Surname	Forename(s)	Centre Number	Candidate Number
	DCMicroSystems		

For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4030/2

PAPER 2

JUNE 2017 SESSION 2 hours 30 minutes

Candidates answer on the question paper.
Additional materials: Geometrical instruments
Mathematical tables/ Non-programmable electronic calculator
Graph/plain paper

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 Non-programmable electronic calculators may be used to evaluate explicit numerical expressions.

This question paper consists of 30 printed pages.

[Turn over

Centre Number	Candidate Number

Section A [64 marks]

*Answer **all** questions in this section.*

1 **(a)** Simplify $2 - \frac{1}{2} \times \frac{4}{5}$, giving the answer as a mixed number.

Answer: *(a)* ________________ [2]

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

$2^3 \times 3^2 \times 5 \times 7^4$,

$2^3 \times 3^3 \times 5^2 \times 7^2$,

$2^4 \times 3 \times 5 \times 7^3$,

leaving the answer in index form.

Answer *(b)* ________________ [2]

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1 **(c)** Find the Lowest Common Multiple (L.C.M) of $3x^2y$, $5x^3y^2$ and $8xy^3$.

Answer: *(c)* ____________________ [2]

(d) **(i)** Express 248 as a product of its prime factors.

(ii) Find the number by which 248 must be multiplied to make it a perfect square.

Answer: *(d)* *(i)* ____________________ [2]

(ii) ____________________ [1]

2 **(a)** Two similar square-based pyramids have base areas of 9 cm^2 and 25 cm^2.

Find the ratio of their volumes, in the form $a : b$, where a and b are integers such that $a < b$.

Answer: *(a)* ________________ [2]

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

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

Answer: *(b)* *(i)* US$ _______ [3]

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

Answer: *(b)* *(ii)* US$ _______ [2]

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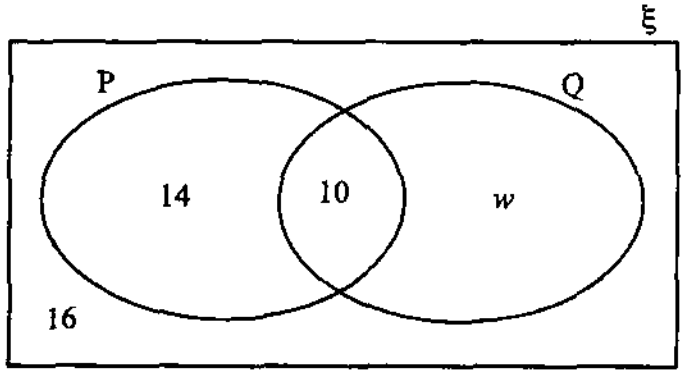
2 **(c)**



The Venn diagram shows the universal set, ξ, and subsets P and Q. The number of elements in each region is as shown.

Find

(i) n(P),

Answer: *(c)* *(i)* n(P) = ________ [1]

(ii) n(Q^1), where Q^1 is the compliment of set Q.

Answer: *(ii)* n(Q^1) = ________ [1]

(iii) the value of *w* if the number of elements in the universal set, ξ, is **twice** the number of elements in Q.

Answer: *(iii)* *w* = ________ [3]

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3 **(a)** It is given that $244_n + 32_n = 331_n$.

Find the value of n.

Answer: *(a)* $n =$ ______________ [2]

(b) Simplify $\dfrac{m^2 - m - 12}{m^3 - 9m}$

Answer: *(b)* ____________________ [3]

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3 **(c)** The length of each side of an equilateral triangle is 8 cm.

(i) Calculate the area of the triangle.

Answer: *(c)* *(i)* ______________ cm^2 [2]

(ii) Express the area of the triangle in square metres.

Answer: *(ii)* ______________ m^2 [2]

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4 **(a)** H varies directly as $\sqrt{Q}$ and H = 51 when Q = 289.

Find the

(i) formula connecting H, Q and a constant k,

Answer: *(a)* *(i)* H = ______________ [1]

(ii) value of Q when H = 81.

Answer: *(a)* *(ii)* Q = ______________ [2]

(b) Make m the subject of the formula $T = 2\pi\sqrt{\frac{em}{g}}$.

Answer: *(b)* m = ________________ [3]

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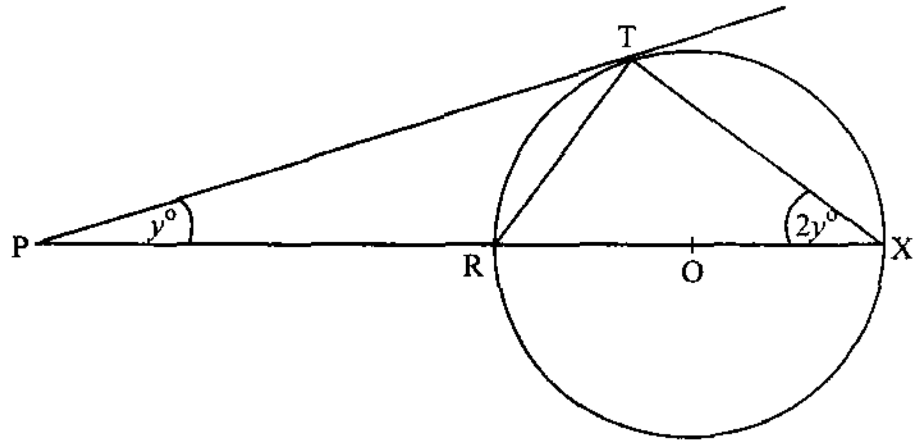
4 **(c)**



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

Find

(i) $R\hat{T}P$ in terms of y,

Answer: *(c)* *(i)* $R\hat{T}P =$ __________ [1]

(ii) the value of y.

Answer: *(ii)* $y =$ __________ [3]

5 **(a)** The radius of a circle is 32 cm measured to the nearest centimetre.

(i) Write down the least possible value of the radius.

Answer: *(a)* *(i)* ____________ cm [1]

(ii) **Take π to be $\frac{22}{7}$.**

Calculate the least possible value of the circumference of the circle.

Answer: *(a) (ii)* ____________ cm [2]

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5 **(b)** **(i)** State the order of the matrix $\begin{pmatrix} 3 & 1 \end{pmatrix}$.

Answer: *(b)* *(i)* ____________ [1]

(ii) Evaluate $\begin{pmatrix} 3 & 1 \end{pmatrix}\begin{pmatrix} 4 \\ 3 \end{pmatrix}$.

Answer: *(ii)* ____________ [1]

(c) Matrix $\mathbf{G} = \begin{pmatrix} -2 & 5 \\ 0 & 6 \end{pmatrix}$.

Find $\mathbf{G}^{-1}$, the inverse of matrix **G**.

Answer: *(c)* ________________ [2]

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5 **(d)** Solve the equation $3x^2 - 4x - 11 = 0$, giving the answers correct to 2 significant figures.

Answer: *(d)* $x =$ ________ or ________ [5]

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6 **Answer the whole of this question on a sheet of plain paper on page 14.**

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

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

(a) Construct

(i) triangle ABC in which AB = 8 cm, AC = 6,5 cm and $B\hat{A}C = 60°$,
[Line AB has been drawn on page 14] [3]

(ii) the locus of points equidistant from AB and BC, [2]

(iii) the perpendicular bisector of BC. [2]

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

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

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

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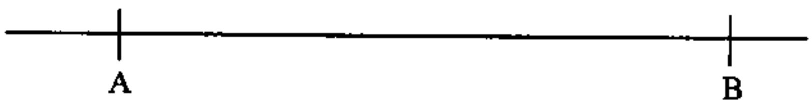
6 **Answer the whole of question 6 on this page.**



Answer: *(a)* *(i)* on diagram [3]

(ii) on diagram [2]

(iii) on diagram [2]

(b) *(i)* on diagram [2]

(ii) BC = ____________ cm [1]

(c) ________________________

____

________________________ [2]

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Section B [36 marks]

*Answer any **three** questions in this section.*

Each question carries 12 marks.

7 A luxury bus has 100 units of seating area. There are two types of seats, Ordinary and First Class.

Let the number of Ordinary seats be x and First Class seats be y.

(a) Ordinary seats take up 1 unit of seating area and First Class seats take up 1.5 units of seating area.

Form an inequality which satisfies this condition and show that it reduces to $2x + 3y \leq 200$.

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

(b) There must be at least 10 First Class seats.
Write down an inequality which satisfies this condition.

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

(c) There must also be at least twice as many Ordinary seats as First Class seats.
Write down an inequality which satisfies this condition.

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

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Answer d, e and f of question 7 on the grid on page 17.

7 **(d)** The point $(x; y)$ represents x Ordinary seats and y First Class seats.

Draw the graphs of the inequalities in

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

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

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

(e) Show, by shading the **unwanted** regions, the region in which $(x; y)$ must lie. [2]

(f) A luxury bus company which uses this type of luxury bus charges $15 for each Ordinary seat and $25 for each First Class seat for a certain trip.

Use the graph to find the greatest possible amount of money that the company would receive from this trip. [3]

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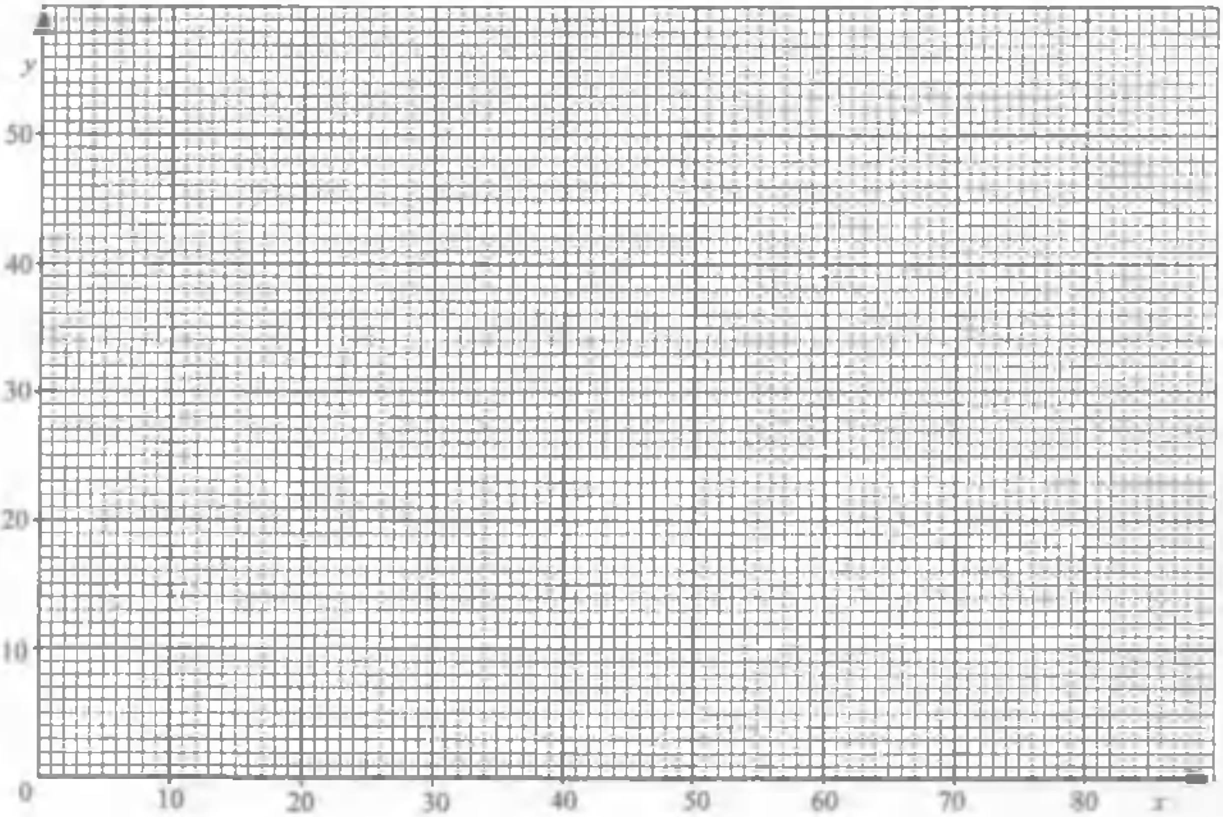
7



Answer: *(d)* *(i)* on graph [1]

(ii) on graph [1]

(iii) on graph [1]

(e) on graph [2]

(f) $ ______________ [3]

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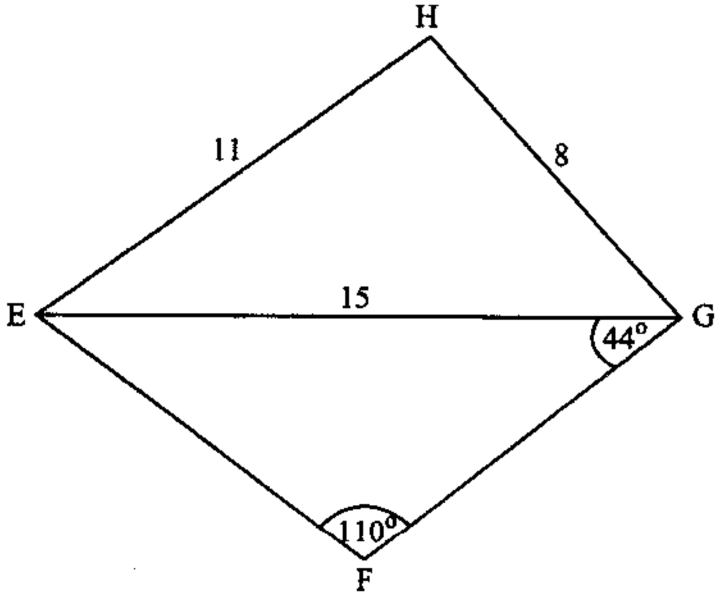
8 **(a)** Evaluate $log_7 7^{-2} - log_5 \frac{1}{5}$.

Answer: *(a)* ______________ [2]

(b)



In the diagram, EH = 11 cm, HG = 8 cm, EG = 15 cm, $E\hat{G}F = 44°$ and $E\hat{F}G = 110°$.

(i) Calculate

EF,

Answer: *(i)* EF = __________ cm [3]

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8 (b) Calculate

(ii) $E\hat{H}G$, giving the answer to the nearest degree,

Answer: *(ii)* $E\hat{H}G$ = ____________ [3]

(iii) the shortest distance from E to GF produced,

Answer: *(b)* *(iii)* ____________ cm [2]

(iv) the bearing of F from G, given that E is due west of G and E, F, G and H are on level ground.

Answer: *(iv)* ____________ [2]

[Turn over

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9 **Answer the whole of this question on the grid provided on page 21.**

Triangle ABC has vertices at A(1; 1), B(3; 1) and C(2; 3).

(a) (i) Draw and label triangle ABC. [1]

(ii) Triangle ABC is mapped onto triangle $A_1B_1C_1$ by a transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$.

Draw and label triangle $A_1B_1C_1$. [3]

(iii) An enlargement of factor $-1\frac{1}{2}$, centre (0; 0) maps triangle ABC onto triangle $A_2B_2C_2$.

Draw and label triangle $A_2B_2C_2$. [3]

(b) (i) Describe completely the transformation represented by matrix $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$ in (a)(ii). [3]

(ii) Write down the matrix that represents the enlargement in (a)(iii). [1]

(c) A translation $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ maps point B onto point B_3.

Write down the coordinates of point B_3. [1]

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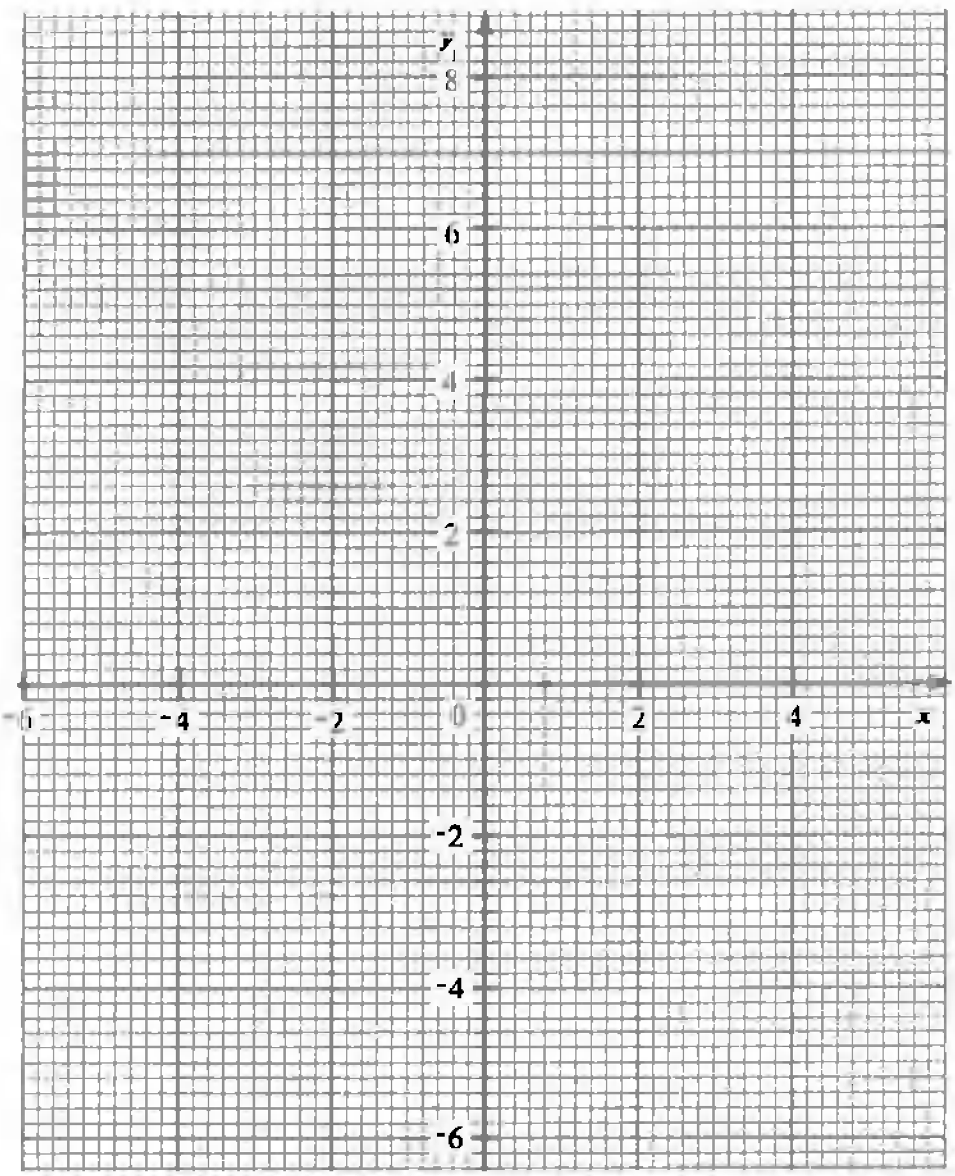
9



[Turn over

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Answer: *(a)* *(i)* on graph [1]

(ii) on graph [3]

(iii) on graph [3]

(b) (i) ______________________

____

______________________ [3]

(ii) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(iii) B_3 (;   ) [1]

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10 The following is an incomplete table of values for the function $y = \frac{1}{5}(3 - 2x - x^2)$.

x	−4	−3	−2	−1	0	1	2	3
y	−1	0	0,6	0,8	0,6	0	−1	p

(a) Calculate the value of p.

Answer: *(a)* $p =$ ____________ [1]

Answer the following questions on the grid on page 24.

(b) Draw the graph of $y = \frac{1}{5}(3 - 2x - x^2)$. [4]

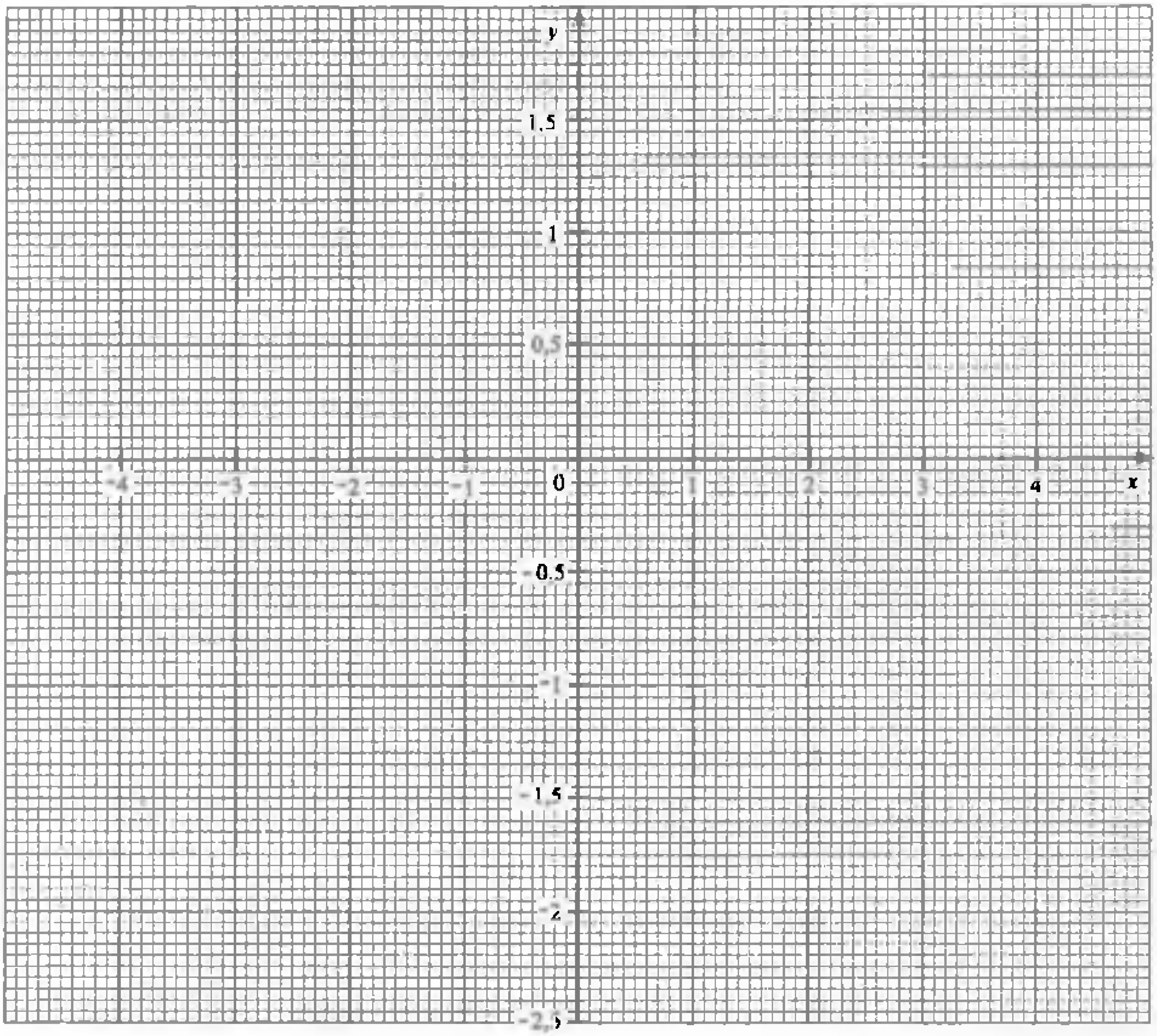
(c) By drawing a suitable tangent, estimate the gradient of the curve at $x = 0$. [2]

(d) Use the graph to

(i) solve the equation $\frac{1}{5}(3 - 2x - x^2) = -0{,}5$, [3]

(ii) find an estimate of the area bounded by the x-axis and the curve. [2]

10



Answer: (b) on graph [4]

(c) ______________________ [2]

(d) (i) $x =$ ______ or ______ [3]

(ii) ______________________ [2]

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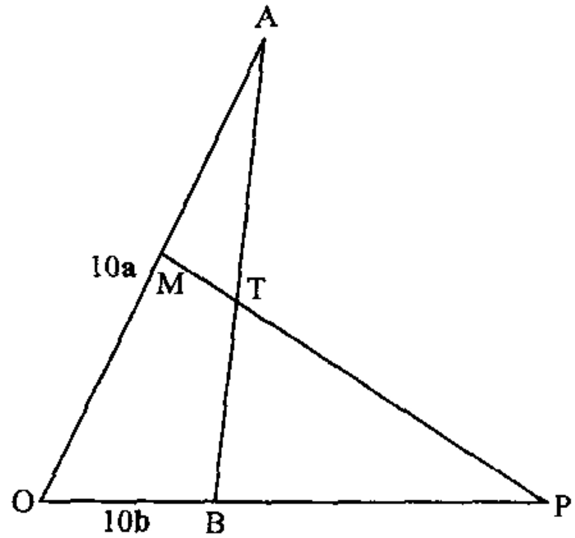
11



In the diagram $\overrightarrow{OA} = 10\boldsymbol{a}$ and $\overrightarrow{OB} = 10\boldsymbol{b}$. M is the mid-point of OA. T is a point on AB such that $\frac{AT}{AB} = \frac{3}{5}$.

MTP and OBP are straight lines.

(a) Express, in terms of ***a*** and/or ***b***,

(i) $\overrightarrow{AB}$,

Answer: *(a)* *(i)* $\overrightarrow{AB}$ = ____________ [1]

(ii) $\overrightarrow{AT}$,

Answer: *(ii)* $\overrightarrow{AT}$ = ____________ [1]

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11 **(a)** **(iii)** $\overrightarrow{MT}$

Answer: *(a)* *(iii)* $\overrightarrow{MT}$ = __________ [2]

(b) It is given that $\overrightarrow{OP} = k\overrightarrow{OB}$.

Express $\overrightarrow{OP}$ in terms of $\boldsymbol{b}$ and k.

Answer: *(b)* $\overrightarrow{OP}$ = ________________ [1]

(c) It is also given that $\overrightarrow{OP} = \overrightarrow{OM} + h\overrightarrow{MT}$.

Show that $\overrightarrow{OP} = (5 - h)\boldsymbol{a} + 6h\boldsymbol{b}$

Answer: *(c)* ____________________ [2]

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11 **(d)** Use the results from **(b)** and **(c)** to find the value of h and the value of k.

Answer: *(d)* h = ____________

k = ____________ [4]

(e) Hence express $\overrightarrow{OP}$ in terms of $\boldsymbol{b}$.

Answer: *(e)* $\overrightarrow{OP}$ = ____________ [1]

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12 The heights of 60 children were recorded. Below is an incomplete frequency and frequency density table of the results.

Height (h cm)	$110<h\leq120$	$120<h\leq125$	$125<h\leq130$	$130<h\leq145$	$145<h\leq150$
Frequency	12	18	8	12	10
Frequency density	1,2	3,6	m	0,8	2

(a) State the modal class.

Answer: *(a)* ____________________ [1]

(b) Find the value of m.

Answer: *(b)* ____________________ [1]

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12 **(c)** Calculate an estimate of the mean height.

Answer: *(c)* ____________________ cm [3]

(d) If two children were chosen at random, calculate the probability that one had a height of not more than 120 cm and the other had a height greater than 145 cm.

Answer: (d) ____________________ [3]

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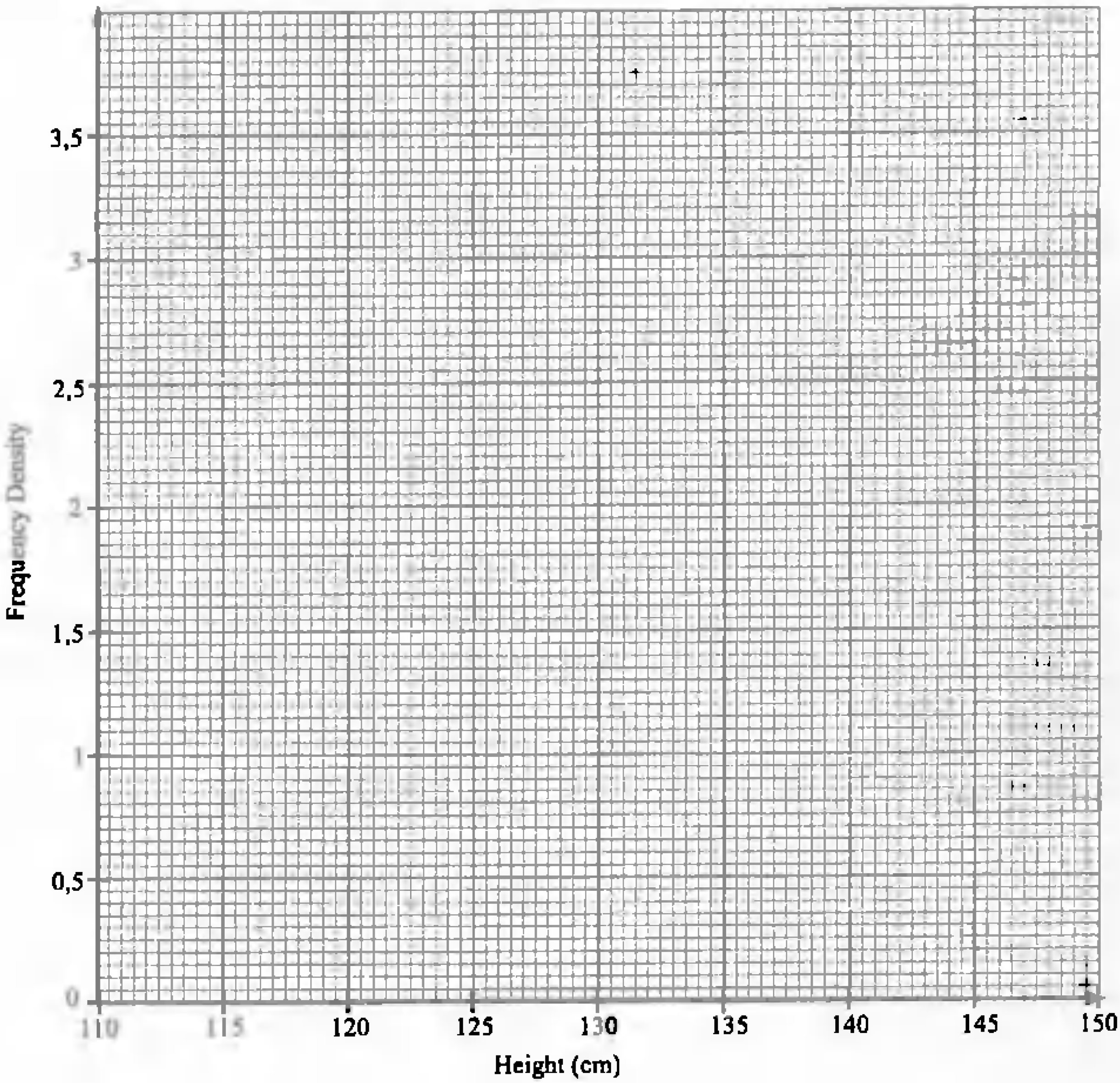
12 (e) **Answer this part of question 12 on the grid below.**

Draw a histogram which represents this information.



Answer: *(e)* on the graph [4]