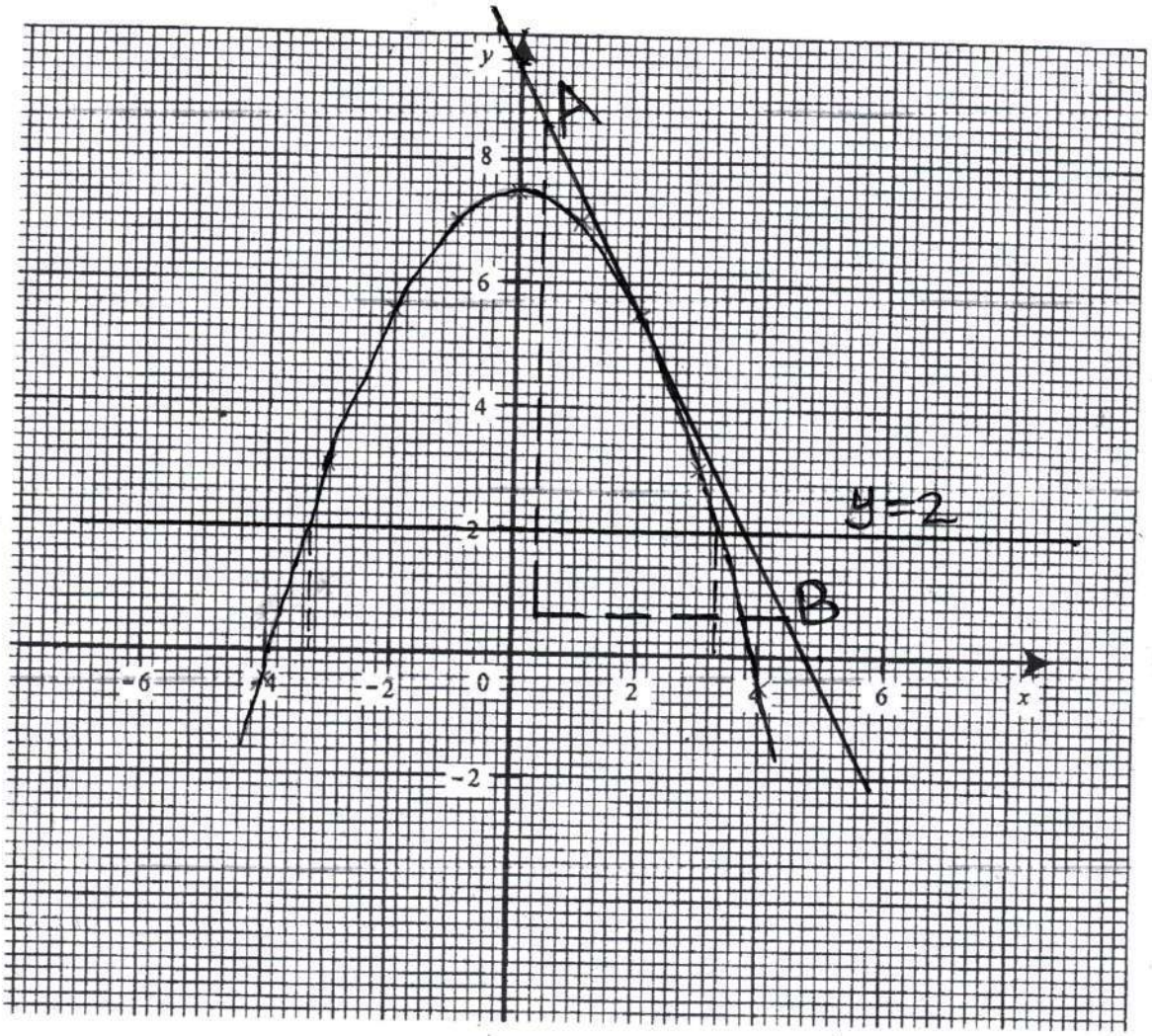
2. 4,3 ± 0,1 cm [1]

(ii) on the diagram [2]

(iii) cyclic quad [1]

Centre Number		Candidate Number	
X	X	X	X

17



a) i) $m = 3$ ii) $n = 5.5$

$A(0,4; 8,6)$ $B(4,4; 0,6)$

Gradient $= \frac{8,6 - 0,6}{0,4 - 4,4} = -2$

Answer (b) *(i)* On the graph [4]

(ii) On the graph [1]

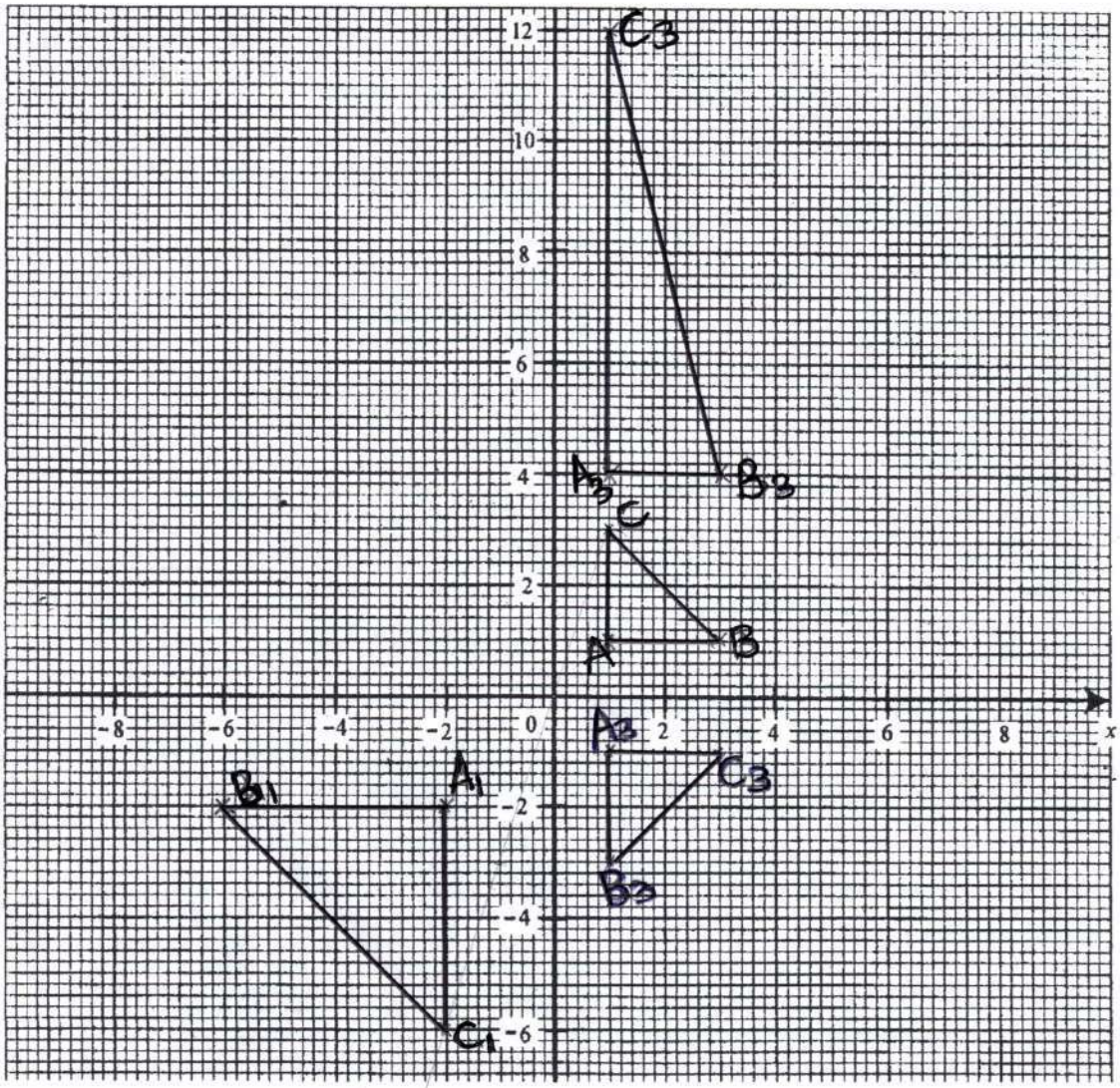
(c) *(i)* $x = 0$ [1]

(ii) $x =$ 3,3 or $-3,3$ [2]

(iii) Gradient $= -2$ [2]

Centre Number		Candidate Number	
X	X	X	X

10 Answer the whole of question 10 on this page.



Answer (a) *(i)* On the graph [1]

(ii) On the graph [1]

(iii) On the graph [2]

(iv) On the graph [3]

(b) *(i)* Enlargement, Factor -2
Centre (0, 0)

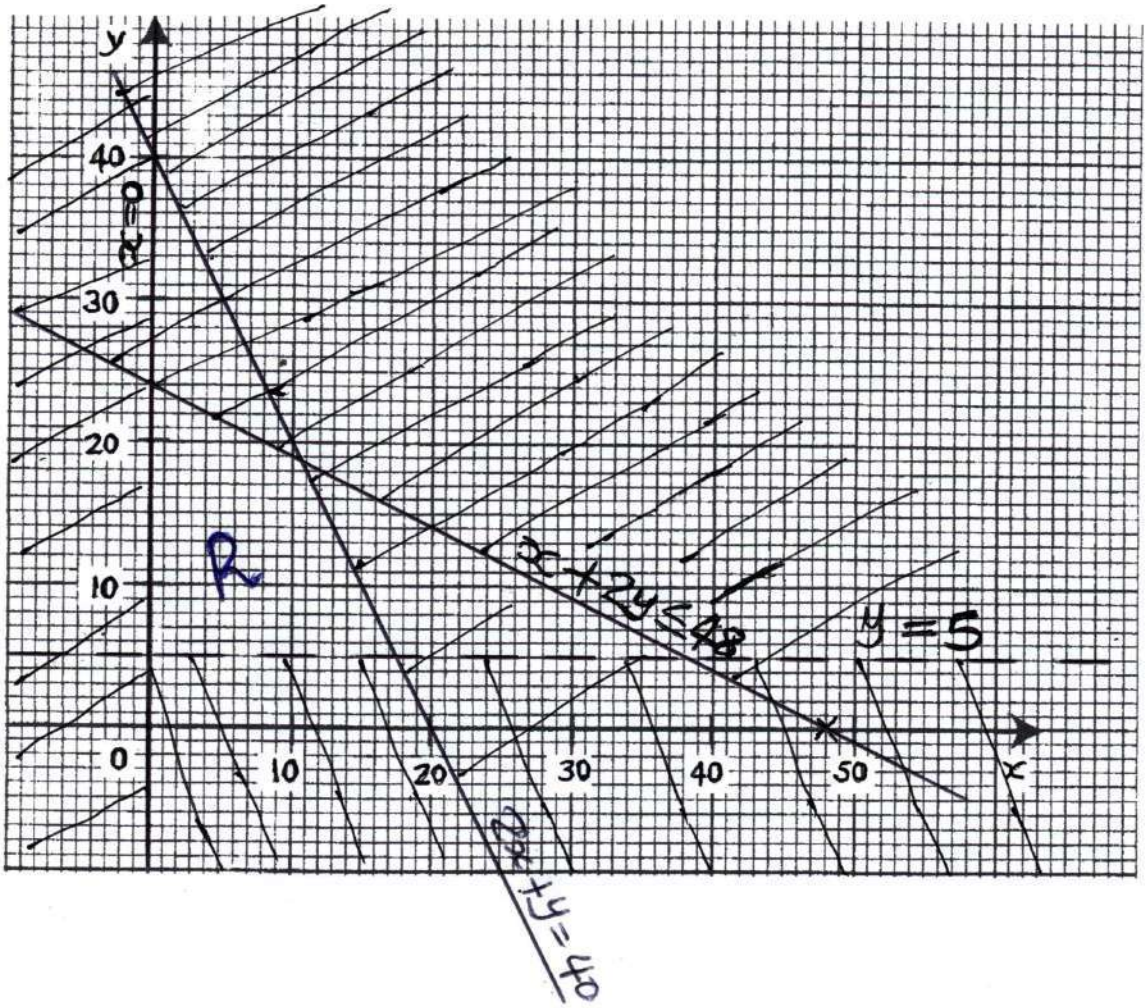
[3]

(ii) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

[2]

Centre Number		Candidate Number	
×	×	×	×

12 (a) **Answer the whole of question 12 on this page.**



Answer (a) (i) On the graph [2]

(ii) On the graph [2]

(iii) On the graph [2]

(iv) On the graph [2]

(b) On the graph [1]

(c) (i) $\left(\frac{32}{3}, \frac{56}{3}\right)$ [2]

(ii) $29\frac{1}{3}$ [1]

Zimsec Ordinary Level Mathematics

November 2018 Paper 1 Suggested Answers

Individual Tuition Centre

1. a) $\frac{8}{25}$ b) **0.24** c) 1.25×10^{-1}

2. a) √64 b) $\sqrt{\left(\frac{3}{2}\right)}$, π

3. a) **4 302** b) i) **100 001** ii) **44_7**

4. a) 12.45 am [Without **a.m**, answer is wrong!]

b) **17 38** [Do not write hrs!]

c) **500 ha.**

1 ha = 10 000 m²

1 km² = 1000 000 m²

5. a) $60\,700$

b) 2.591×10^{-1}

6. a) **42°** b) **138°** c) **48°**

7. **x = 1 y = 3**

8. a) $k = fw = 60\,750$ b) **121.5**

9. a) **45.40**

b) $7.5 \leq t < 8.5$

10. a) $3x(x - 5)$

b) $\boldsymbol{4l^2m}$ --- Start with numbers then letters.

11. a) Gradient $= \frac{5-2}{8-6} = \frac{3}{2}$

b) $\frac{y-2}{x-6} = \frac{3}{2}$

So **y = 1.5x – 7** or **y = $\frac{3}{2}$x – 7**

12. $\frac{2a+6}{a-3} \div \frac{a+3}{(a+1)(a-3)}$

$= \frac{2(a+3)}{a-3} \times \frac{(a+1)(a-3)}{a+3}$

$= 2(a + 1)$ ***or*** $2a + 2$

13. a) **35 : 8** **3.75** tonnes

14. a) $x > -\frac{4}{7}$ b) **0** (zero)

15. a) **10**

15. b) $log\left(\frac{1}{b}\right) = logb^{-1} = -log\, b = -7$

c) $\frac{1}{3} log\, a = \frac{1}{3} \times 3 = 1$

16. a) $f(3) = 7 \times 5 = 35$

b) **m = 6**

17. a) $\begin{pmatrix} -x \\ -4 \end{pmatrix}$ b) $3\ or\ -3$

18. a) **square** (rhombus is wrong!)

b) Sum of angles = 720° $x = 129.$

19. a) 6√2 cm b) sin ACD = sin 45° = $\frac{\sqrt{2}}{2}$

c) **tan ACB = 1** so **tan ACD** = -1 (obtuse)

20. a) i) $6 < h \leq 8$ ii) $6 < h \leq 8$

21. a) $\frac{1}{4}$ b) $\frac{1}{6}$ c) $\frac{7}{12}$

22. a) 46.8 km/h (use 36 km/h = 10m/s)

b) i) **78m** (area under graph)

ii) **-4 m/s²**

23. a) **30°** b) **60°**

c) **$7\frac{1}{3}$ cm**

d) **$25\frac{2}{3}$ cm²**

24. a) P = $\{2,\ 3,\ 5,\ 7\}$ Q = $\{1,\ 4,\ 7\}$

M = $\{3,\ 6,\ 9\}$ N.B: 1 is not a prime number.

b) **0 (zero)**

c) Draw universal set.

Draw M in the middle, intersecting with P and with S. Fill in the gaps correctly.

25. a) Translation of vector $\begin{pmatrix} -6 \\ 3 \end{pmatrix}$

b) i) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ ii) Triangle Z **must** have vertices at

(8 ; 2) , (4 ; 10) and (12 ; 10)

Zimsec Ordinary Level Mathematics

November 2018 Paper 2 Suggested Answers

1. a) i) $3bx$ ii) $4-4x$ *or* $4(1-x)$ b) $\mathbf{P = 1}$

c) $\frac{-5}{(x-2)(x+3)}$ **or** $\frac{5}{(2-x)(x+3)}$

2. a) i) \$10 ii) \$6.52 iii) \$36.40

b) Total amount = $P(1+\frac{i}{100})^n$

= $400(1+\frac{3}{100})^3$ = **\$437.09**

3. a) i) $-4 \leq x \leq 2$ ii) Correct diagram

b) $R^2(Q+bx) = ax - p$

$R^2Q + p = ax - R^2bx$ *So* $\boldsymbol{x = \frac{R^2Q+p}{a-R^2b}}$

c) $(2m^2n+m)(mn-2)$

4. See attached diagram

5. a) i) A = $\{1,\ 4,\ 9\}$ B = $\{4\ ;\ 8\}$

ii) $\{4\}$ ii) 4

b) i) Venn diagram, P wholly inside Q.

Q wholly inside R.

ii) $\boldsymbol{R \supset P}$

c) i) R—B : $\frac{3}{9}$ (or $\frac{1}{3}$)

B— R: $\frac{7}{9}$

B— B: $\frac{2}{9}$ ii) $\frac{7}{15}$

ii) 1 – P(no red) = 1 - $\frac{6}{90}$ = $\mathbf{\frac{14}{15}}$

or $\frac{7}{15} + \frac{21}{90} + \frac{21}{90} = \frac{14}{15}$

6. a) $\frac{25+90+462.5+892.5+225}{120}$ **=** $\frac{1695}{120}$ = **14.125**

b) i) $n = 59$

ii) Correct scale. Smooth curve.

c) i) Median age = 15 $\frac{1}{2}$ years

ii) Upper quartile = 17.5 years

7. a) i) 65° ii) **AC** = 9.78 km (sine rule)

7. a) iii) 9 sin35° = 5.16 km

b) i) **54°** ii) **72°** iii) **18°** vi) **36°**

8. a) i) $y = \frac{k}{\sqrt{x}}$ $k = 6$ So $\boldsymbol{y = \frac{6}{\sqrt{x}}}$

ii) $x = 12^2 = 144$

b) i) $\log[(3x+1)(x-3)] = log10$

$(3x+1)(x-3) = 10$

$3x^2 - 8x - 13 = 0\ (shown)$

ii) Use quadratic formula; $x = 3.8\ or\ -1.1$

9. a) a) i) $\boldsymbol{\overrightarrow{BC}} = -a + b$ ii) $\boldsymbol{\overrightarrow{BN}} = -\frac{1}{3}a + \frac{1}{3}b$

iii) $\boldsymbol{\overrightarrow{AN}} = \frac{2}{3}a + \frac{1}{3}b$ iv) $\boldsymbol{\overrightarrow{BM}} = -a + \frac{1}{2}b$

b) i) $\boldsymbol{\overrightarrow{AX}} = (1-h)a + \frac{1}{2}hb$ ii) $\boldsymbol{\overrightarrow{AX}} = \frac{2k}{3}a + \frac{k}{3}b$

By comparing coefficients: $h = \frac{1}{2}$ $k = \frac{3}{4}$

10. a) i) p = 0 q = 4

b) i) Plot points correctly. Draw smooth curve.

ii) Use any 2 points eg (0;0) & (5;-5) Draw y = -x.

c) i) x = 3.8 or 0.8 ii) Area = 4.2 $(\pm 0.1)\ (unit)^2$

11. a) i) Total volume = 136.659

Volume of hole = 14.137

Volume of aluminium = 122.5 cm^3

ii) $2.8 \times 122.5 = 343g$

iii) **\$2 573**

b) i) $\frac{\frac{1}{2} \times 400 \times 440 \sin 46}{10\,000}$ = **6.33 ha.**

N.B: 1 ha = 10 000 m^2

12. a) Required vertices $(1\ ;\ 2)$ $(1\ ;\ 4)$ $(2\ ;\ 4)$

b) Required vertices: $(-4\ ;-8)$ $(-2\ ;-8)$ $(-1\ ;-4)$

c) Vertices of R: $(-2\ ;\ -1)$ $(-1\ ;\ -1)$ $(-2\ ;\ -3)$

d) Vertices of N: $(3\ ;\ 2)$ $(6\ ;\ 2)$ $(5\ ;\ 3)$

e) i) S = correctly drawn.

ii) **Stretch, Factor 2, y axis is the invariant line.**

Ordinary Level Mathematics

Zimsec 2018 Paper 2 Suggested Answer

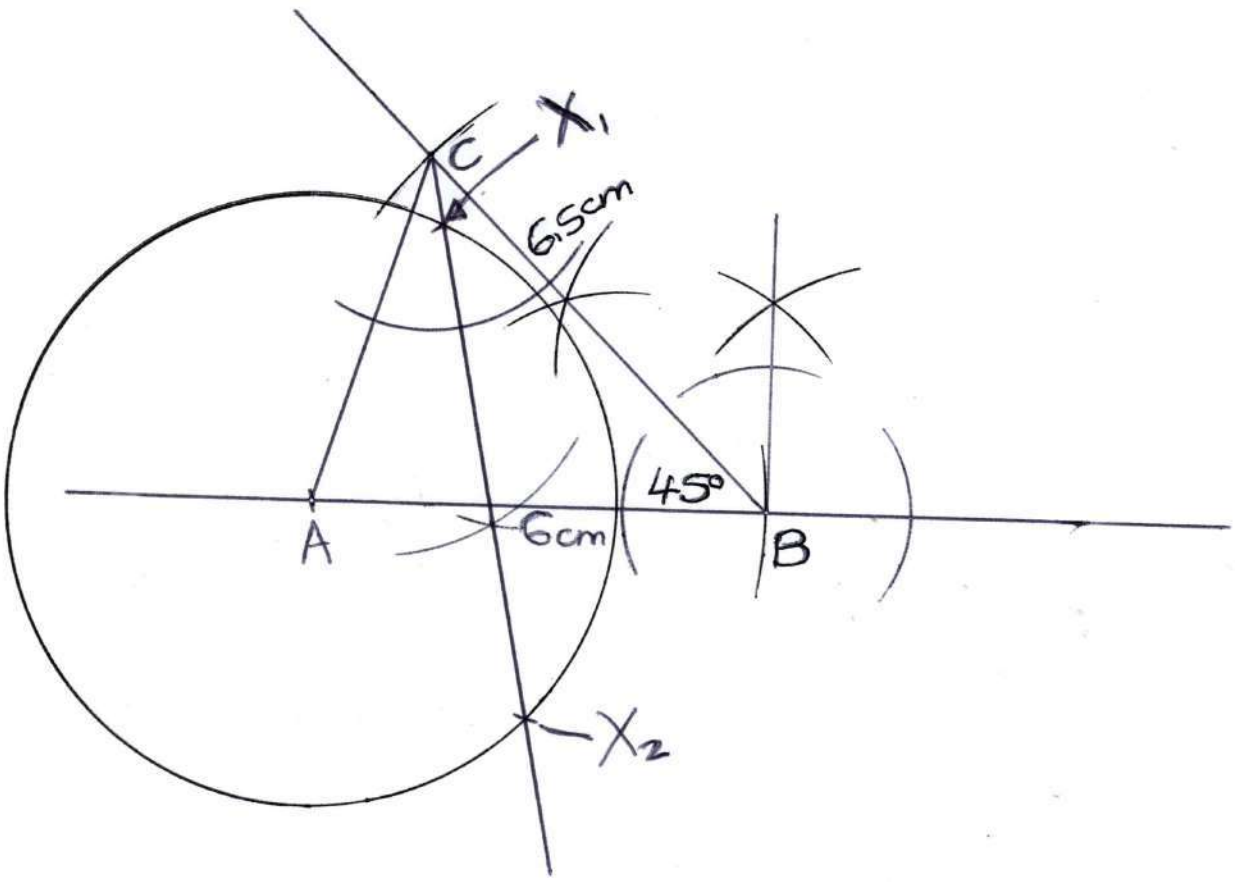
Individual Tuition Centre

Question 4 - Locus

N.B This is a compulsory topic. Make sure you thoroughly understand it.

Briefly, the locus of a moving object is the path it follows. STUDY the 5 cases below.

1. Locus of points equidistant from a given point - circle of a given radius
2. Locus of points equidistant from 2 points - perpendicular bisector of line joining the 2 points
3. Locus of points equidistant from a given line - Lines parallel to the given line, above and/or below the line
4. Locus of points equidistant from a 2 lines forming an angle - bisector of the angle
5. Combined Loci (plural of locus) - a combination of 2 or more loci above eg a point can be 5cm from A but also 3 cm from the line AB. N.B: Show ALL construction arcs.



e. The locus of points equidistant from BC and AC

Zimsec Ordinary Level Mathematics

June 2019 Paper 1 Suggested Answers

Individual Tuition Centre

1. a) 0.48 b) 40% c) $\frac{3}{80}$

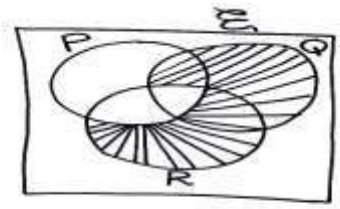
2. a) 49 b) √13 c) 0.5 or $\frac{1}{2}$

3. 12: \$30 13: \$32.50 15: \$37.50

4. a) i) 119_{10} ii) 1001011_2 iii) 1010_8

5. a) kite b) i) 10^0 ii) 90^0

6.



7. a) \$6.47 b) R1047.42

8. **x = 4 y = 3**

9. Area = $\frac{1}{2}absinC \times 2$ **[sin 150^0 = sin 30^0]**

= $\frac{1}{2}$ x 8 x 10sin 150^0 x 2 = 40 cm^2

10. a) $\frac{2}{5}$

b) P(YY) + P(GG) = $\frac{8}{20} \times \frac{7}{19} + \frac{12}{20} \times \frac{11}{19} = \frac{47}{95}$

11. a) 7 b) 6 c) 6

12. a) log (5 x 6) = log5 + log6 = 1.4771

b) $log\left(\frac{1000\,000 \times 6}{5}\right)$ = 6+07781 - 06990 = 6.0791

N.B : log 1000 000 = 6. You must know this!

13. a) 20^0 b) 900^0

14. N = $\frac{S}{25}$ = 0.04S b) 4 500

15. a) $\frac{5}{12}$ b) $\frac{5}{13}$ c) $\frac{5}{13}$

16. a) 10 kg b) 10 kg c) 10 kg

17. a) i) (p + 2)(p – 2) ii) (2p + 3)(p + 2)

b) (p + 2)

18. a) h = 9 b) 432Л

19. a) 48

b) $(3x + 4)(x - 2) = 0$

$So\ x = 2\ or\ -\frac{4}{3}$

20. a) $x = 4^{\frac{3}{2}} = 8$ b) x = 10

21. a) $y \leq 2x$ $x + y < 300$

b) Remember $x + y < 300\ so\ \max value = 299$

22. a) i) 6.18 x 10^5 ii) 4.23 x 10^{-4}

b) 1.665 x 10^{-1}

23. a) i) $-p + q$ $ii)\ 3p - 3q$

b) **AX** and **YB** are parallel

YB is 3 times longer than **AX**

24. a) 200^0 b) $\sqrt{\frac{74}{5}}$

25. a) $\left(\frac{2}{1}\right)^2$ x 1.44 = 5.76 cm^2

b) $\left(\frac{1}{2}\right)^2$ x 16 = 2 cm^3

26. a) Rotation, 90^0 anticlockwise, Centre (0 ; 0).

b) $\binom{-1}{1} + \binom{x}{y} = \binom{1}{-2}$ $x = 2\ y = -3$

Translation Vector is $\binom{2}{-3}$

27. a) 900 m (area under graph)

b) 60 m/s c) 12 m/s^2

Zimsec Ordinary Level Mathematics

June 2019 Paper 2 Suggested Answers

1. a) $\frac{5}{7}$ b) 7 + 3

c) i) \$117.60 ii) Tendai: \$60 Chipo: \$45

2. a) 50° or 130°

b) i) AP = 9.4Sin37 = 5.66 cm

ii) AC = $\frac{5.66}{Cos\ 42} = 7.61\ cm$

c) i) 360 – 3y

ii) 360 – 3y = 2(4y + 4) ie y = 32

3. a) i) US\$1 : 13.1 Pula ii) \$6.93

b) $\frac{84}{100}P = 210 \quad so\ P = \$250$

c) $P = \frac{100I}{RT} = \frac{100 \times 210}{3 \times 5} = \$13\ 400$

d) Amount = $600\left(1 + \frac{4}{100}\right) = \$674.92$

4. a) $\frac{2x-5}{x-1}$ b) i) $x^2 + 3x - 8 = 3x + 1$

$x^2 - 9 = 0 \ \ x = 3\ or - 3$

b) $2^x = 0.25 = \frac{1}{4} = 2^{-2} \ \ So \ \ x = -2$

c) $ax + b = d^2 \ \ gives\ x = \frac{d^2-b}{a}$

5. **See attached diagram**

6. a) i) 0 ii) 50

b) i) **G----F:** $\frac{1}{5}$ ii) **O ----F:** $\frac{2}{5}$ iii) **F----F =** $\frac{4}{5}$

ii) P(GG) = $\frac{3}{5} \times \frac{4}{5} = \frac{12}{25}$ iii) $\mathrm{P(FF)} = \frac{2}{5} \times \frac{4}{5} = \frac{8}{25}$

iv) $1 - \frac{8}{25} - \frac{12}{25} = \frac{1}{5}$

7. i) $5x - 13 = x - 6 \ \ gives\ x \leq \frac{4}{7}$

$x - 6 < 9 + 4x \ \ gives \ \ x > -5$

Combining: $-5 < x \leq \frac{4}{7}$

ii) Correct diagram iii) -4

b) i) $\frac{x+2}{2x+3}$ ii) $\frac{x+2}{2x+3} = \frac{9}{16}$ $iii)\ x = \frac{5}{2}$

iv) 8 cm v) 6.61 cm

8. See attached diagram

9. a) $0.5 \times 26 \times 24Sin40 = 200.5\ cm^2$

b) $AD^2 = 26^2 + 24^2 - 2(26)(24)Cos40 = 295.98$

AD = 17.2 cm

c) $\frac{BC}{Sin\ 30} = \frac{24}{Sin110} \ \ ie \ \ BC = 12.77\ cm$

d) h = 12.77Sin40 = 8.21 cm

10. a) i) $165 < h \leq 180$

ii) $165 < h \leq 180$ iii) $160 < h \leq 165$

b) (155 x 5 + 162.5 x 9 + 172.5 x 18 + 185 x 10)/42

= **171.25**

c) $\frac{27}{42} \times \frac{26}{41} = \frac{117}{287}$ d) **See attached diagram**.

11. a) 5 m^2 b) 5 x 3 = 15 m^3 c) $\frac{23}{4.5} = 5.111$

N.B 6 tins are required. 5 tins not enough.

d) i) 1.17 m (Pythagoras theorem)

ii) Area of sloping roof = 1.17 x 3 x 2 = 7.00 m^2

Cost = 7.00 x 6.40 = **\$44.80** (\$44.78 accepted).

12. a) i) $\binom{12}{6}$ ii) $\sqrt{12^2 + 6^2} = 6\sqrt{5}$

b) i) $OC = 2p + 2q \quad ii)\ OM = p + \frac{1}{2}q$

iii) $AC = p + 2q \quad iv)\ OT = kp + \frac{1}{2}kq$

v) $OT = (h + 1)p + 2hq$

vi) $h + 1 = k\ and\ 2h = \frac{1}{2}k$

$gives\ h = \frac{1}{3}\ and\ k = \frac{4}{3}$

vii) $OM = \frac{3}{4}OT \ \ and\ MT = \frac{1}{4}OT$

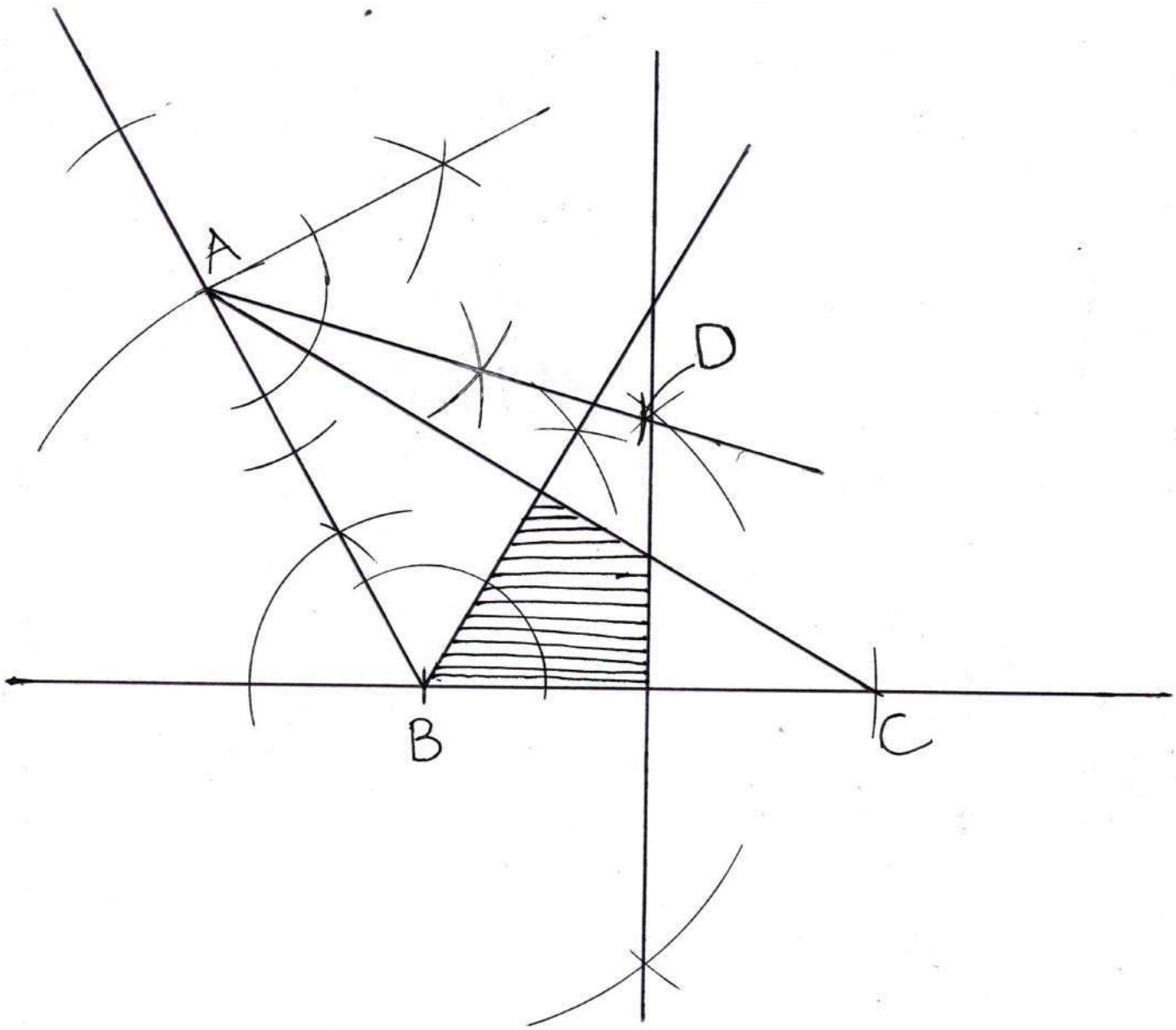
$so \ \ MT : OT = \mathbf{1 : 4}$

Candidate Name | Centre Number | Candidate Number

X X X	X X X	X X X

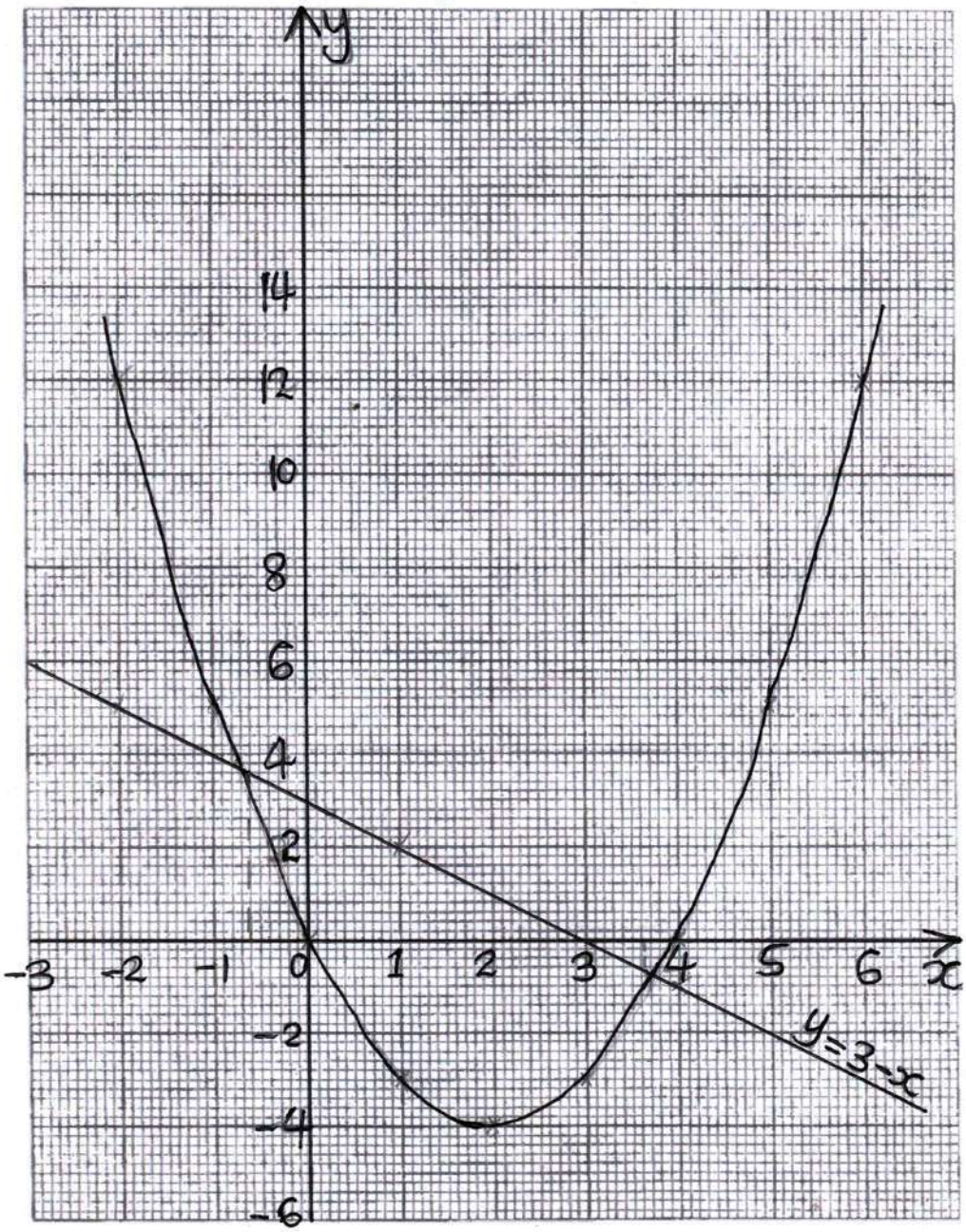
5. **Answer the whole of this question on the plain space below.**
User ruler and compasses only for all constructions and show clearly all construction lines and arcs. All constructions should be done on a single diagram.

*Drawn to scale



8

Answer parts (b) and (c) of the question on the grid.



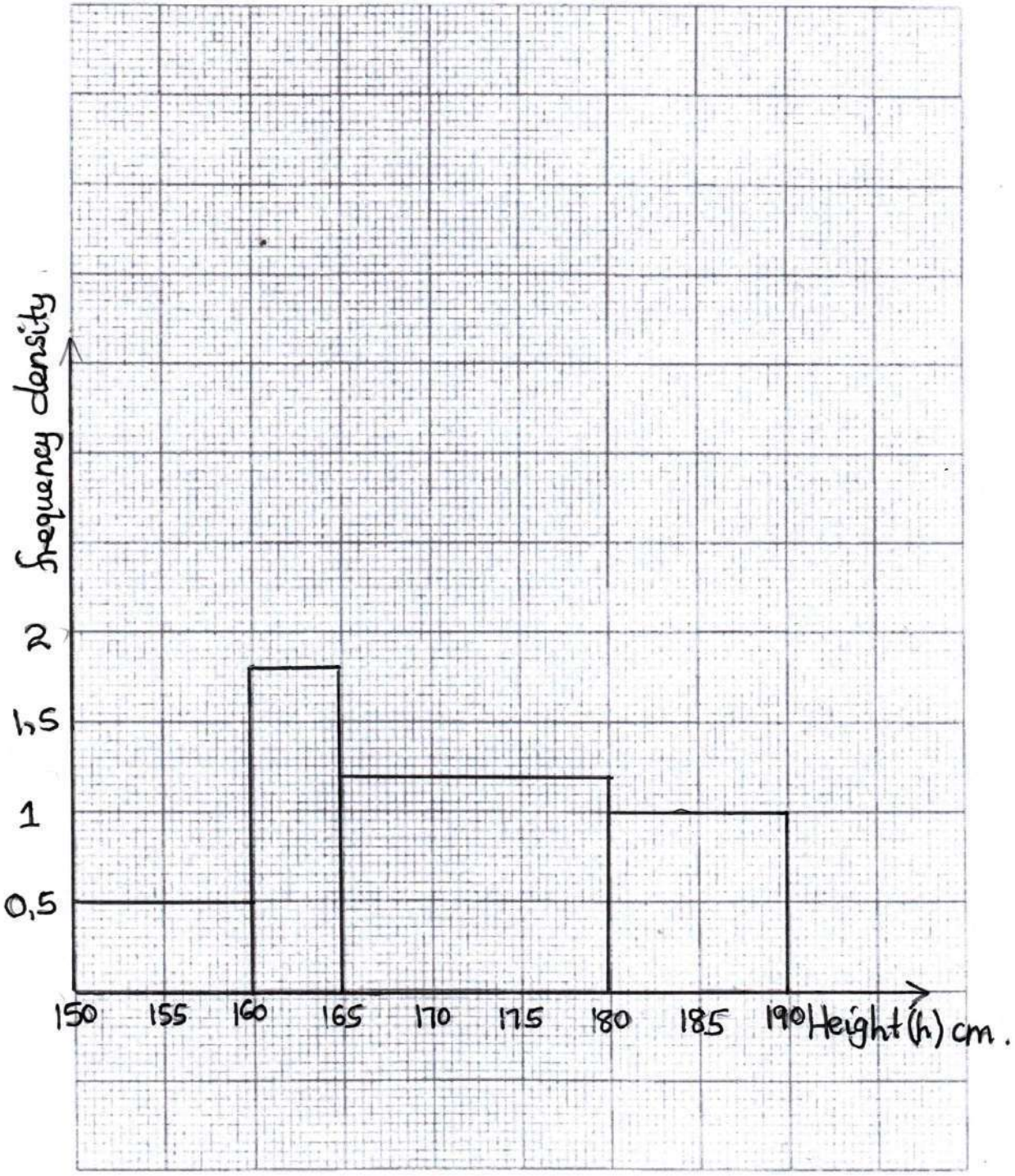
a) i) $p = -3$ ii) $q = 5$ c) i) $x = -0,6$ or $3,6$ ii) $x = 2$

b) i) Draw the graph of $y = x^2 - 4x$ on the grid provided using a scale of 2 cm to 1 unit on the x axis and 2 cm to 2 units on the y axis.
Answer (b)(i) on the graph ..... [4]

Candidate Name	Centre Number	Candidate Number
Individual Tuition Centre	x x	x x

10

d) **Answer this part of the question on the grid.**
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.



Answer (d) On the graph ..... [3]

Zimsec Ordinary Level Mathematics

November 2019 Paper 1 Suggested Answers

Individual Tuition Centre

1. a) **2.46 litres**

b) 1 ha = 10 000m^2 1 km^2 = 1000 000m^2

$\frac{10\,000}{250\,000}$ x 100% = **4%**

2. a) **4** b) **√147 + √108 = 7√3 + 6√3 = 13√3**

3. $x = 4 \quad and \quad y = 10$

4. a) **3** b) **-11** c) **49**

5. a) 2

b) Sum of interior angles = 1800°

4x + 16x = 1800° giving **x = 90**

Answer is mathematically correct but does not make sense!! Possible setting error.

6. a) 36 km b) $\frac{35}{7}$ x 15 = **75**

7. a) i) $\{7\,;8\}$ ii) 4 b) $(\mathbf{K} \cap \boldsymbol{L})'$

8. a) $(x + \frac{1}{2})(x - \frac{1}{2})$

b) $(x - 2y)(x + 2y)$

9. a) **2 x 5^3 + 2 x 5^2 + 1 x 5^1 + 4 x 5^0**

b) 1 x n^2 + 0 x n^1 + 1 x n^0 = 37

n^2 + 1 = 37 giving **n = 6** **N.B n** $\neq -6$

10. a) 2×1 b) $\begin{pmatrix} 2 & 1 \\ 3 & -1 \end{pmatrix}$

11. a) 30° b) 60° c) 60°

12. a) Locus of points 4 cm from O

b) Locus of points equidistant from A and O

c) Region inside circle, to the left of the line l

13. a) 64.80 Rands b) Total amount = $2 800

14. a) **210°**

b) $\frac{BC}{\sin 10°} = \frac{4}{\sin 50°}$ gives **BC = 1 km**

15. **a) -5** since $\frac{1}{243} = 2^{-5}$ **b)** $2x - 1 = 4 \; so \; x = \frac{5}{2}$

6. a) V = kh^3 k = **3** So **V = 3h^3**

b) 648 = 3q^3 So **q = 6.**

17. a) (4 ; -10) **N.B** Multiply the point by the matrix.

b) **Shear, Factor -3, y axis as invariant.**

18. a) $2 < x \leq 3$ b) Unshaded circle above 2,

shaded circle above 3, join the 2.

19. a) $\frac{4}{5}$ **or** $-\frac{4}{5}$

20. a) **h** $= \frac{5g^2 + 4}{1 - g^2}$

21. a) P(4 ; 0) Q(3 ; 0)

b) Write equation as $y = -\frac{3}{4}x + 3$

So gradient = $-\frac{3}{4}$

c) Length = √(3^2 + 4^2) = **5 units**

22. a) ii) $40 < h \leq 60$ b) $\frac{1390}{30}$ **= 46 $\frac{1}{3}$**

23. a) **EBD** in that order!

b) i) $\frac{AB}{4.2} = \frac{3.5}{2.1} \quad gives \; AB = 7cm$

b) ii) $Scale\ factor = \frac{3.5}{2.1} = \frac{5}{3}$

$Area\ of\ ABC = \left(\frac{5}{3}\right)^2 \times \frac{45}{2}$ = **62.5 cm^2**

24. a) $\frac{54-36}{6}$ = **3m/s^2**

b) **30 m/s** N.B Consider the deceleration.

c) Total distance = **288 m** (Area under graph)

So average speed = $\frac{288}{15}$ **= 19.2** m/s

25. a) 22 cm

b) 14 + 10.5 + 10.5 + 22 = 57 cm

c) Total area of rectangle = 147 cm^2

Unshaded area = 115.5 cm^2 (3 circles)

Shaded area = **31.5 cm^2**

Zimsec Ordinary Level Mathematics

November 2019 Paper 2 Suggested Answers

1. a) $\frac{7}{12}$ b) 5.25 x 4.15 = 21.79

c) i) 18 30 ii) 66612 – 19(1830) = 31 842

$Cost\ of\ an\ Executive\ room = \frac{31842}{1098}$ = **$29**

2. a) i) $3(x+2) - 42 < 7$

$x < 14\ \frac{1}{3}$ **Smallest integer = 14**

ii) $A^{-1} = \frac{1}{6}\begin{pmatrix} -16 & 3 \\ 14 & -3 \end{pmatrix}$

b) i) 6y ii) 3x + 6y iii) 2x + 4y iv) -x + 4y

3. a) i) $\widehat{PQS}$ ii) **33°** iii) **123°** iv) **24°**

b) i) **PS** = $\frac{3.7}{sin 22.3}$ = 9.75 cm ii) SPR = 23.1°

iii) QPR = 67.7 – 23.1 = 44.6°

4. a) i) V = $\pi r^2 h = \frac{22}{7} \times 1.9 \times 1.9 \times 4.9$ = 55.6 cm^3

ii) 55.6 x 0.3 = 35 g **b**) i) 240 cm^3 ii) 86.1 cm

b) i) 240 cm^2 ii) 86.1 cm

5. See attached diagram

6. a) $3^k = 3^{8+5-11} = 3^2$ giving **k = 2.**

b) i) 2(3y^2 – 5y + 2) = **2(3y -)(y – 1)**

ii) a(x + 1) +b(x + 1) = **(a + b)(x + 1)**

c) $\frac{6x-3(2x-x^2}{x(2-x)}$ **=** $\frac{3x^2}{x(2-x)}$ **=** $\frac{3x}{2-x}$

d) i) $p = kt^{-3} = \frac{k}{t^3}$ We get $k = 32$ **p =** $\frac{32}{t^3}$

ii) $t = 4$

7. a) $\frac{85}{100}$ **P** = 55 So **P = $64.71**

b) ***X*** **= $4.12** ***Y*** **= $407.88** ***Z*** **= $115**

c) i) I = $\frac{PRT}{100}$ **= $72**

ii) Total amount = (1.04)^3 x 600 = $674.92

Interest = $74.92

iii) **$2.92**

8. a) i) 5.4 ii) $h = \frac{2A}{12+b}$

b) i) **Cos 120° =** $\frac{4^2 + x^2 - (2x)^2}{2 \times 4 \times x}$

i.e $-\frac{1}{2} = \frac{16-3x^2}{8x}$ giving $3x^2 - 4x - 16 = 0$

ii) $x = \frac{\sqrt{[16-4(3)(-16)]}}{6} = \frac{4 \pm \sqrt{208}}{6}$

$x = 3.07\ or\ -1.72$

9. a) x **= 60** b) i) **p = 60** ii) **q = 40** iii) **r = 60**

c) **Mean =** $\frac{80+180+200+420}{240}$ **= 3** $\frac{2}{3}$

d) $\frac{100}{240} \times \frac{99}{239} = \frac{165}{956}$

e) Draw a histogram (no spaces between bars)

Join the top mid points of each bar.

10. a) $p = -5$

b) Plot points correctly. Use given scale.

Join points using a smooth curve.

c) i) (2.7 ; -5.5)

ii) $x = -0.9 \quad and \quad 1.3 \quad and\ 3.7$

These are points where graph cuts x axis.

iii) 5 $(\pm 0.2)\ units^2$ iv) $2 \leq x \leq 3.2$

11. $x = area\ for\ beans \quad y = area\ for\ peas$

a) $x + y \leq 5$

b) $2x + 4y \leq 16 \quad so \quad x + 2y \leq 8$

c) $x \geq 1 \quad y \geq 1$

d) Draw the lines x = 1 and y =1 and 2 other lines. Shade appropriate regions.

e) i) For Max. Profit: x = 2 and y =3 ii) $180.

12. a) Vertices plotted correctly. Easy!

b) **C** Coordinates: (2 ; -1) , (2 ; -7) and (-1 ; -2.5)

c) $\begin{pmatrix} 8 \\ -4 \end{pmatrix}$ d) $(-5; 12)\ (-2; 6)\ (-2;\ 8)$

e) Clockwise Rotation of centre $(-1; -1)$

Ordinary Level Mathematics

Zimsec 2019 Paper 2 Suggested Answer

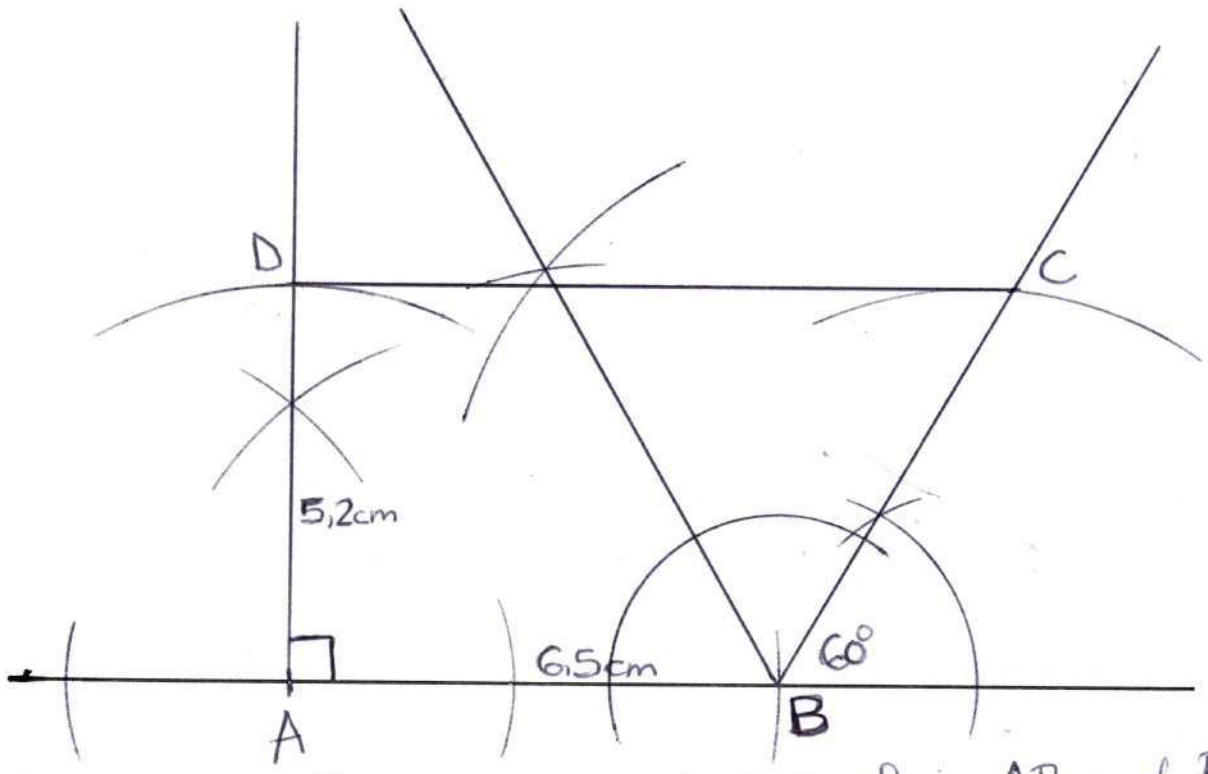
Individual Tuition Centre

Question 5 - Locus

N.B This is a compulsory topic. Make sure you thoroughly understand it.

Briefly, the locus of a moving object is the path it follows. STUDY the 5 cases below.

1. Locus of points equidistant from a given point - circle of a given radius
2. Locus of points equidistant from 2 points - perpendicular bisector of line joining the 2 points
3. Locus of points equidistant from a given line - Lines parallel to the given line, above and/or below the line
4. Locus of points equidistant from a 2 lines forming an angle - bisector of the angle
5. Combined Loci (plural of locus) - a combination of 2 or more loci above eg a point can be 5cm from A but also 3 cm from the line AB. The 2 loci have been combined.



b) The locus of points equidistant from AB and BC.

BC = 6cm

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Wishing them all the best in their upcoming exams

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