MATHEMATICS PAPER 2

YEARS :

NOV	2007
JUNE	2008
NOV	2008
JUNE	2009
NOV	2009
JUNE	2010
NOV	2010
JUNE	2011
NOV	2011
JUNE	2012
NOV	2012
JUNE	2013
NOV	2013
JUNE	2014
NOV	2014
JUNE	2015

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS

4008/2

PAPER 2

NOVEMBER 2007 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- [illegible] paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer all questions in Section A and any three questions from Section B.

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

Electronic calculators must not be used.

[illegible] be clearly shown. It should be done on the same sheet as the rest of the [illegible]

Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 may be used to evaluate explicit numerical expressions.

This question paper consists of 11 printed pages and 1 blank page.

[Turn over

Section A [64 marks]

Answer all the questions in this section.

1 (a) Simplify $5{,}2 - 8{,}3 \times 0{,}2$. [2]

(b) Evaluate $(4\times10^2)+(6\times10^3)+(1\times10^5)$ giving your answer in standard form. [2]

(c) Solve the equation

$$\frac{2}{3}(x-1)-\frac{1}{4}(3x-5)=1.$$ [3]

(d) Given that $3=\sqrt{b^2+c^2}$,

make c the subject of the formula. [3]

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2 (a) (i) If $\begin{pmatrix}1 & -3\\ 2 & -4\end{pmatrix}-\begin{pmatrix}e & 0\\ 5 & -10\end{pmatrix}=\begin{pmatrix}-1 & -3\\ -3 & 2f\end{pmatrix}$, find the value of e and the value of f. [3]

(ii) Given that $\begin{pmatrix}7 & -5\\ 3 & -1\end{pmatrix}\mathrm{M}=\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}$, find the matrix M. [3]

(b) Solve the equation

$$5x^2-3x-2=0.$$ [3]

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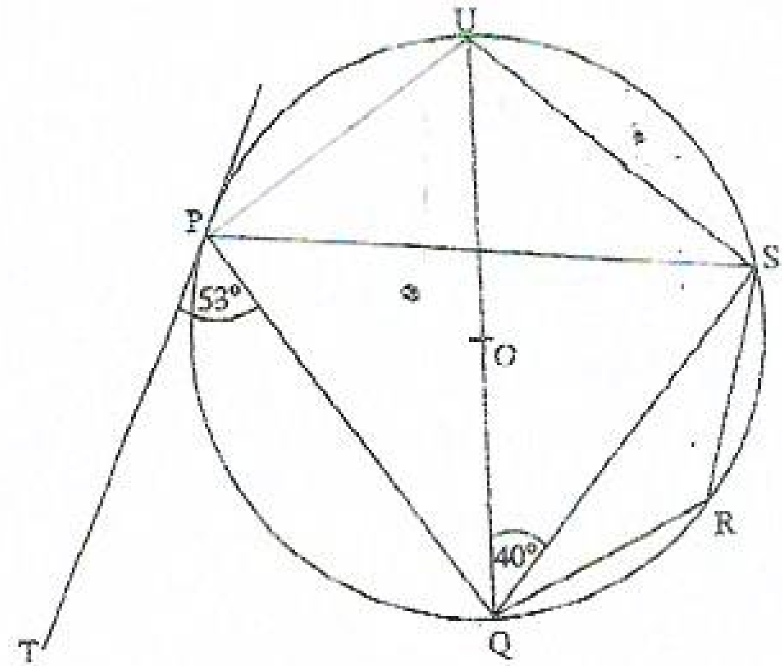
3 (a)



In the diagram, PQRSU is a circle centre O. UQ is a diameter and PT is a tangent to the circle at P. $T\hat{P}Q = 53°$ and $U\hat{Q}S = 40°$.

Find

(i) $P\hat{S}U$, [2]

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

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

(b) $\xi = \{x : 2 \le x \le 30,\ \ x \text{ is a multiple of } 4\}$,

$A = \{x : x \text{ is exactly divisible by } 8\}$,

$B = \{4; 8; 28\}$.

Draw a clearly labelled Venn diagram to show the elements in each region. [3]

(c) A polygon has n sides. If the sum of the interior angles of the polygon is three times the sum of its exterior angles, find the value of n. [3]

4 (a) Given that $23_x = 21_{10}$, where x is a base, find the value of x. [3]

(b) The mean of eight numbers is 13. When four more numbers are added, the mean of the twelve numbers is 11.

Find the mean of the four numbers which were added. [3]

(c) y varies directly as v and inversely as $(x + 2)$.

(i) Express y in terms of v, x and a constant k. [2]

(ii) Given that when $y = \frac{3}{2}$, $x = 8$ and $v = 5$, find the value of k, [2]

(iii) Find y when $x = -11$ and $v = 2$. [2]

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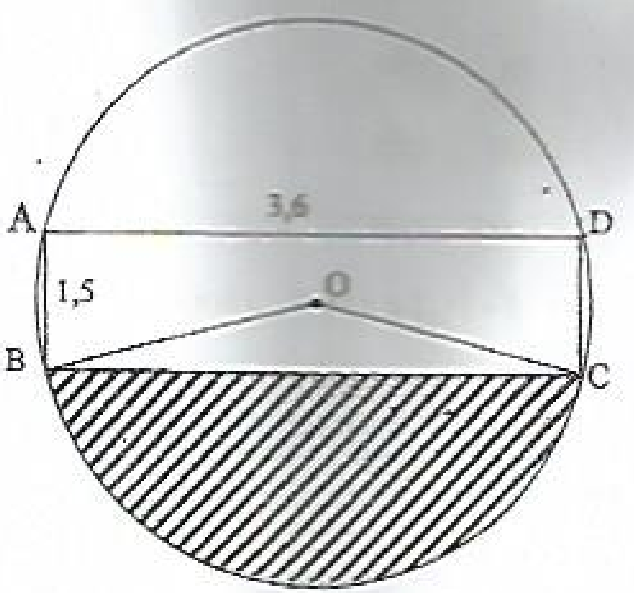
5 (a) Factorise completely

$$y^2(x-2) - x + 2$$ [3]

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



In the diagram, ABCD is a rectangle inscribed in a circle centre O. AD = 3,6 cm and AB = 1,5 cm

Calculate

(i) OC, the radius of the circle, [2]

(ii) $B\hat{O}C$, [3]

(iii) the area of the shaded segment. [4]

---

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

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

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

(i) the triangle PQR with PQ = 7 cm, QR = 8,2 cm and $P\hat{Q}R = 120°$, [3]

(ii) the locus of points that are 4,5 cm from R, [1]

(iii) the locus of points that are 3,6 cm from PQ and on the same side of PQ as R, [2]

(iv) the perpendicular bisector of PQ. [2]

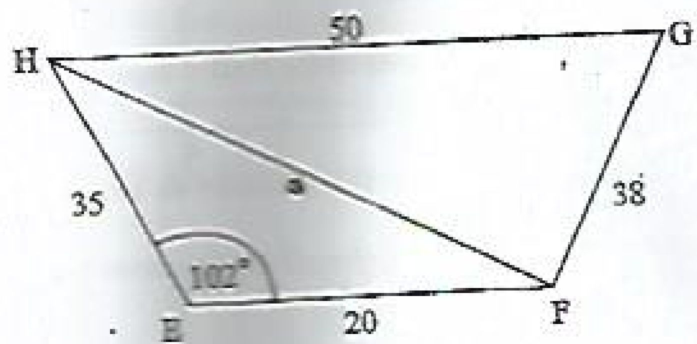
(b) Measure and write down the length of PR. [1]

(c) Describe **fully** the locus represented by the perpendicular bisector of PQ. [2]

Section B [36 marks]

Answer any three questions in this section.

7



In the diagram, H, E, F and G are points on level ground. HE = 35 m, EF = 20 m, FG = 38 m, HG = 50 m and $H\hat{E}F = 102°$.

(a) Calculate HF.

(b) If the area of triangle HFG is 0,08034 ha,

(i) convert 0,08034 ha to m^2,

(ii) calculate $H\hat{G}F$.

(c) At G, there is a vertical pole 8 m high (not shown on diagram). Calculate the angle of elevation of the top of the pole from H.

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8 **Answer the whole of this question on a sheet of graph paper.**

Below is a table of values for the function $y = 4 + x - x^2$.

x	-3	-2	-1	0	1	2	3	4
y	-8	p	2	4	4	q	-2	-8

(a) Calculate the value of p and the value of q.

(b) Using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 2 units on the y-axis, draw the graph of $y = 4 + x - x^2$ for $-3 \le x \le 4$.

(c) Use the graph to estimate

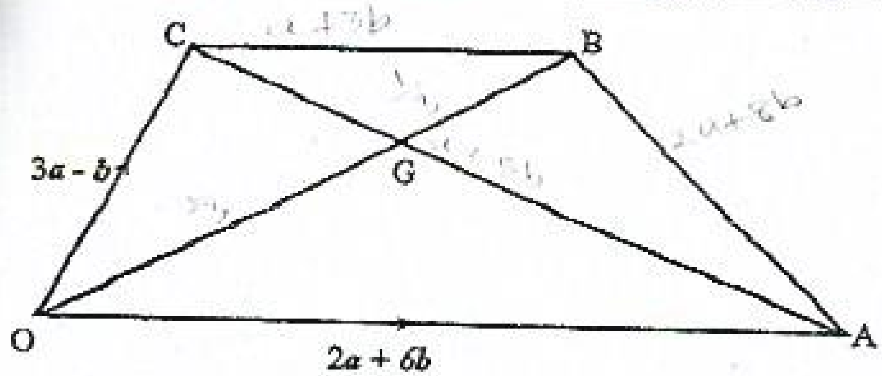
(i) the roots of the equation $4 + x - x^2 = -4$, [2]

(ii) the gradient of the curve when $x = -\frac{1}{2}$ by drawing a suitable tangent, [2]

(iii) the value of x when y is maximum, [1]

(iv) the area of the region bounded by the graph, the x – axis and the lines $x = 3$ and $x = 4$. [2]

9



In the diagram, OABC is a trapezium with OA parallel to CB. OB and AC intersect at G. OG: GB = 2: 1 and CB = $\frac{1}{2}$OA. $\mathbf{OC} = 3\boldsymbol{a} - \boldsymbol{b}$ and $\mathbf{OA} = 2\boldsymbol{a} + 6\boldsymbol{b}$.

(a) Express in terms of $\boldsymbol{a}$ and /or $\boldsymbol{b}$.

(i) AC, [2]

(ii) AB, [2]

(iii) OG. [2]

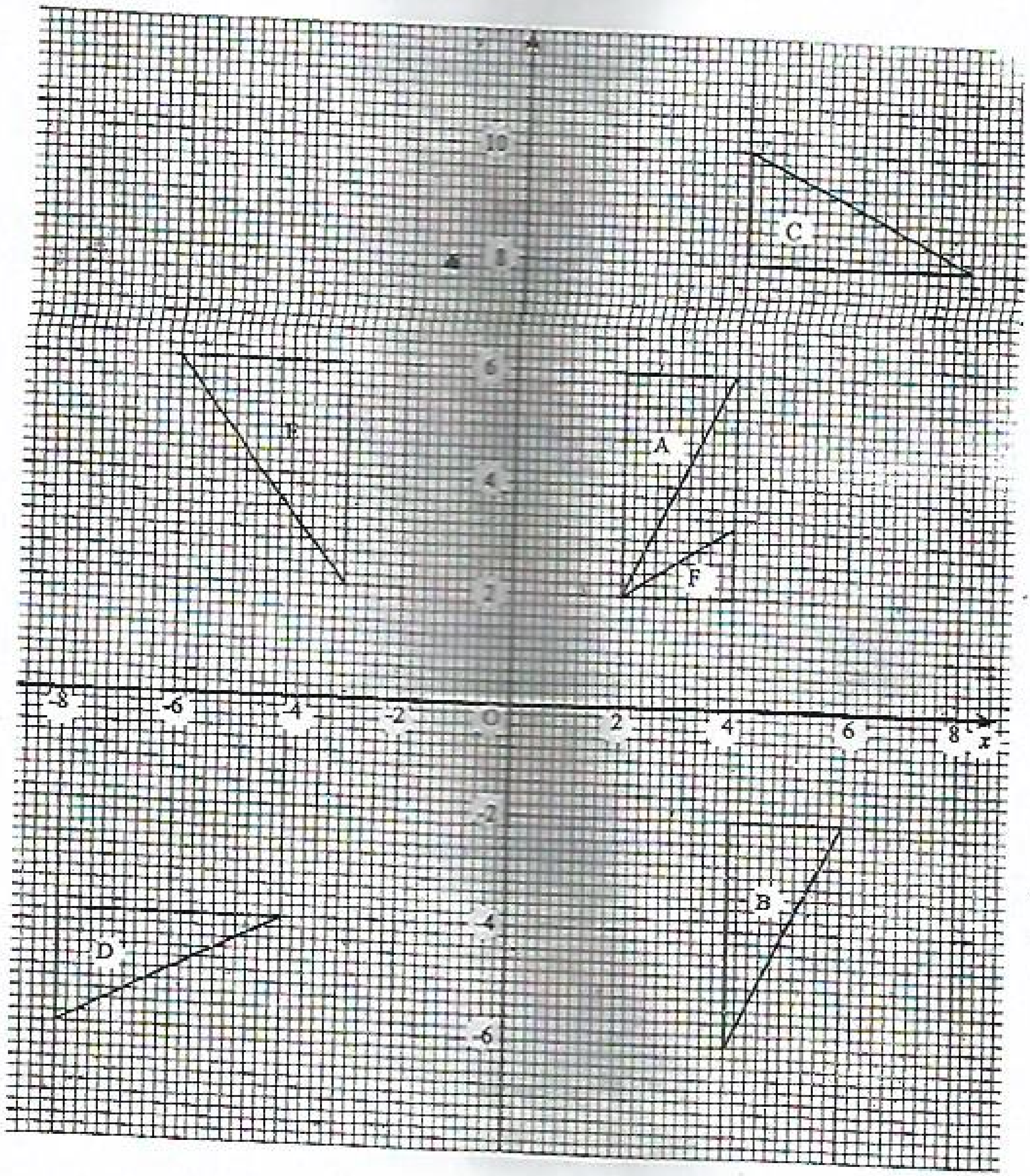
(b) Given that AG = kAC.

(i) express AG in terms of $\boldsymbol{a}$, $\boldsymbol{b}$, and scalar k, [1]

(ii) show that $\mathbf{OG} = (2 + k)\boldsymbol{a} + (6 - 7k)\boldsymbol{b}$. [3]

(c) Using the two expressions of OG, find the value of k. [2]

10 (a) [Do not re-draw the graph]



Use the graph above to answer the question which follow.

(i) ΔA is mapped onto ΔB by a translation. Write down the column vector for this translation. [1]

(ii) Describe **fully** the **single** transformation which maps ΔA onto ΔC. [3]

(iii) A reflection maps ΔA onto ΔD. Write down the equation of the mirror line. [2]

(iv) ΔD is mapped onto ΔF by a single transformation. Write down the matrix which represents this transformation. [2]

(v) ΔA is mapped onto ΔE by a one-way stretch.

Write down

(a) the stretch factor,

(b) the equation of the invariant line. [2]

(b) A transformation represented by $\begin{pmatrix} 3 & 1 \\ -1 & 0 \end{pmatrix}$ maps point R onto point (0; 2).

Write down the coordinates of R. [2]

11 (a) Study the patterns below.

Column 1	Column 2	Column 3
0	0	1
1	0	2
2	1	4
3	3	7
4	t	11
5	10	u
⋮	⋮	⋮
10	v	
11	55	
⋮	⋮	⋮
x	y	z
⋮	⋮	⋮

Use the patterns to write down

(i) the value of t, [1]

(ii) the value of u, [1]

(iii) the value of v, [1]

(iv) an expression for z in terms of x and y. [1]

(b) Mrs Chido, a trader, imported a television (T.V.) set from South Africa for R1 600.

(i) If the exchange rate was Z\$800 to R1, convert R1 600 to dollars. [

(ii) Mrs Chido paid 65% of the value of the T.V. set as import duty. Calculate the import duty paid in Z\$. [2]

(iii) The T.V. set was then sold for Z\$4 600 000. If this amount included 15% Value Added Tax (V.A.T), calculate in Z\$

(a) the V.A.T paid, [2]

(b) the profit made by Mrs Chido. [3]

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12 Answer the whole of this question on a sheet of graph paper.

The table shows the number of patients who are H.I.V. positive recorded at a district hospital.

Age x (years)	$0 < x \leqslant 10$	$10 < x \leqslant 20$	$20 < x \leqslant 30$	$30 < x \leqslant 40$	$40 < x \leqslant 50$	$50 < x \leqslant 60$	$60 < x \leqslant 70$
Frequency	60	140	450	510	r 390	150	50
Cumulative frequency	60	p 200	q 650	1 160	1 550	1 700	1 750

(a) Find the values of p, q and r. [2]

(b) Using a scale of 2 cm to represent 200 patients on the vertical axis and 2 cm to represent 10 years on the horizontal axis, draw the cumulative frequency curve for the given data. [3]

(c) Use the graph to estimate

(i) the median age,

(ii) the number of patients in the age group $22 < x \leq 45$. [4]

(d) If two patients are chosen at random, find the probability that one is at most 20 years old and the other is more than 60 years old. [3]

MATHEMATICS
NOVEMBER 2007
ANSWERS

1(a) $5,2 - 8,3 \times 0,2$

$5,2 - (8,3 \times 0,2)$ (Apply BODMAS)

$5,2 - 1,66$

$3,54$ (Ans)

(b) $(4 \times 10^2) + (6 \times 10^3) + (1 \times 10^5)$

First fact out the common number i.e 10^2

$10^2 [4 + (6 \times 10) + (1 \times 10^3)$

Then solve the brackets

$10^2 [\,4 + 60 + 1000]$

$10^2 [\,1064]$

1064×10^2

(1064 should be put in standard form i.e "only one significant figure before the comma"

$1064 = 1,064 \times 10^3$

Thus $1,064 \times 10^3 \times 10^2$

$1,064 \times 10^{3+2}$

$1,064 \times 10^5$

(c) $\frac{2}{3}(x - 1) - 1/4\,(3x - 5) = 1$

The LCD is 12

Multiply every number by the L.C.D

$12 \times \frac{2}{3}(x - 1) - 12 \times \frac{1}{4}(3x - 5) = 12 \times 1$

$4 \times 2\,(x - 1) - 3 \times 1\,(3x - 5) = 12$

$8(x - 1) - 3\,(3x - 5) = 12$

$8x - 8 - 9x + 15 = 12$

$8x - 9x = 12 + 8 - 15$

$\frac{-x}{-1} = \frac{5}{-1}$

$x = -5$

(d) $3 = \sqrt{b^2 + c^2}$

$3^2 = (\sqrt{b^2 + c^2})^2$ (Square both sides)

$9 = b^2 + c^2$

$c^2 = 9 - b^2$

$\sqrt{c^2} = \sqrt{9 - b^2}$ (Introduce square roots both sides)

Answer $c = \sqrt{9 - b^2}$

NB: Do not find the square root of 9 and that of b^2. That is wrong.

2(a) (i) $\begin{bmatrix} 1 & -3 \\ 2 & -4 \end{bmatrix} - \begin{bmatrix} e & 0 \\ 5 & -10 \end{bmatrix} = \begin{bmatrix} -1 & -3 \\ -3 & 2f \end{bmatrix}$

Use the addition / subtraction rule of matrices

$1 - e = -1$

$-e = -1 - 1$

$\frac{-e}{-1} = \frac{-2}{-1}$ Answer $e = 2$

$-4 - (-10) = 2f$

$-4 + 10 = 2f$

$\frac{6}{2} = \frac{2f}{2}$

$3 = f$

$f = 3$ *(Answer)*

(ii) $\begin{matrix} 7 & -5 \\ 3 & -1 \end{matrix} \; M = \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$

Find the inverse of $\begin{matrix} 7 & -5 \\ 3 & -1 \end{matrix}$

Det $\begin{bmatrix} 7 & -5 \end{bmatrix} = (7 \times (-1)) - (3 \times (-5))$

$= -7 - (-15)$

$= -7 + 15$

Det $\begin{bmatrix} 7 & -5 \\ 3 & -1 \end{bmatrix} = 8$

Inverse $\begin{bmatrix} 7 & -5 \\ 3 & -1 \end{bmatrix} = \frac{1}{8} \begin{bmatrix} -1 & 5 \\ -3 & 7 \end{bmatrix}$

"Multiply both sides of the equation by the above inverse"

$\frac{1}{8}\begin{bmatrix} -1 & 5 \\ -3 & 7 \end{bmatrix}\begin{bmatrix} 7 & -5 \\ 3 & -1 \end{bmatrix} M = 1/8 \begin{bmatrix} -1 & 5 \\ -3 & 7 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} M = 1/8 \begin{bmatrix} -1 & 5 \\ -3 & 7 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$M = 1/8 \begin{bmatrix} -1 & 5 \\ -3 & 7 \end{bmatrix}$

$M = \begin{bmatrix} -1/8 & 5/8 \\ -3/8 & 7/8 \end{bmatrix}$ Answer

(ii) $5x^2 - 3x - 2 = 0$

(Multiply the coefficient of x^2 by the y – interest)

i.e. $5 \times (-2) = -10$

"Two Numbers such that if added or subtracted gives -3 ad when multiplies gives -10" are; -5 and 2

Break the middle term;

$5x^2 - 5x + 2x - 2 = 0$

$5x(x - 1) + 2(x - 1) = 0$

$(x - 1)(5x + 2) = 0$

Either $x - 1 = 0$ or $5x + 2 = 0$

$x - 1 = 0$ $\quad$ $5x + 2 = 0$

$x = 1$ $\quad$ $\frac{5x}{5} = \frac{-2}{5}$

$x = \frac{-2}{5}$

Either $x = 1$ or $\frac{-2}{5}$

3(a) To find PSU apply the following theorems

1. A diameter substends an angle of 90° the circumference

QSU = 90°

2. If a tangent forms an angle with a chard and that chard substends an angle at the circumference, those two angles are equal. (Alternate segment)

TPQ = PSQ = 53°

(iii) PSU = 90° – 53°

PSU = 37°

(iv) QPS = QUS (Angles in the same segment are equal)

$QPS = 90^\circ - 40^\circ$

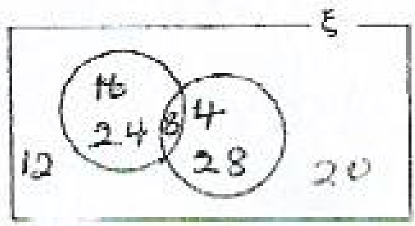
$QPS = 50^\circ$ **Answer**

(iii) QRS (opposite interior angles of a cyclic quadrilateral are supplementary)

$QRS = 180^\circ - 50^\circ$

$QRS = 130^\circ$ **Answer**

(b)



(c) $180(n-2) = 3\,(360)$

$180n - 360 = 1080$

$180 = 360 + 1080$

$$\frac{180n}{180} = \frac{1440}{180}$$

$n = 8$ Answer

4(a) $23_x = 21_{10}$

(Express everything to base 10)

x^1	x^0	$= 21$
2	3	

$2x + 3 = 21$

$2x = 21 - 3$

$$\frac{2x}{2} = \frac{18}{2}$$

$x = 9$ **Answer**

(b) The sum of the first eight numbers is;

8×13

$= 104$

Sum of the 12 numbers is :

12×11

$= 132$

Sum of the 4 numbers added is,

132 − 104

= 28

Mean = $\frac{\text{Sum of the numbers}}{\text{Frequency}}$

Mean = [illegible]

(a)(i) $y \propto \frac{x}{(x+2)}$

$y = \frac{kx}{(x+2)}$

(ii) $\frac{3}{2} = \frac{5k}{(8+2)}$

$\frac{3}{2} = \frac{5k}{10}$

$3 \times 10 = 5k \times 2$ (cross and multiply)

$\frac{30}{10} = \frac{10k}{10}$

$k = 3$ Answer

(iii) $y = \frac{3x}{(x+2)}$

$y = \frac{3(2)}{(-11+2)}$ $\qquad y = \frac{6}{(-9)}$

$y = \frac{-2}{3}$ Answer

5(a) $y^2(x-2) - x + 2$

$y^2(x-2) - 1(x-2)$

$(x-2)(y^2-1)$ (apply difference of squares for y^2-1)

$(x-2)(y-1)(y+1)$ Answer

(b) First find AC (the diameter) using Pythagoras Theorem

$(AC)^2 = 3{,}6^2 + 1{,}5^2$

$(AC)^2 = 15{,}21$

$AC = \sqrt{15{,}21}$

$AC = 3{,}9$

$OC = \dfrac{AC}{2}$

$OC = \dfrac{3{,}9}{2}$

$OC = 1{,}95$ **Answer**

(ii) $B\hat{O}C$ (You can use Cosine Rule or Trig Ratios)
Using Cosine Rule

$\text{Cos } B\hat{O}C = \dfrac{1{,}95^2 + 1{,}95^2 - 3{,}6^2}{2 \times 1{,}95^2}$

$\text{Cos } B\hat{O}C = \dfrac{3{,}8025 + 3{,}8025 - 12{,}96}{7{,}605}$

$\text{Cos } B\hat{O}C = \dfrac{-5{,}355}{7{,}605}$

$B\hat{O}C = \text{Cos-1 } (-0704142011)$

$B\hat{O}C = 134{,}8^\circ$

(iii) Shaded area = Area of sector OBC - Area of triangle OBC

Area of Sector $= \dfrac{134{,}8}{360} \times \dfrac{22}{7} \times 1{,}95^2$

$= 4{,}474\text{cm}^2$

Area of triangle $O\hat{B}C$ $= \frac{1}{2} \times 1{,}952 \times \text{Sin } 134{,}8$

$= 1{,}35\text{cm}^2$

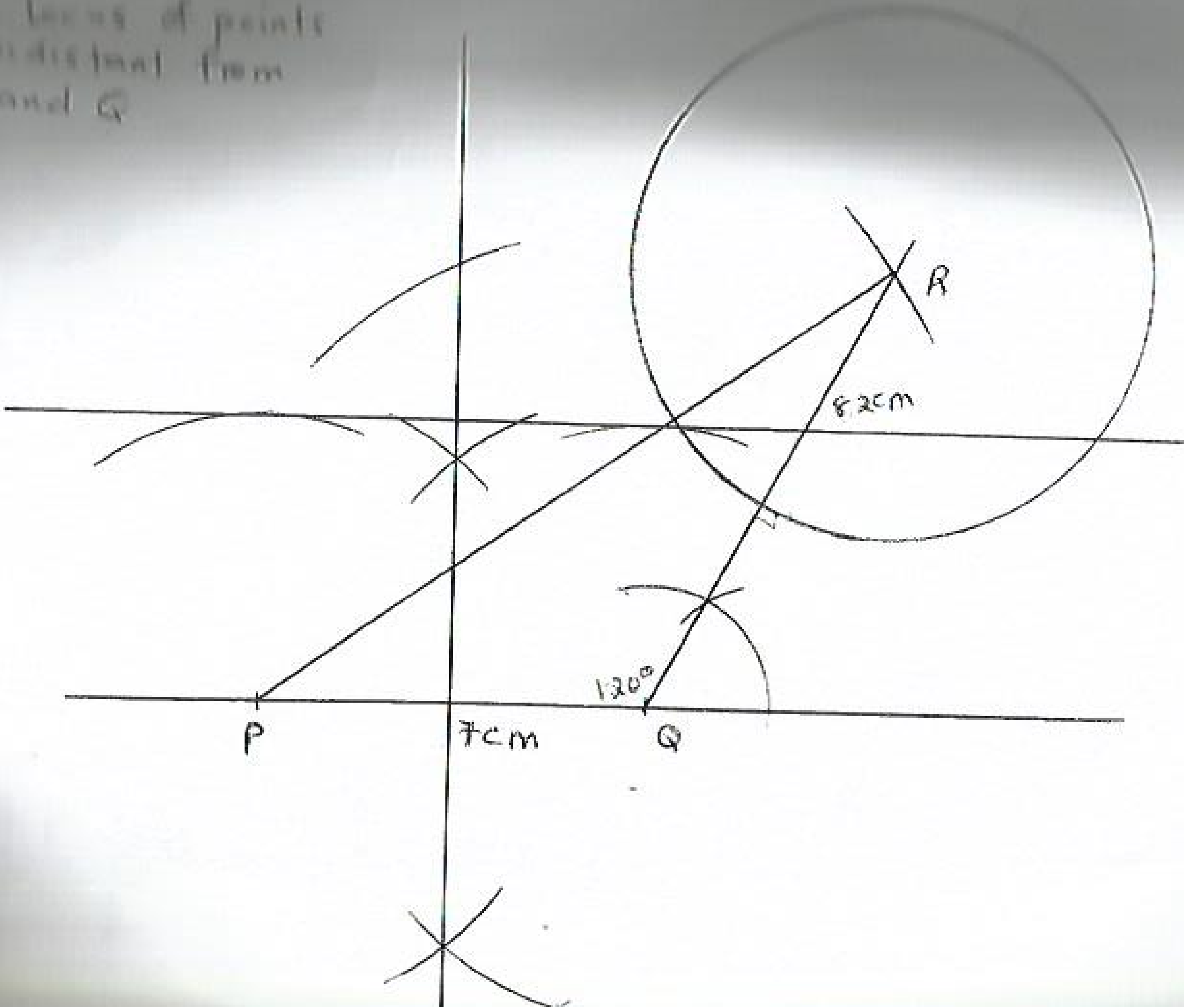
Shaded Area $= 4{,}474\text{cm}^2 - 1{,}35\text{cm}^2$

$= 3{,}124\text{cm}^2$

Diagram

) PR = 13,1cm

) The locus of points equidistant from P and Q



SECTION B

7(a) Use Cosine Rule

$(HF)^2 = 20^0 + 35^2 - 2 \times 20 \times 35 \text{ Cos } 102$

$(HF)^2 = 400 + 1225 - 1400 \text{ Cos } 102$

$(HF)^2 = 1625 - 1400 \text{ Cos } 102$

$(HF)^2 = 1625 - 1400 (-0{,}2079)$

$(HF)^2 = 1625 + 291{,} 076$

$(HF)^2 = 1916{,}076$

$HF = \sqrt{1916{,}076}$

HF = 43,77m Answer

(b) 1 ha = 10 000m²

0,08034 ha ______ less

$\dfrac{0{,}08034\text{ha} \times 10\,000\text{m}^2}{1\text{ha}}$

$803{,}4\text{m}^2$

0,08034ha = 803,4m² Answer

(ii) Consider the 'if' Rule

Area of $\triangle$ HGF = ½ (HG) x (FG) Sin HGF

½ x 38 x 50 x Sin HGF = 803,4

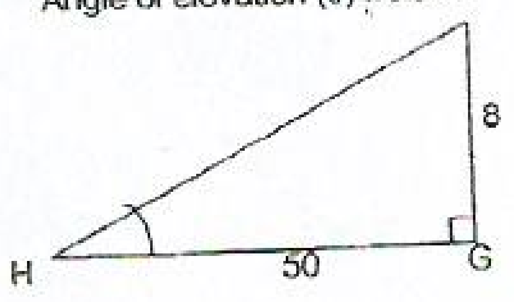
950 Sin HGF = $\dfrac{803.4}{950}$

HGF = Sin – $\left(\dfrac{803{,}4}{950}\right)$

HGF = 57,7°

(You can as well use the cosine rule but it is good to obey the 'if' Rule highlighted"

(c) Angle of elevation (θ) from H



$\text{Tan } \theta = \dfrac{8}{50}$

$\theta = \tan^{-1}\left(\dfrac{8}{50}\right)$

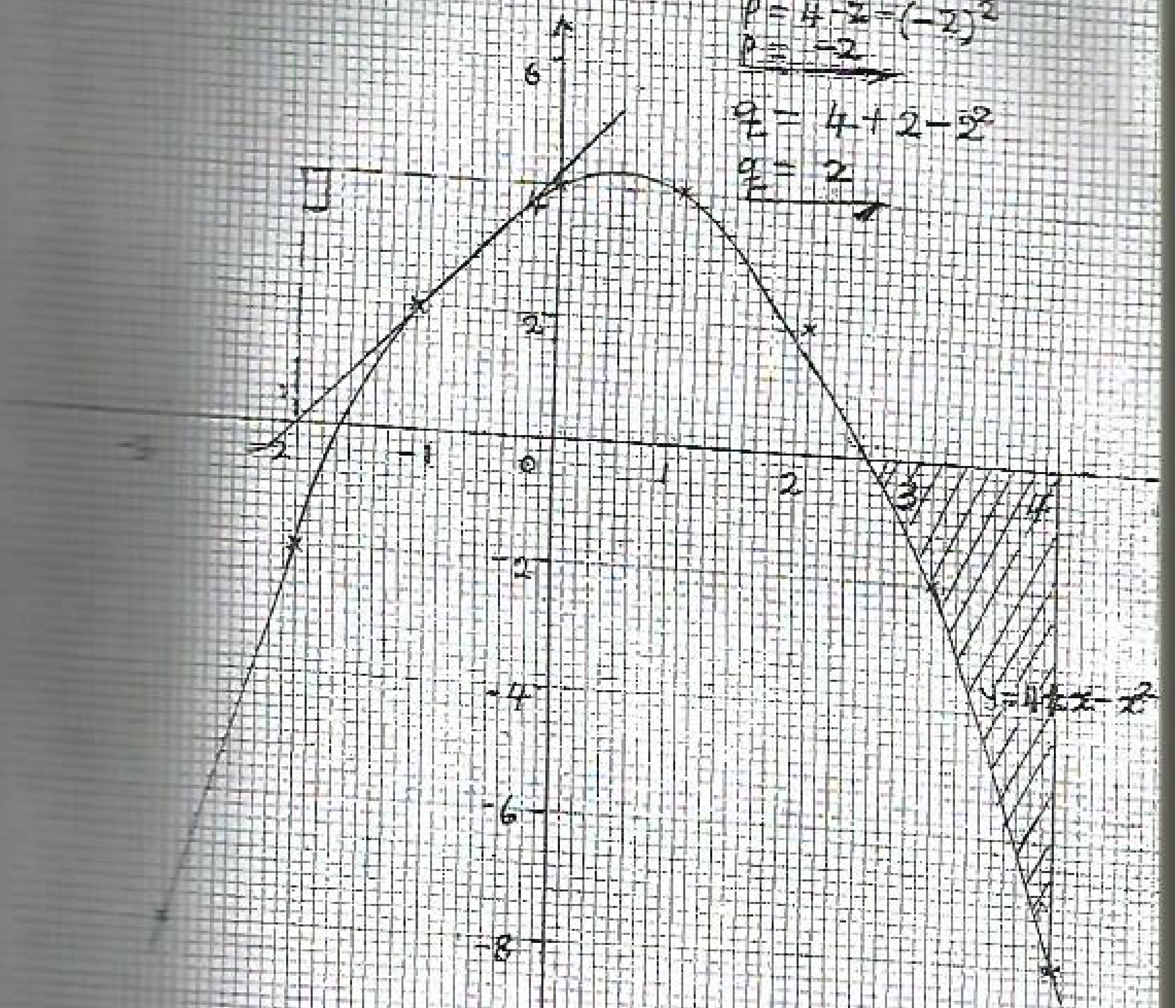
NOVEMBER 2007 Q8

$p = 4 - 2 - (-2)^2$

$p = -2$

$q = 4 + 2 - 2^2$

$q = 2$



(i) $x = -3,4$ or $3,4$

(ii) Gradient $= \dfrac{4 - 0}{0 - (-2)}$

$= \dfrac{4}{2}$

$= 2$

(iii) When y is maximum

$x = 0.5$

(iv) N° of boxes equivalent

Area of 1 box $= 2$ units^2

Area $= 2 \times 2$

$= 4$ units^2

)(i) $\overline{AC} = \overline{AO} + \overline{OC}$

$\overline{AC} = -(2\vec{a} + 6\vec{b}) + 3\bar{a} - \bar{b}$

$\overline{AC} = -2a + 6b + 3a - b$

$\overline{AC} = \vec{a} - 7\vec{b}$ **Answer**

a+5b

i) $\overline{AB} = \overline{AO} = \overline{OC} + \overline{CB}$

$\overline{AB} = -(2a + 6b) + a - b + ½ (2a + 6b)$

$\overline{AB} = 2a - 6b + 3a - b + a + 3b$

$\overline{AB} = 2a - 4b$ **Answer**

(iii) $\overline{OG} = 2/3\ \overline{OB}$

$\overline{OB} = \overline{OC} + \overline{CB}$

$\overline{OB} = 3a - b + ½ (2a + 6b)$

$OB = 3a - b + a + 3b$

$OB = 4a + 2b$

$\overline{OG} = 2/3 (4a + 2b)$

$\overline{OG} = \frac{8a}{3} + \frac{4b}{3}$

(b) $\overline{AG} = KAC$

(i) $\overline{AG} = k(a - 7b)$

$\overline{AG} = ka - 7kb$

(ii) $\overline{OG} = OA + AG$

$\overline{OG} = 2a + 6b + ka - 7kb$

$\overline{OG} = 2a + ka + 6b - 7kb$

$OG = (2 + k)\, a + (6 - 7k)\, b$ [Shown] [illegible] $\frac{8a}{3} - \frac{4b}{3} = (2+k)a + (6-7k)b$

$\frac{8}{3} = 2 + k$ OR $\frac{4}{3} = 6 - 7k$

$k = \frac{8}{3} - 2$ $\qquad$ $7k = 6 - \frac{4}{3}$

$k = \frac{2}{3}$ $\qquad$ $\frac{1}{7} \times 7k = \frac{14}{3} \times \frac{1}{7}$

$k = \frac{2}{3}$

[illegible] $\begin{pmatrix} 2 \\ 6 \end{pmatrix} + T = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$

$T = \begin{pmatrix} 4 \\ -2 \end{pmatrix} - \begin{pmatrix} 2 \\ 6 \end{pmatrix}$

$T = \begin{pmatrix} 2 \\ -8 \end{pmatrix}$

[illegible] Rotation
Centre of Rotation $(2 ; 8)$
Angle of Rotation $= 90^\circ$ anticlockwise

[illegible] $(-2 ; 0)$ & $(0 ; -2)$

$m = \frac{-2-0}{0-(-2)}$

$m = -1$

$-1 = \frac{y-0}{x+2}$

$-(x+2) = y$

$y = -x - 2$ (mirror line)

$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} -8 & -4 \\ -4 & -4 \end{pmatrix} = \begin{pmatrix} 4 & 2 \\ 2 & 2 \end{pmatrix}$

$-8a - 4b = 4$ - - - - (i)

$-4a - 4b = 2$ - - - - (ii)

$\frac{-4a}{-4} = \frac{2}{-4}$

$a = -\frac{1}{2}$

$-8(-\frac{1}{2}) - b = 4$

$-4b = 4 - 4$

$b = 0$

$-8c - 4d = 2 \text{ - - - - (iii)}$

$\underline{-4c - 4d = 2} \text{ - - - (iv)}$

$-4c \quad = 0$

$c = 0$

$-8(0) - 4d = 2$

$\frac{-4d}{-4} = \frac{2}{-4}$

$d = -\frac{1}{2}$

v) $\begin{pmatrix} h & 0 \\ 0 & k \end{pmatrix} \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$

$2h = -3 \qquad 2k = 2$

$h = \frac{-3}{2} \qquad k = 1$

(i) Stretch factor $= \frac{-3}{2}$

(ii) The y – axis is invariant

b) $\begin{pmatrix} 3 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$

$3x + y = 0$

$-x = 2$

$x = -2$

$3(-2) + y = 0$

$y = 6$

Coordinates of R = (-2 ; 6)

---

11) $f = 6$

$u = 11 + 5$

$u = 16$

C1	C2	C3
5	10	16
6	15	22
7	21	29
8	28	37
9	36	46
10	45	56

(ii) $y = 45$

(iii) $z = x + y + 1$

(b) 1 ________ Z$800
[illegible] ______ more

[illegible] = $\frac{1600}{1}$ x Z$800
= Z$1 280 000

[illegible] = $\frac{65}{100}$ x Z$1 280 000
= Z$832 000

(c) (i) $\frac{15}{100}$ x Z$4 600 000 = V A T

VAT = Z$690 000

(ii) Net profit = -(1 280 00 + 832 000) + 4 600 000

Net profit = Z$4 600 000
= <u>Z$2 112 000</u>
Net profit <u>Z$2 488 000</u>

Nov 2007 Q12

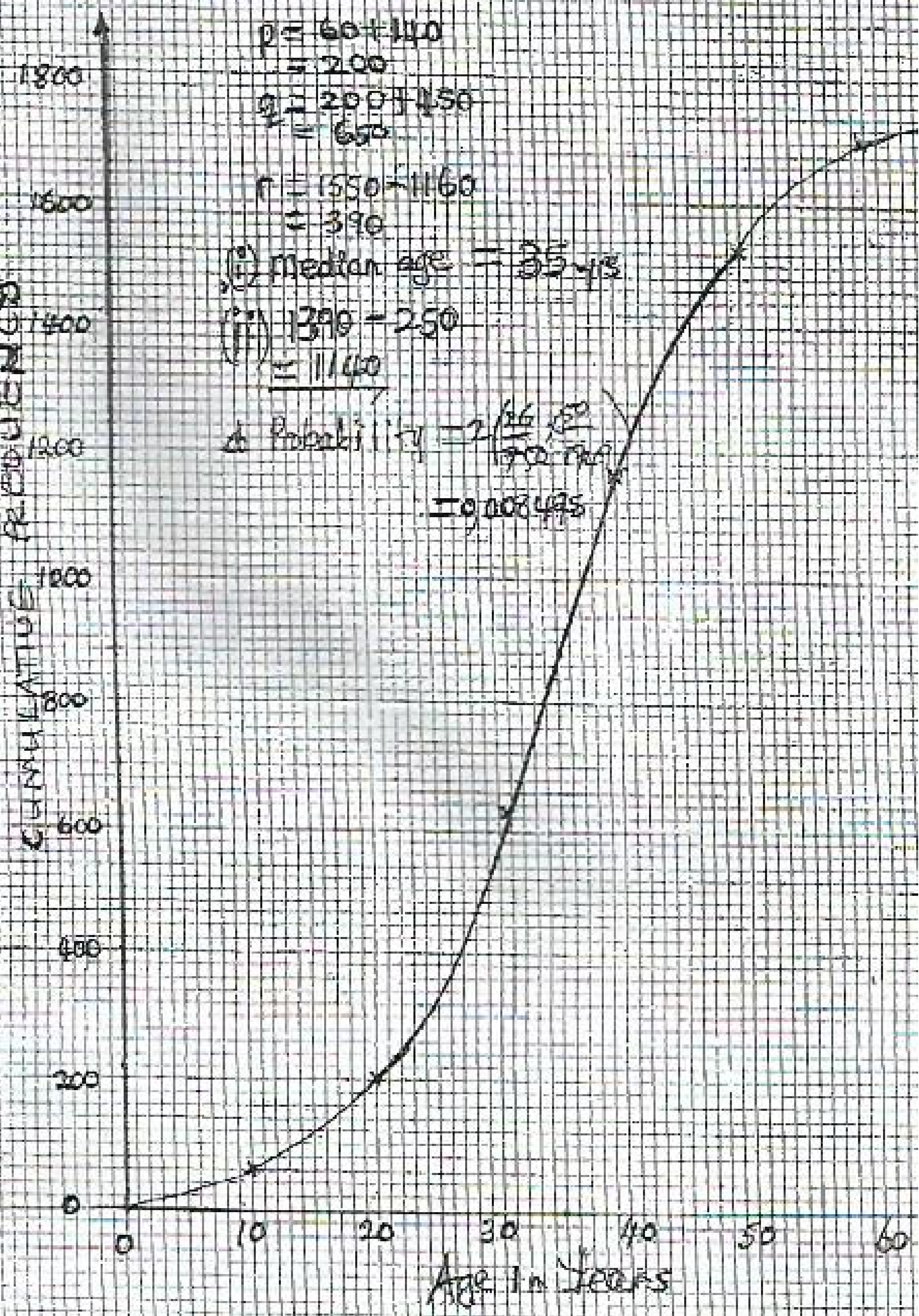
$p = 60 + 140$
$= 200$
$q = 200 + 450$
$= 650$

$r = 1550 - 1160$
$= 390$

(i) Median age $= 35$ yrs

(ii) $1390 - 250$
$= 1140$

$\therefore$ Probability $= 2\left(\frac{26}{1390} \times \frac{102}{1389}\right)$
$= 0.008475$



150

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MATHEMATICS

4008/2

[illegible]

JUNE 2008 SESSION

2 hours 30 minutes

[illegible]

[illegible] CANDIDATES

[illegible] candidate number in the spaces provided on the [illegible]

[illegible] Section A and any three questions from Section B.

[illegible] answer paper provided.
[illegible] paper, fasten the sheets together.

[illegible] must not be used.

[illegible] It should be done on the same sheet as the rest of the [illegible]

[illegible] result in loss of marks.
[illegible] specified in the question and if the answer is not exact, the [illegible] significant figures. Answers in degrees should be given [illegible]

[illegible] CANDIDATES

[illegible] given in brackets [ ] at the end of each question or part [illegible] may be used to evaluate explicit numerical expressions.

This question paper consists of 13 printed pages and 3 blank pages.

[Turn over

Section A [64 marks]

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

1 (a) Solve the equation

$$\frac{2}{3}(x+4) = x-1.$$

(b) Factorise completely

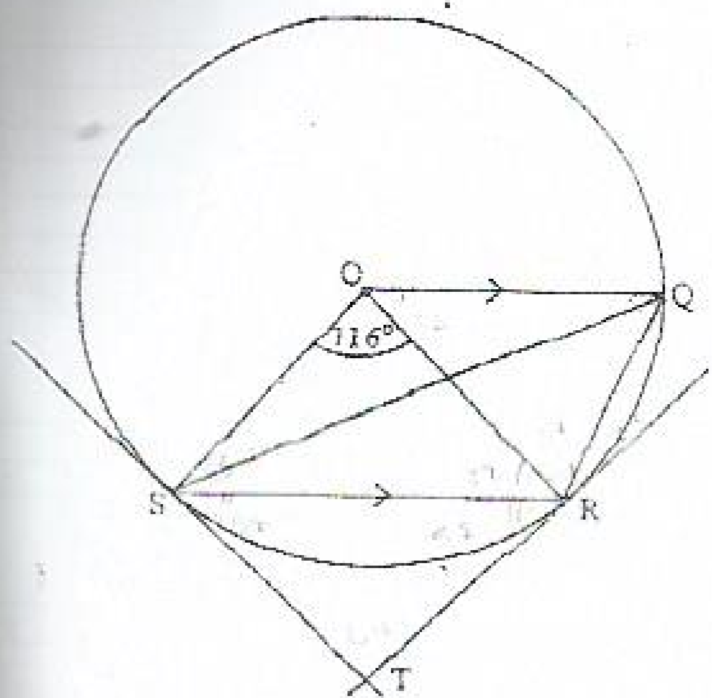
$$6y^2 - y - 12.$$

(c) Express $\frac{2}{2x-1} - \frac{3}{x}$ as a single fraction in its lowest terms.

(d) Given that $z = r\sqrt{n-1}$,

(i) find z when $r = 0.3$ and $n = 50$,

(ii) express n in terms of z and r.



In the diagram, TR and TS are tangents to the circle centre O.

SR is parallel to OQ and $S\hat{O}R = 116°$.

Calculate

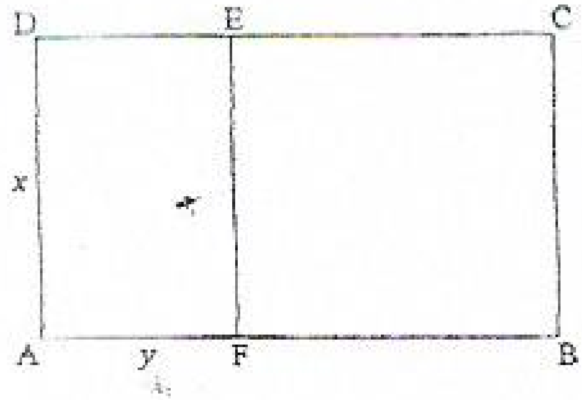
(i) $S\hat{Q}R$, [1]

(ii) $R\hat{S}Q$, [2]

(iii) $R\hat{T}S$. [2]

[Turn over

(b)



In the diagram, ABCD is a rectangle and BCEF is a square.

Given that DA = x cm, AF = y cm, $x + y = 15$ and $x - y = 7$.

Calculate

(i) the value of x, [

(ii) the area of ABCD. [

(c) Six angles of an octagon are 140° each. The remaining angles are equal
Find the size of each of the remaining angles. [

---

3 (a) Given that $\begin{pmatrix} x & 2 \end{pmatrix}\begin{pmatrix} 3 & 1 \\ 0 & y \end{pmatrix} = \begin{pmatrix} 15 & -7 \end{pmatrix}$,

find the value of

(i) x, [

(ii) y. [

(b) It is given that

ξ = {all triangles},

A = {all equilateral triangles},

B = {all isosceles triangles} and

C = {all right angled triangles}.

Draw a clearly labelled Venn diagram to illustrate the relationship between the sets.

(b) Study the number patterns shown in the table.

Column 1	Column 2	Column 3
1	1	1
2	3	9
3	6	36
4	10	100
5		p
6	q	
	⋮	⋮
	66	
r	78	
	⋮	⋮
n	w	v

(i) Write down the numerical value of

(a) p,

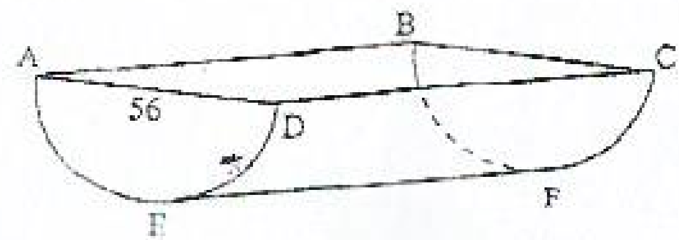
(b) q,

(c) r. [3]

(ii) Express v in terms of w. [1]

[Turn over

4 (a)



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

The diagram ABCDEF represents a metal drinking trough made from a closed cyclindrical drum that was bisected lengthwise.

The trough has a diameter of 56 cm and a capacity of 110 litres.

(i) Calculate

(a) the area of the cross-section ADE,

(b) AB.

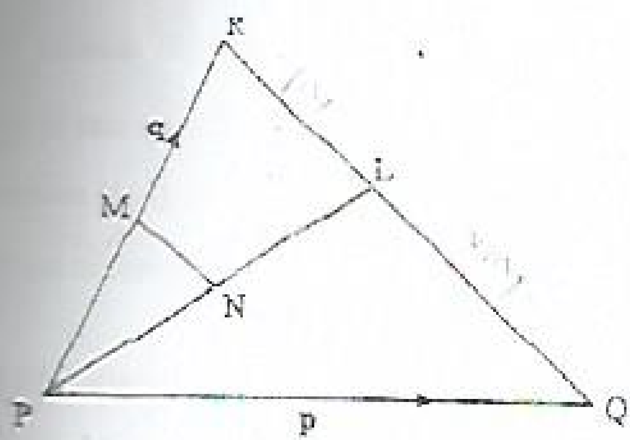
(ii) The whole drum was bought for \$25 500 and this represents a 70% increase in price of such a drum in the previous year.

Calculate the price of such a drum in the previous year.

(b) Solve the equation

$$4x^2 - 2x - 3 = 0,$$

giving your answers correct to 2 significant figures.



In the diagram $\overrightarrow{PQ} = \mathbf{p}$ and $\overrightarrow{PR} = \mathbf{q}$. M is a midpoint of PR, QL : LR = 2 : 1 and MN is parallel to RQ.

(i) Express in terms of p and/or q

(a) $\overrightarrow{QR}$, [1]

(b) $\overrightarrow{LR}$, [1]

(c) $\overrightarrow{MR}$. [1]

(ii) Given that $\overrightarrow{NM} = k\overrightarrow{QR}$, find the scalar k. [2]

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

A hemispherical bowl is made of wood 2 cm thick.

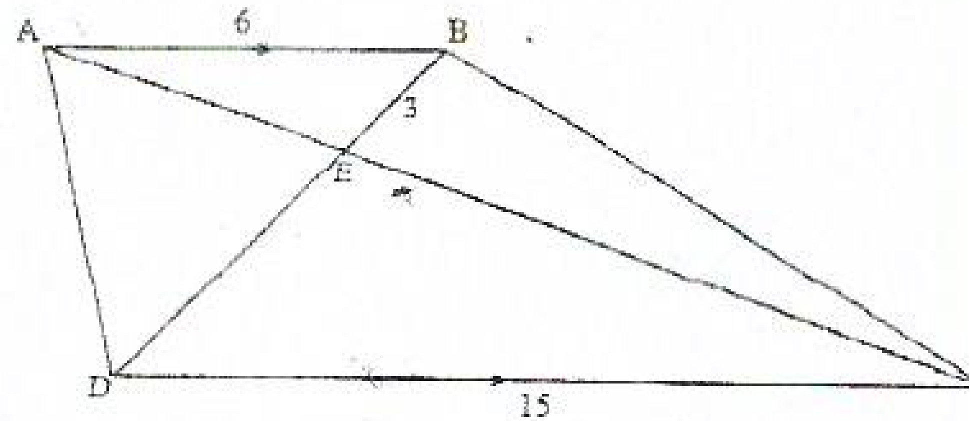
(i) Given that the bowl has an internal diameter of 14 cm, calculate the capacity of the bowl in litres. [3]

(ii) Calculate the mass of the bowl given that the density of the wood is 0,8 g/cm³. [4]

[**Volume of a sphere** $= \dfrac{4}{3}\pi r^3$]

[Turn over

6



In the diagram, ABCD is a quadrilateral with AB parallel to DC. Diagonals and BD meet at E. AB = 6 cm, BE = 3 cm and DC = 15 cm.

(a) Name, in the correct order, the triangle that is similar to ΔABE.

(b) Calculate DE.

(c) If the area of ΔBEC is $22{,}5\ cm^2$, calculate

(i) the area of ΔDEC,

(ii) the ratio $\dfrac{\text{area of } \Delta ABE}{\text{area of } \Delta ADC}$ in its simplest form.

Section B [36 marks]

Answer any three questions in this section.

Answer the whole of this question on a single sheet of graph paper.

Triangle A has vertices (6; 4), (8; 6) and 4; 6).

Using a scale of 2 cm to represent 2 units on each axis, draw the x and y axes for

(a) Draw and label triangle A. [1]

(b) A reflection in the line $y = x + 2$ maps triangle A onto triangle B.

(i) Draw the line $y = x + 2$. [1]

(ii) Draw and label triangle B. [2]

(c) Triangle C has vertices at

(i) Draw and label triangle C. [1]

(ii) Describe fully the single transformation which maps triangle A into triangle C. [2]

(d) A transformation P represented by the matrix $\begin{pmatrix} 1 & 0 \\ -1\frac{1}{2} & 1 \end{pmatrix}$ maps triangle A onto triangle D.

(i) Draw and label triangle D. [2]

(ii) State the name of the transformation represented by P. [1]

(e) A clockwise rotation of 90°, centre (0;10) maps triangle A onto triangle E.

Draw and label triangle E. [2]

[Turn over

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

Use ruler and compasses only. All construction arcs and lines must be clearly shown

Three schools, P, Q and R are such that the bearing of Q from P is 045° and that of R from P is 300°. The distance between P and R is 18 km and Q is due east of R.

(a) (i) Using a scale of 1 cm to represent 2 km, construct a **single diagram** to show the relative positions of the 3 schools, P, Q and R.

(ii) Use the diagram to find the actual distance between P and Q.

(iii) Construct the perpendicular from R to QP produced.

(b) Calculate the area of the triangular region PQR, giving your answer in km^2.

---

9 Answer the whole of this question on a single sheet of graph paper.

The following is an incomplete table of values for the graph of $y = x^2 + \frac{1}{x}$.

x	0,25	0,5	0,8	1	1,5	2	2,5	3
y	4,1	2,3	1,9	p	2,9	4,5	q	9,3

(a) Calculate the value of p and the value of q.

(b) Taking 4 cm to represent 1 unit on the x-axis and 2 cm to represent 1 unit on the y-axis, draw the graph of

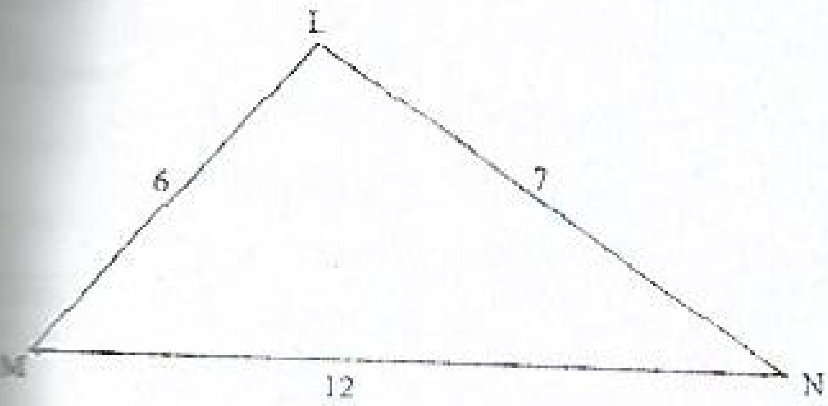
$$y = x^2 + \frac{1}{x} \text{ for } 0,25 \leq x \leq 3.$$

(c) On the same axes draw the graph of $2y = 5x + 2$.

(d) (i) Write down the coordinates of their points of intersection of the graph of $y = x^2 + \frac{1}{x}$ and graph of $2y = 5x + 2$.

(ii) Estimate the area bounded by $y = x^2 + \frac{1}{x}$ and $2y = 5x + 2$ and the lines $x = 1$ and $x = 2$.

A vertical aerial mast is 20.5 m high. Calculate, to the nearest degree, the angle of elevation of the top of the mast from a point on horizontal ground which is 32,6 m from the foot of the mast. [2]



The diagram shows ΔLMN in which $LM = 6$ cm, $LN = 7$ cm and $MN = 12$ cm.

Calculate $M\hat{L}N$. [5]

A co-operative deposited $60 million into a bank for $1\frac{1}{2}$ years at the rate of 20% per annum simple interest.

After $1\frac{1}{2}$ years the co-operative was charged 15% tax on the total interest they made and $4.32 million as bank charges.

Calculate

(i) the interest the co-operative made, [2]

(ii) the tax deducted, [1]

(iii) the net profit they made. [2]

[Turn over

11 **Answer the whole of this question on a single sheet of graph paper.**

A group of 70 students were involved in a 50 km sponsored walk.

The distances covered by the students are shown in the table.

Distance x covered (km)	$10 < x \leq 20$	$20 < x \leq 25$	$25 < x \leq 40$	$40 < x \leq 50$
Number of students	30	12	w	13
Frequency density	3	v	1	1.3

(a) Find the value of

(i) v,

(ii) w.

(b) Using a scale of 2 cm to represent 10 km on the horizontal axis and 2 cm to represent 1 unit on the vertical axis, draw a **histogram** to represent the information in the table.

(c) State the modal class.

(d) A sponsor paid at the rate of \$10 000 per km. Calculate an estimate of the total amount paid to those who walked more than 25 km.

(e) Two students were chosen at random from the group. Calculate the probability that one walked at most 20 km and the other walked more than 20 km but less than or equal to 25 km.

Answer the whole of this question on a single sheet of graph paper.

Mr Hove manufactures tables and chairs using softwood and hardwood.

A table requires 5 metres of softwood and 3 metres of hardwood.

A chair requires 3 metres of softwood and 4 metres of hardwood.

Mr Hove has 45 metres of softwood and 48 metres of hardwood.

Let x be the number of tables made and y be the number of chairs made.

(a) Using the above information, write down two inequalities other than $x \geq 0$ and $y \geq 0$ in x and y, which satisfy these conditions. [2]

(b) In order for Mr Hove to make a profit, he should manufacture more than 2 tables and at least 4 chairs. Write down two inequalities, one in x and the other one in y, which satisfy these conditions. [2]

(c) The point $(x; y)$ represents x tables and y chairs manufactured. Using a scale of 2 cm to represent 2 tables on the horizontal axis and 2 cm to 2 chairs on the vertical axis, draw the axes for

$$0 \leq x \leq 16 \text{ and } 0 \leq y \leq 16.$$

Indicate clearly by shading the UNWANTED regions, the region in which $(x; y)$ should lie. [4]

(d) Use your graph to write down all possible combinations which give the maximum number of tables and chairs manufactured. [2]

MATHEMATICS PAPER 2
JUNE SESSION 2008
4008/2
ANSWERS

1(a) $\,^2/_3\,x \quad ^8/_3 = x - 1$ (removing brackets)

$\,^2/_x \times 3 + \underline{8}$ (clear the fraction)

$3 \qquad\quad 3$

$2x + 8 = 3x - 3$

$3x - 2x = 8 + 3$ (Collect like terms)

Therefore $x = 11$ (3)

(1b) $6y^2 - y - 12$

$\Rightarrow 6y^2 - 9y + 8y - 12$ (using factors of $-72y^2$)

$\Rightarrow 3y(2y - 3) + 4(2y - 3)$ (factorising by grouping)

$\Rightarrow (3y + 4)(2y - 3)$ (2)

(1c) $\dfrac{2}{2x - 1} - \dfrac{3}{x}$

$= \dfrac{2x - 3\,(2x - 1)}{x\,(2x - 1)}$ (Using the LCM)

$= \dfrac{2x - 6x\ 3}{x(2x - 1)}$

$= \dfrac{-4x = 3}{x(2x - 1)}$ (expanding and simplify)

(2)

1d(i) $Z = r\sqrt{n - 1}$

$Z = 0{,}3\sqrt{50 - 1}$ (substitute)

$Z = 0{,}3\sqrt{49}$

$= 0{,}3\ (\pm 7)$ (2)

$= \underline{-2{,}1 \text{ or } 2{,}1}$

(ii) $Z = r\sqrt{n-1}$

$Z^2 = r^2\ (n-1)$ (square evert term)

$\frac{Z^2}{r^2} = n - 1$

$n = \frac{z^2}{r^2} + 1$ / $\left[\frac{z}{r^2}\right]^2 + 1$ (2)

Q2a(i) SQR = 116 = 58° (L at the Circumference is ½ L at the centre (1)

(ii) RSQ = 16° [L at the circumference ½ at the centre ROQ = OR (2)

(iii) RTS = 180 – 116 = 64° (supplementary Angles) (2)

2(b) (i) $\left.\begin{array}{l} x + y = 15 \\ x - y \quad 7 \end{array}\right\}$ Simulataneous equations

$2x = 22$ (by elimination)

Therefore $\underline{x = 11}$ (2)

b(ii) A = L x W

= x (x + y) (in terms of x and y)

= 11(11 + 4) (Substitution)

= 11 x 15

= $\underline{165cm^2}$ (1)

2(c) (2n – 4) 180° (Sum of interior Angles)

= (2(6)-4) 180°

= (16-4) 180°

= *12 x 180°*

= ***1080°***

1080 – 6(140) Remaining angles)

= **240°**

$\frac{240°}{2}$

= **120°***(each angle)* *(3)*

(c) 3kg = 3 000g

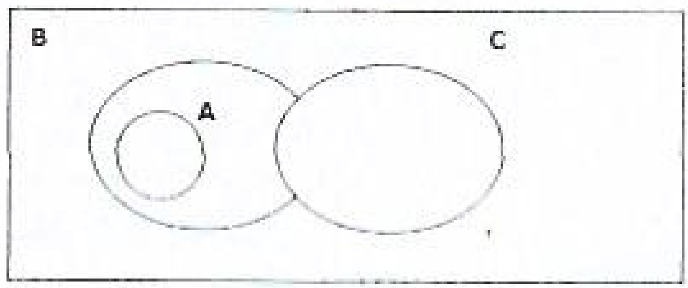
$\frac{150 \times 100}{3\,000}$ = $\underline{5\%}$

Q3(a) $(x \ -2)\begin{bmatrix} 3 & 1 \\ 0 & y \end{bmatrix} = (15 \ -7)$ (Multily row by column)

$3x + 2(0) = 15$ (i)
$x + 2y = -7$ (ii) Simultaneous
$x = 5$
$5 + 2y = -7$
$+ 2y = -12$
$y = -6$
Therefore $x = 5$
<u>$y = -6$</u> (4)

---

b)



(3)

(c) (i) (a) $P = 225$ (1)
(b) $q = 21$ (1)
(c) $r \ -12$ (1)
(ii) $v = w^2$ (1)

4i)a $A = \frac{1}{2} \pi r^2$ (Area of A Semi-Circle)

$= \frac{1}{2} \times \frac{22}{7} \times \left(\frac{56}{2}\right)^2$

$= \frac{1}{2} \times \frac{22}{7} \times 28^2$

$=$ **<u>1232 cm²</u>** (2)

(bi) $V = AL$

$110\,000 = 1232 \times AB$

$\frac{110\,000}{1232} = \frac{1232 \times AB}{1232}$

$89{,}2857 = AB$

Therefore AB = 89,3cm (to 3 Sg fig) (2) b(ii) $\frac{100}{170} \times 25\,500$

$= \frac{10}{17} \times 25\,500$

$=$ **$15 000** (2)

---

b) Use quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{2 \pm \sqrt{4 - (4 \times 4 \times -3)}}{2 \times 4}$$

$$= \frac{2 \pm 7.21111}{8}$$

$=$ **1,2 / -0,65** (5)

Q5(a) (i) a $\overline{QR} = \overline{QP} + PR$ (Resultant Vector)

$= -p + q$ (QP is a negative vector)

$=$ **q – p**

(1)

(b) $\overline{LR} = 1/3\ \overline{QR}$

$= 1/3\ (Q - P)$

$=$ **1/3q – 1/3 p**

(1)

(c) $\overline{MR} = \frac{1}{2}\overline{PR}$

$= \frac{1}{2}(q)$

(1)

(ii) $NM = k\overline{QR}$

$= \frac{1}{2} LR$

$= \frac{1}{2} \times \frac{1}{3}\ QR$

$=$ **$\frac{1}{6}$ QR** $k = \frac{1}{6}$ (2)

---

b) $V = \frac{4}{3}\pi r^3 \times \frac{1}{2}$

$= \frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \frac{22}{7} \times \left(\frac{14}{2}\right)^3$

$= 718{,}67\text{cm}^3$

$= \frac{718{,}67}{1\,000}$

$=$ **0,71867 Litres** (4)

Q6a) Δ CDE (1)

b) $\frac{DE}{15} = \frac{3}{6}$ (ratio of similar shapes)

$DE = \frac{3 \times 15}{6}$

$= \underline{\mathbf{7{,}5\ cm}}$ (2)

---

c) $\left[\frac{DE}{BE}\right] \times 22{,}5$ (Sharing Height)

$\frac{7\frac{1}{2}}{3} \times 22{,}5$ (Ratio of Bases)

$= \frac{5}{2} \times 22{,}5$

$= 56{,}25cm^2$ (2)

(ii) $\left[\frac{6}{15}\right]^2$ (Ratio of similar shapes)

$\Delta ABE = \frac{4}{25} \times 56{,}25$

$= \underline{9cm^2}$

$\Delta ADC = \mathbf{\Delta BDC}$

$= \left[\frac{10{,}5}{3}\right] 22{,}5$

$= \underline{\mathbf{78{,}75\ cm}}$

Therefore Ratio $\frac{\Delta ABE}{\Delta ADC} = \frac{9}{78{,}75}$ (4)

$= \underline{\mathbf{0{,}1143}}$

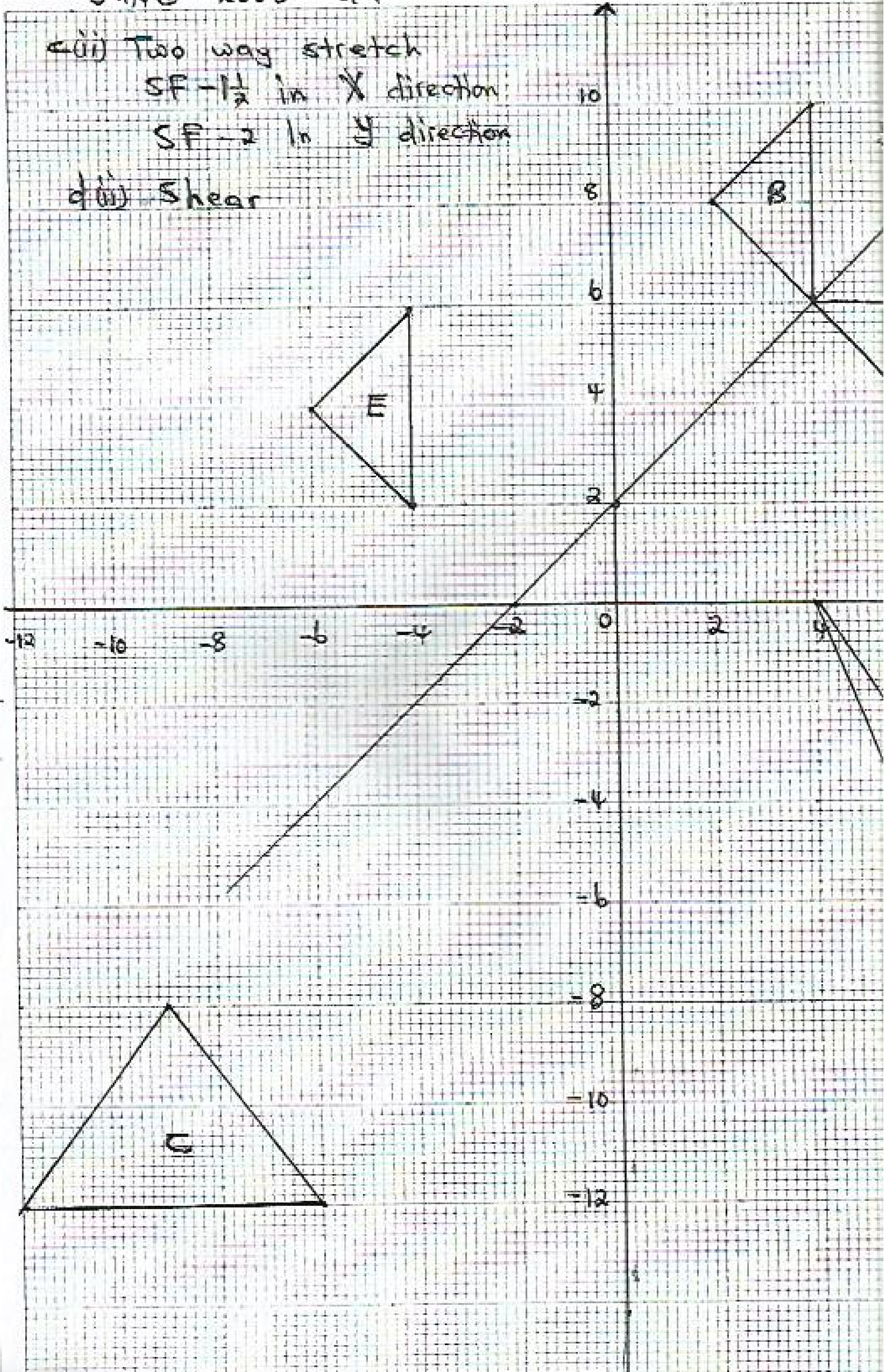
JUNE 2008 Q7

c(ii) Two way stretch

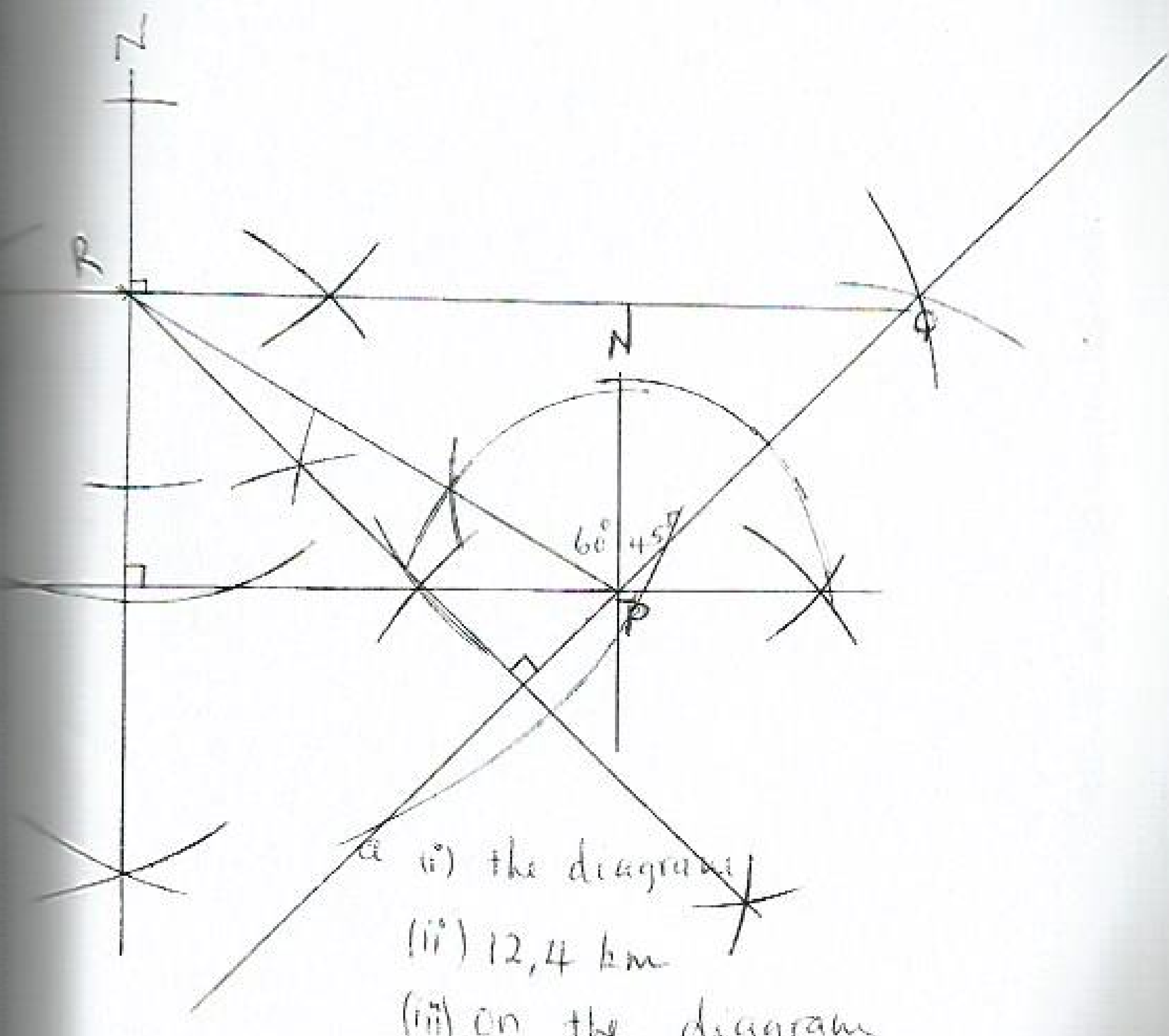
SF - $1\frac{1}{2}$ in X direction

SF - 2 in y direction

d(ii) Shear



Draw a sketch diagram first!



a (i) the diagram

(ii) 12,4 km

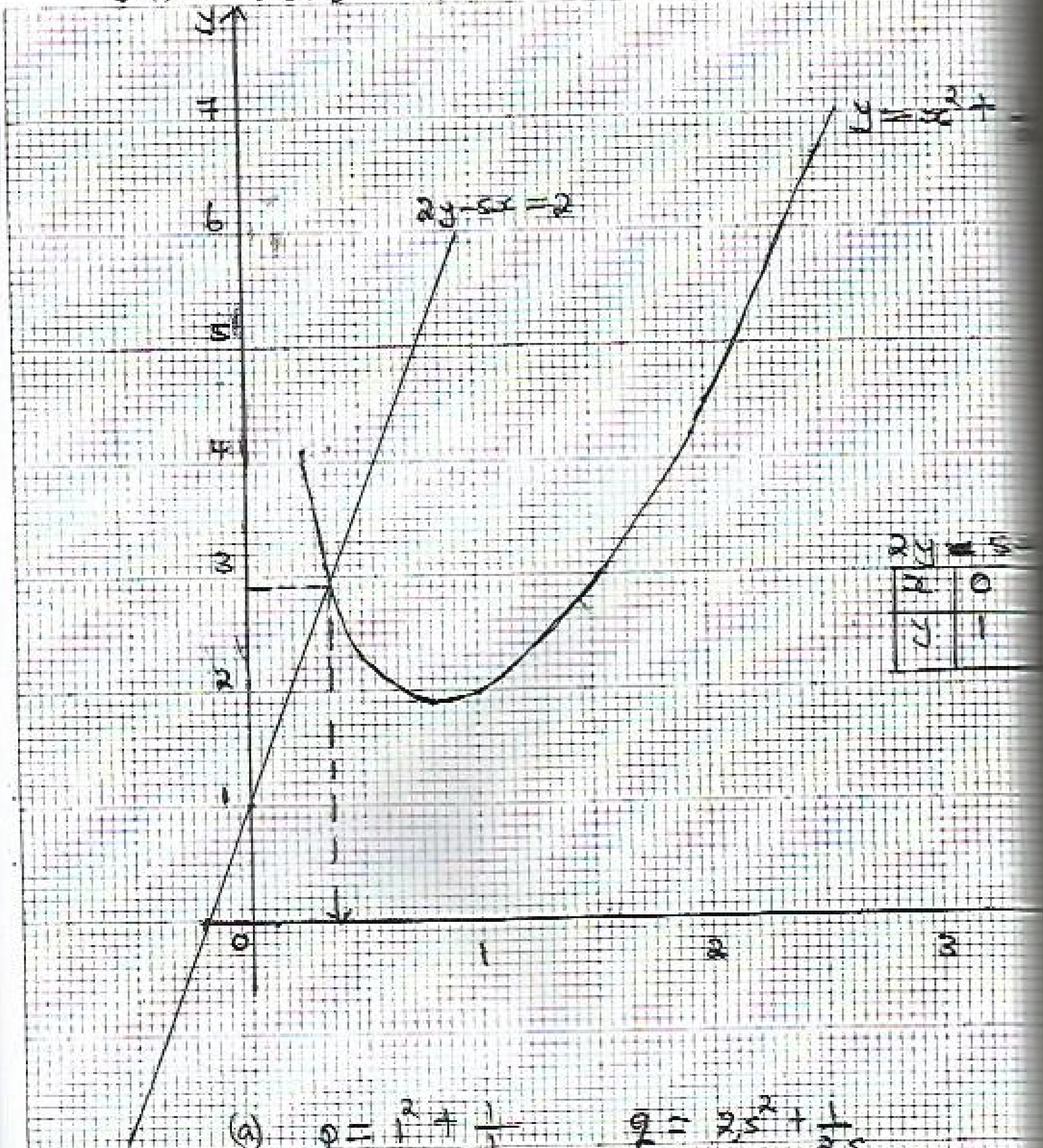
(iii) on the diagram

b) $\frac{1}{2}b \times h = \frac{1}{2} \times 12,4 \times 18$

$= 12,4 \times 9$

$= \underline{111,6\ km^2}$

JUNE 2008 Q9



(a) $p = 1^2 + \frac{1}{1}$ $= \underline{2}$

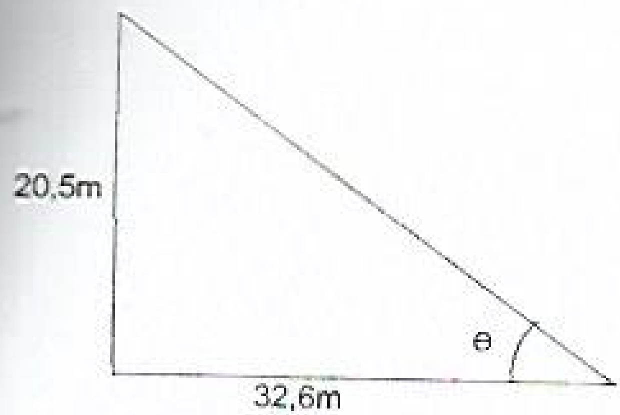
$q = 2{,}5^2 + \frac{1}{2{,}5}$ $= 6{,}25 + 0{,}4$ $= \underline{6{,}65}$

d(i) $\left(\frac{1}{2}; 2\frac{1}{4}\right)$

$\left(2\frac{4}{5}; 8\right)$

(ii) 1,72 Square Units

10 a)



Tan θ $= \frac{O}{A}$

$= \frac{20,5}{52,6}$

$= 0,6288$

Therefore θ = 32, 16°

≈ ***32.2°***

---

b) Use Cosine rule

Cos θ $\frac{6^2 + 7^2 - 12^2}{2 \times 6 \times 7}$

$= \frac{59}{84}$

$= 0,7024$

Therefore θ **134,6°**

---

c) (i) SI $= \frac{20}{100} \times 60 \times \frac{3}{2}$

= **$18 million**

(ii) Tax $= \frac{15}{100} \times 18$ million

= 2,7million

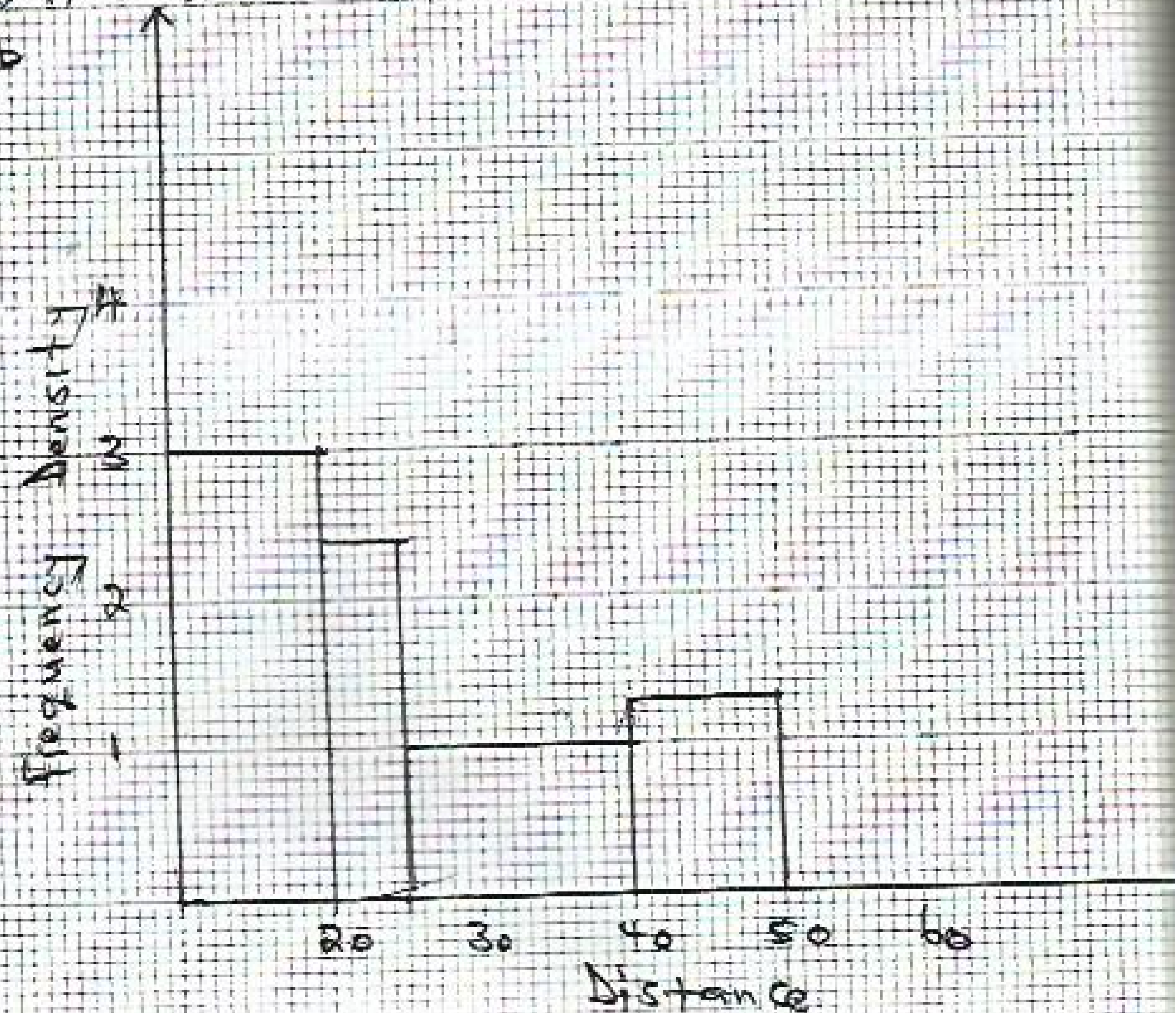
(iii) Net profit = Income – Tax – Bank Charges

= 18 - 2.7 – 4,32

= **10,98**

JUNE 2008 Q11

b



a) i) $v = \frac{12}{5} = \underline{2.4}$ $\qquad w = 70 - (30 + 12 +$

$= 15$

d) $(15 \times 32.5 + 13 \times 45) \times 10000$

\$ 10 725 000

e) $\frac{30}{70} \times \frac{12}{61} \times 2$

$= \underline{\frac{72}{427}}$

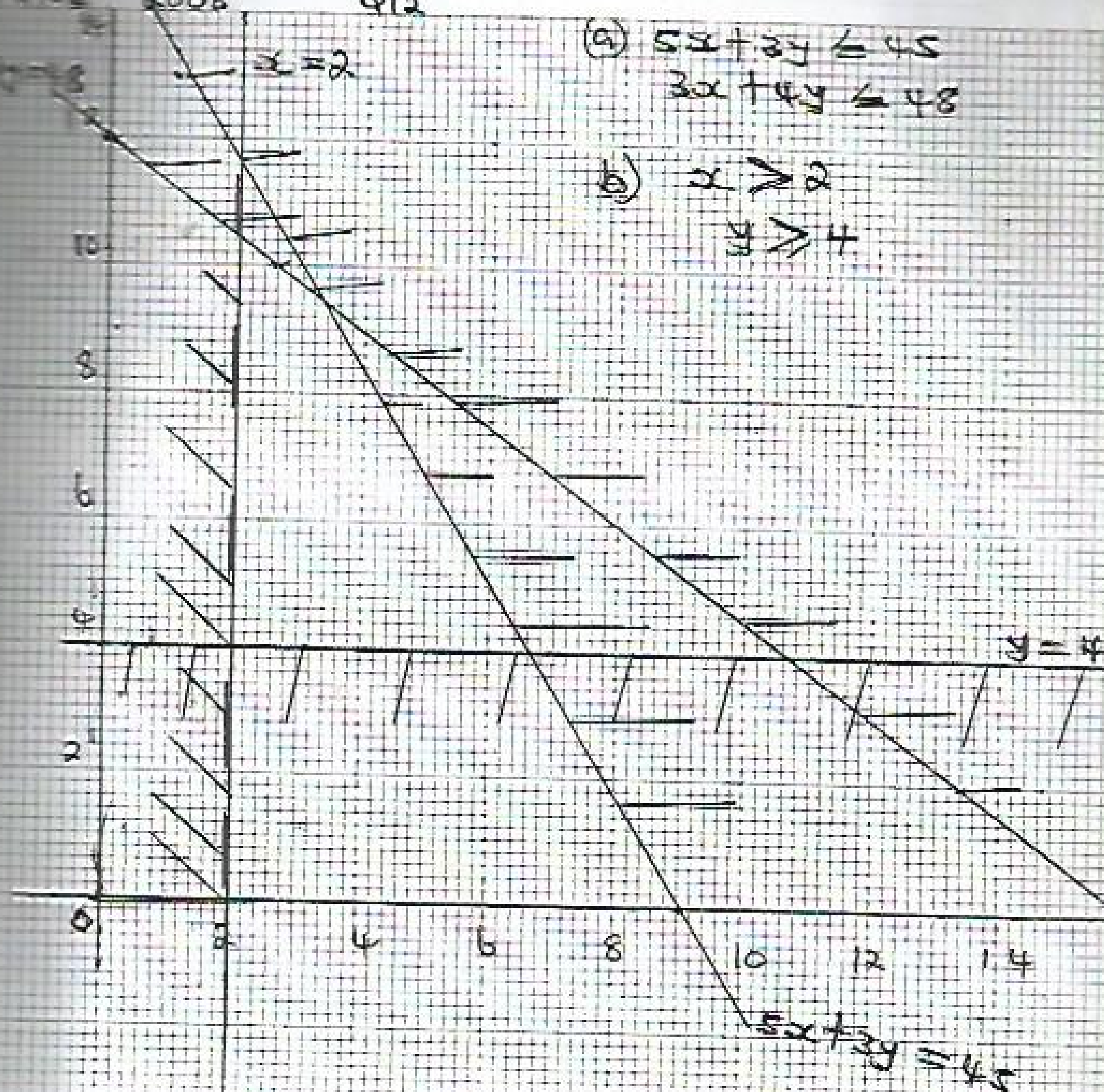
June 2008 Q12

(a) $5x + 3y \leq 45$

$3x + 4y \leq 48$

(b) $x \geq 2$

$y \geq 4$



(c)

d) 4 tables and 8 Chairs

3 tables and 9 Chairs

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS

4008/2

PAPER 2

NOVEMBER 2008 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

Electronic calculators must not be used.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 may be used to evaluate explicit numerical expressions.

This question paper consists of 11 printed pages and 1 blank page.

[Turn over

Section A [64 marks]

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

1 (a) Express $3\frac{2}{5} - 2\frac{13}{20}$ as a single fraction in its lowest terms. [2]

(b) Remove the brackets and simplify

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

(c) Solve the equation

$$\frac{4x-5}{7} = 1\frac{3}{4}.$$ [3]

(d) Find the number of circular rings each of diameter 6,3 cm which can be made from a wire 19,8 m long.

$\left(\text{Use } \pi = \frac{22}{7}\right)$. [4]

---

2 (a) Factorise completely

(i) $2x^2 + ax - 2bx - ab$,

(ii) $3-12y^2$. [4]

(b) It is given that P(4; 8) and R(−4; −2) are points on the Cartesian plane. Find

(i) $\overrightarrow{PR}$ as a column vector,

(ii) $|\overrightarrow{PR}|$.

(d) Two cyclists, Alice and John, started a journey at the same time from two villages which are 27 km apart. Alice cycled at x km/h and John cycled at $2x$ km/h. They travelled towards each other and met after $\frac{3}{4}$ hour.

(i) Write down, in terms of x, the distance that Alice travelled in $\frac{3}{4}$ hour.

(ii) Form an equation in x and solve it.

(iii) Hence write down the numerical value of John's speed. [4]

---

5 (a)

In the diagram, the Sun, Earth and Mars are in a straight line. It is given that the Earth is $1{,}496 \times 10^{8}$ km from the Sun and Mars is $2{,}279 \times 10^{8}$ km from the Sun.

(i) Write down $1{,}496 \times 10^{8}$ in ordinary form.

(ii) Find, in standard form, the distance of Mars from the Earth. [3]

(b) In a certain year, a paint manufacturer mixed 27 litres of white paint with 9 litres of red paint to produce 36 litres of **pink** paint. If one litre of the white paint cost $36 800 and the average cost of the **pink** paint was $33 575 per litre, calculate the cost of one litre of the red paint then. [3]

(c) (i) Solve the simultaneous inequalities

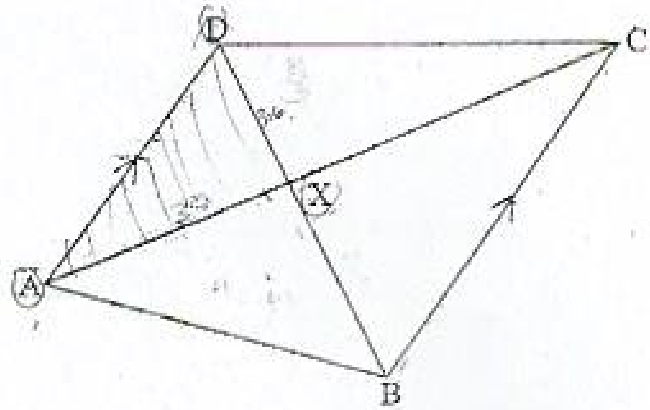
$$2x - 6 < 5x + 3 \leq 3x + 11$$

giving your answer in the form $a < x \leq b$ where a and b are integers.

(ii) Write down the least possible value of x. [4]

[Turn over

4 (a)



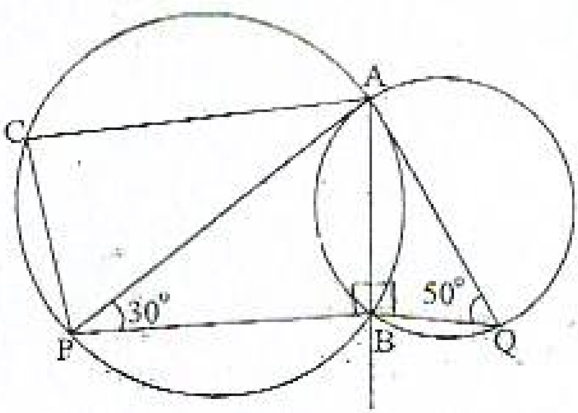
In the diagram, ABCD is a quadrilateral in which AD is parallel to BC and AC and BD intersect at X such that the ratio BX: XD = 3: 2. Given that $\Delta ABX = 9\ \text{cm}^2$ in area,

(i) calculate the area of ΔADX,

(ii) name, in correct order, the triangle which is similar to ΔBCX,

(iii) hence calculate the area of ΔBCX. [5]

(b)



In the diagram, AP and AQ are tangents to the circles ABQ and ABPC respectively. Given that $A\hat{P}B = 30°$ and $A\hat{Q}B = 50°$,

calculate

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

(ii) $B\hat{A}Q$,

(iii) reflex $P\hat{B}Q$,

(iv) $A\hat{C}P$.

[6]

5 (a) Express as a single fraction in its simplest form

$$n + \frac{2n}{6n + 5}.$$ [2]

(b) Make m the subject of the formula

$$a = \frac{m - 5}{3m - 2}.$$ [3]

(c) Given that $\mathbf{A} = \begin{pmatrix} 3 & 5 \\ -2 & 7 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 5 & y \\ y & 3 \end{pmatrix}$ find

(i) $\mathbf{A}^2$,

(ii) the two possible values of y given that the determinant of the matrix $\mathbf{B}$ is $5y + 1$. [5]

---

6 **Answer the whole of this question on a sheet of plane paper.**

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

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

(i) a line OP, 9 cm long,

(ii) a circle centre O and radius 3,5 cm,

(iii) the locus of points which are equidistant from O and P,

(iv) the circle whose diameter is OP to cut the circle centre O at R and Q,

(v) the two tangents to the circle centre O from the point P. [7]

(b) OP represents a certain locus. Describe this locus **fully**. [2]

(c) A point T lies inside the quadrilateral PQOR and is such that it is nearer PQ than PR and nearer O than P. Given also that OT $\geq$ 3,5 cm, show by shading clearly the region in which T lies. [2]

Section B [36 marks]

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

7 **Answer the whole of this question on a sheet of graph paper.**

Mass (m kg)	$35 < m \leq 45$	$45 < m \leq 50$	$50 < m \leq 55$	$55 < m \leq 60$
Frequency	p	11	13	8
Frequency density	0,5	2,2	2,6	q

The table gives the masses, m kg, of a group of students at a teachers' college.

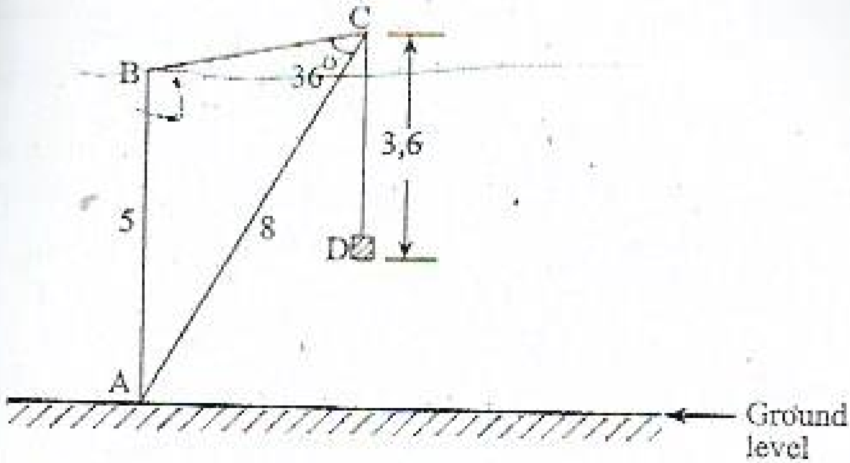
(a) Find the value of p and the value of q.

(b) Using a horizontal scale of 2 cm to represent 5 kg and a vertical scale of 4 cm to represent 1 unit of frequency density, draw a histogram of the data.

(c) Calculate an estimate of the mean mass of the students in the group whose masses are greater than 45 kg.

(d) Two students are chosen at random from the whole group. Find the probability that each of them has a mass which is greater than 50 Kg.

8 (a)

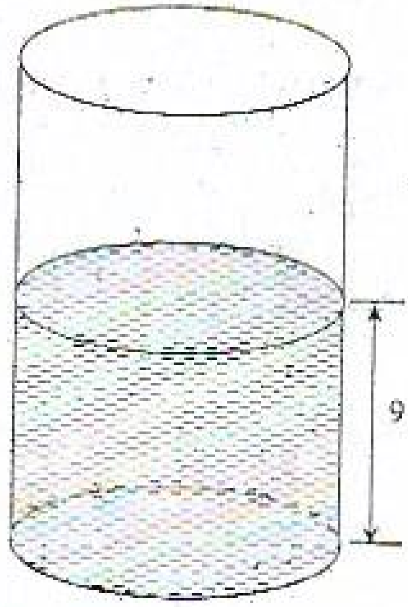


In the diagram, ABC is a crane lifting a load D. AB and BC are beams and ACD is a string. Given that the vertical beam AB = 5 m, AC = 8 m, CD = 3,6 m and $B\hat{C}A$ calculate

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

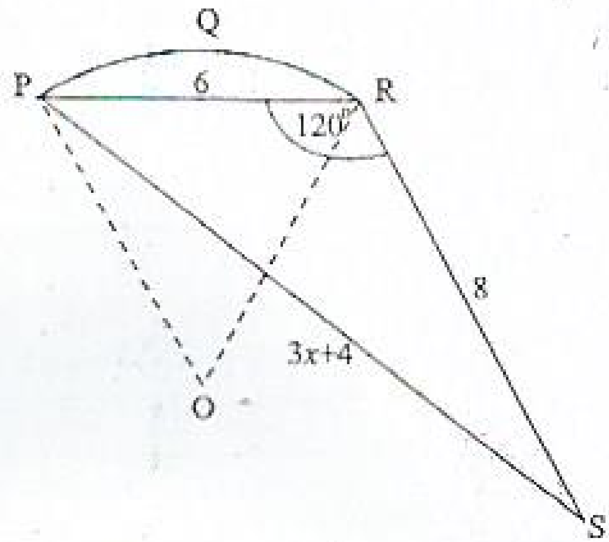
(ii) the height of D above the ground level. [6]

(b)



The diagram shows a vertical cylindrical container with water up to a height of 9 cm. The volume of the water in the container is 512 cm^3. A metal solid, of volume 217 cm^3, is lowered into the container until the solid is completely immersed in water. Calculate the height by which the water level rises in the container. Give your answer correct to the nearest millimetre. [6]

9



Take π to be = 3,142

In the diagram, PQR is a segment of a circle of radius 6 cm and centre O. PR = 6 cm, RS = 8 cm, PS = $(3x + 4)$ cm and $P\hat{R}S = 120°$.

(a) Calculate the area of the segment PQR.

(b) (i) Form an equation in x and show that it reduces to $3x^2 + 8x - 44 = 0$.

(ii) Solve the equation $3x^2 + 8x - 44 = 0$ giving your answers co
to 2 decimal places.

9 **Answer the whole of this question on a sheet of graph paper.**

A stone is thrown into the air. Its height h metres after t seconds is given by the formula $h = 60 + 30t - 5t^2$.

Below is a table of values for $h = 60 + 30t - 5t^2$.

Time (t seconds)	0	1	2	3	4	5	6	7	8
Height h(metres)	60	85	100	p	100	85	60	q	−20

(a) Find the value of p and the value of q. [2]

(b) Using a horizontal scale of 2 cm to represent 1 second and a vertical scale of 2 cm to represent 20 metres, draw the graph of $h = 60 + 30t - 5t^2$ for $0 \le t \le 8$. [8]

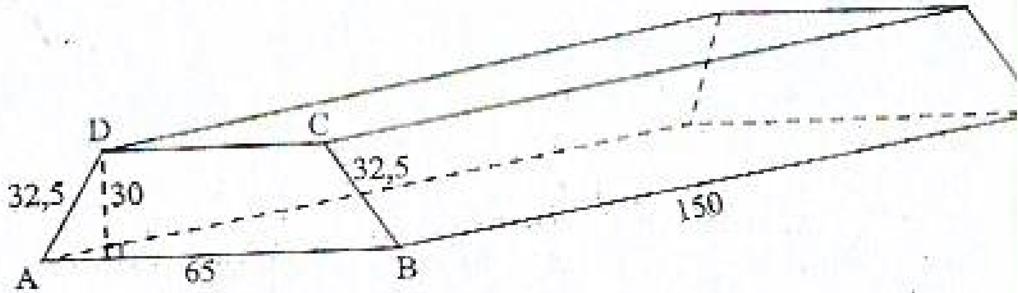
(c) Use your graph to find

(i) the maximum height reached by the stone,

(ii) the velocity of the stone when $t = 2$,

(iii) the times when the stone is at a height of 80 m. [6]

11



The diagram shows a wooden block of length 150 cm, whose cross-section , A trapezium in which AB is parallel to DC. AB = 65 cm, AD = BC = 32,5 cm a perpendicular height is 30 cm.

(a) Calculate

(i) the length CD given that the area of the trapezium is 1 575 cm

(ii) the volume of the block,

(iii) the mass of the block given that the density of the wood of which it is made, is 0,72 g/cm^3,

(iv) the total surface area of the block.

(b) The block is to be varnished. One litre of varnish covers an area of 2 000 cm^2 and is bought in 5-litre tins only. Calculate the number of tins of varnish that need to be bought to varnish the whole block.

Answer the whole o f this question on a sheet of graph paper.

A quadrilateral E with vertices $(-8; -4)$, $(-4; -4)$, $(-6; -12)$ and $(-10; -8)$ is the image of quadrilateral A with vertices $(4; 2)$, $(2; 2)$, $(3; 6)$ and $(5; 4)$.

Using a scale of 1 cm to represent 1 unit on both axes, draw the x and y axes for $-10 \leq x \leq 6$ and $-12 \leq y \leq 8$.

(a) (i) Draw and label clearly the quadrilateral E.

(ii) Draw and label clearly the quadrilateral A.

(iii) Write down the matrix which represents the transformation which maps E onto A. [5]

(b) Quadrilateral T with vertices $(0; 6)$, $(0; 4)$, $(-4; 5)$ and $(-2; 7)$ is the image of quadrilateral A under a certain transformation.

(i) Draw and label clearly the quadrilateral T.

(ii) Describe completely, the single transformation which maps A onto T. [4]

(c) A one-way stretch represented by $\begin{pmatrix} 1 & 0 \\ 0 & -1\frac{1}{2} \end{pmatrix}$ maps quadrilateral A onto quadrilateral S.

Draw and label clearly the quadrilateral S. [3]

MATHEMATICS NOV 2008

1(a) $3\,{}^{2}/_{5} - 2\,{}^{13}/_{20}$

$= \frac{17}{5} - \frac{53}{20}$ [Changing to improper fractions]

$= \frac{4 \times 17 - 53}{20}$ [Using a common Denomination]

$= \frac{68 - 53}{20}$

$= \frac{15}{20}$

$= \underline{3/4}$ (2)

(b) $3(a + 2c) - 4(2a - c)$

$= 3a + 6c - 8a + 4c$ (remove brackets)

$= 3a - 8a + 6c + 4c$ (collect like terms)

$= -5a + 10c$

$= \underline{10c - 5a}$ (2)

(c) $\frac{4x - 5}{7} = 1\,3/4$

$\frac{4x - 5}{7} = \frac{7}{4}$

$4(4x - 5) = 7 \times 7$ [By cross multiplication]

$16x - 20 = 49$

$16x = 49 + 20$ [Collectng terms and simplifying]

$16x = 69$

$x = \frac{69}{16}$ (Reducing to lowest terms)

$= \underline{4\,{}^{5}/_{16}}$ (3)

(d) $\frac{19{,}8 \times 100}{2 \times \frac{22}{7} \times \frac{6{,}3}{2}}$

$= \frac{1980}{22 \times 0{,}9}$

$= \underline{100 \text{ rings}}$ (4)

2(a)(i) $2x^2 + ax - 2bx - ab$

$2x^2 - 2bx + ax - ab$ *[collecting like terms]*

$2x(x - b) + a(x - b)$ *[by grouping factors]*

$\underline{(2x + a)\ (x - b)}$ (2)

(ii) $3 - 12y^2$

$3(1 - 4y^2)$ Diffrenmce of two squares

$3(1 + 2y)(1 - 2y)$ (2)

b(i) PR = R – P [Translation vector]

$$= \begin{bmatrix} -4 \\ -2 \end{bmatrix} - \begin{bmatrix} 4 \\ 8 \end{bmatrix}$$

$$= \begin{bmatrix} -8 \\ -10 \end{bmatrix}$$

(2)

$|PR| = \sqrt{8^2 + 10^2} = \sqrt{164} = 12{,}8$ (1)

---

c)i) $D = S \times T$

$= \frac{3}{4} \times x$

$\underline{= \frac{3}{4}x}$ (2)

(ii) $\frac{3}{4} \times 2x = 27 - \frac{3}{4}x$

$6x = 908 - 3x$ *[clear the denominator]*

$9x = 908$

$\underline{n = 12}$ (2)

(iii) 24km/h (1)

3(a)(i) $\underline{149\ 600\ 000}$ (1)

(ii) $2{,}279 \times 10^8 - 1{,}496 \times 10^8$

$= (2{,}279 - 1{,}496)\ 10^8$ [By Factorisation]

$= 0{,}783 \times 10^8$

$7{,}83 \times 10^{-1} \times 10^8$

$\underline{7{,}83 \times 10^7}$ (3)

(b) $\dfrac{\underline{36 \times 33575 - 27 \times 36\ 800}}{9}$

$= \underline{\$23\ 900}$ (3)

c(i) $2x - 6 < 5x + 3 \leq 3x + 11$

$2x - 6 < 5x + 3$ | $5x + 3 \leq 3x + 11$

$2x - 5x < 9$ | $5x - 3x \leq 11 - 3$

$-3x < 9$ | $2x \leq 8$

$\frac{-3x}{-3} < \frac{9}{-3}$ | $\underline{x \leq 4}$

$\underline{x > -3}$

Therefore $\underline{-3 < x \leq 4}$

(ii) $\underline{x = -2}$

4(a) (i) $\Delta ADX = \frac{2}{3} \times 9$ [Ratio of similar shapes]

$= \underline{6cm^2}$

(ii) ΔDAX

(iii) $\Delta BCX = \frac{3}{2} \times 9$ [Ratio of similar shapes]

$= \underline{13.5cm^2}$

b(i) 50° [Alternate Segments] (1)

(ii) 30 [Alternate Segments] (2)

(iii) $100 + 100 = 200^\circ$ (2)

(iv) $180 - 100 = 80^\circ$ (1)

5(a) $\frac{6n^2 + 5n + 2n}{6n + 5}$ [using Common denom]

$\frac{6n^2 + 7}{6n + 5}$

(b) $a = \frac{m - 5}{3m - 2}$

$a(3m - 2) = m - 5$ [Cross multiplication]

$3am - 2a = m - 5$

$3am - m = 2a - 5$ [Collect like terms]

$m(3a - 1) = 2a - 5$

$m = \frac{2a - 5}{3a - 1}$

---

c) $A^2 = \begin{pmatrix} 3 & 5 \\ -2 & 7 \end{pmatrix} \begin{pmatrix} 3 & 5 \\ -2 & 7 \end{pmatrix}$

$= \begin{pmatrix} 3 \times 3 + 5 \times -2 & 3 \times 5 + 5 \times 7 \\ -2 \times 3 + 7 \times -2 & -2 \times 5 + 7^2 \end{pmatrix}$ $\left\{ \begin{matrix} \text{Multiply} \\ \text{Row by} \\ \text{Column} \end{matrix} \right.$

$= \begin{pmatrix} 9 - 10 & 15 + 35 \\ -6 - 14 & -10 + 49 \end{pmatrix}$

$= \begin{pmatrix} -1 & 50 \\ -20 & 39 \end{pmatrix}$ (5)

NoV 2008 Q6.

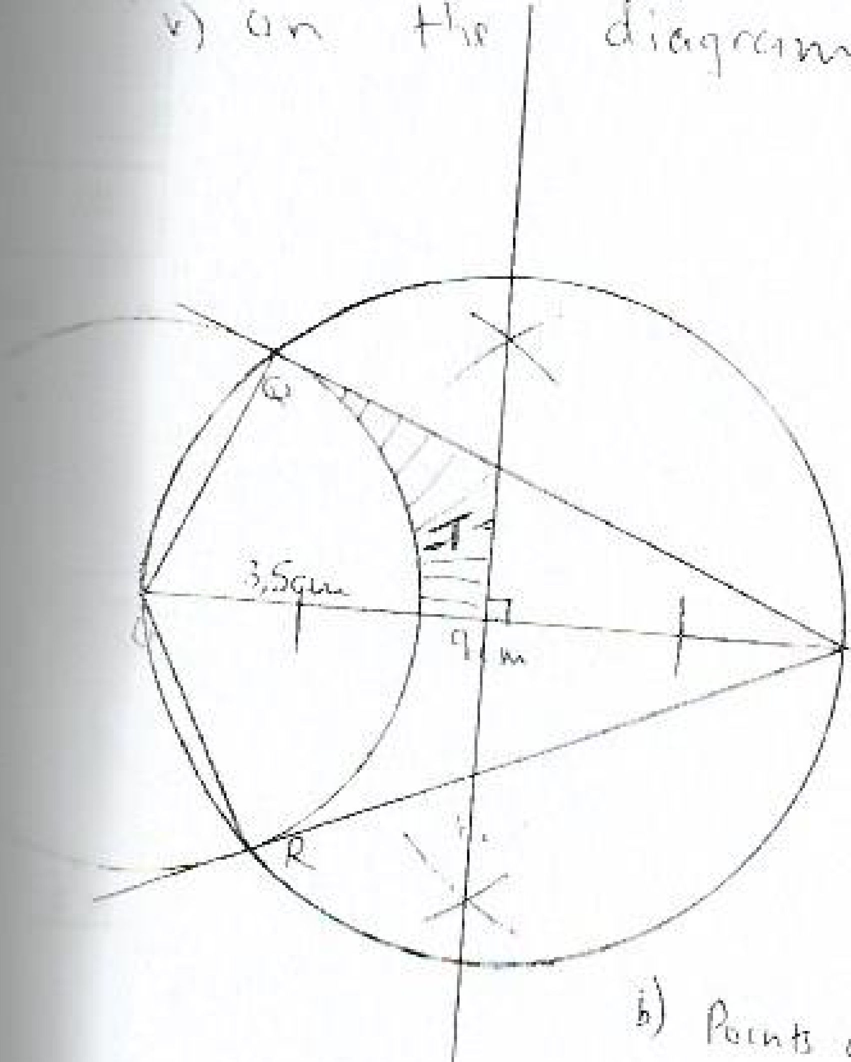
a) (i) On the diagram.

(ii) on the diagram.

(iii) perpendicular bisector of OP

(iv) On the diagram.

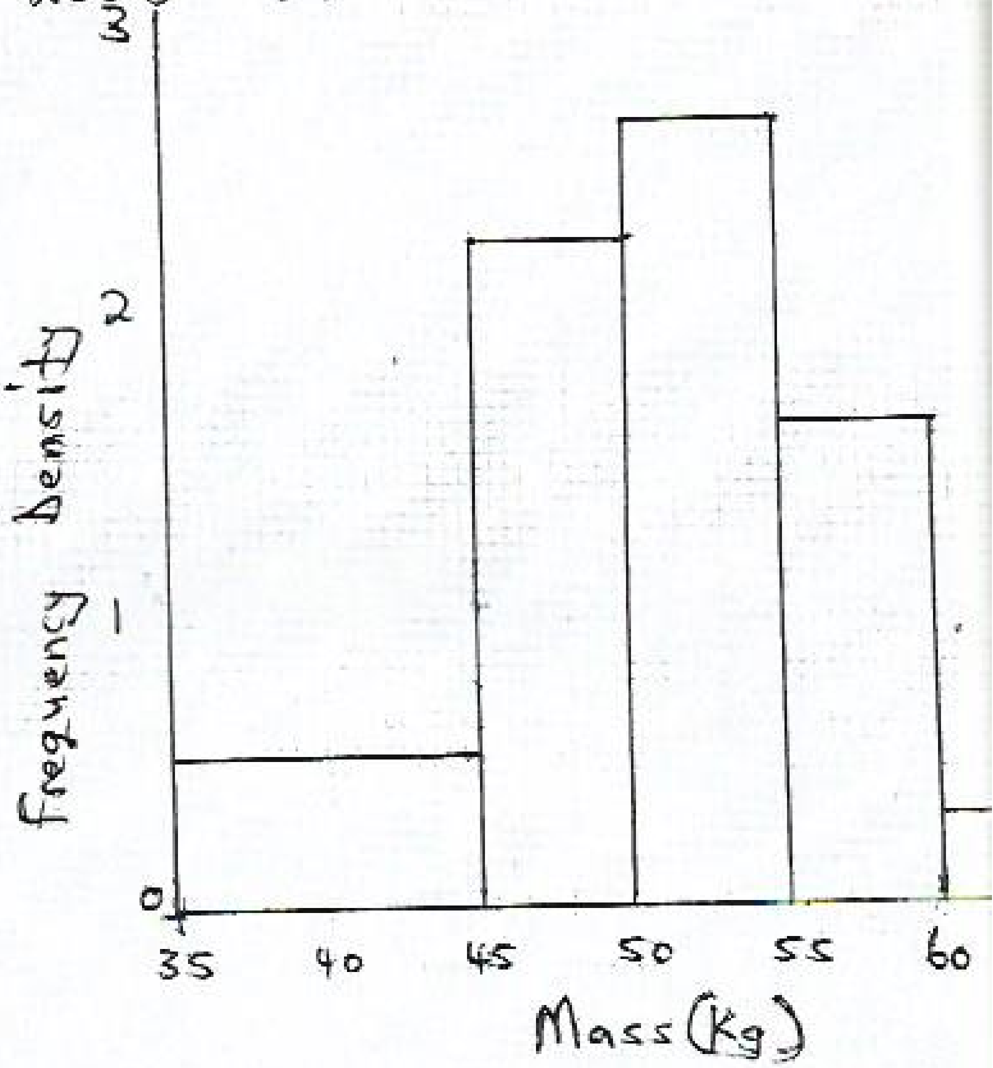
v) on the diagram.



b) Points equidistant from PQ and PR

c) Shaded Area on the diagram

Nov 2008 Q7



(a) $p = 0{,}5 \times 10$

$= \underline{\underline{5}}$

$q = \frac{8}{5}$

$= \underline{\underline{1{,}6}}$

(c) $\frac{47{,}5 \times 11 + 52{,}5 \times 13 + 57{,}5 \times 8 + 65}{35}$

$= 57{,}14 \text{ Kg}$

(d) $\frac{24}{40} \times \frac{23}{39} = \frac{23}{65}$

9(a) Area of segment = Area of Sector – Area of Δ

$$= \frac{\theta}{360}\pi r^2 - \tfrac{1}{2} r^2 \sin\theta$$

$$= \frac{60}{360} \times 3.142 \times 6 \times 6 - \tfrac{1}{2} \times 6 \times 6 \sin 60$$

$$= 18.852 - 15.588$$

$$= \underline{\mathbf{3.26cm^2}}$$

(4)

b(i) $(3x + 4)^2 = 8^2 + 6^2 - 2(8 \times 6) \cos 120$

$9x^2 + 24x + 16 = 64 + 36 - 96 \cos 120$

$9x^2 + 24x + 16 = 100 - -48$

$9x^2 + 24x + 16 = 100 + 48$

$9x^2 + 24x + 16 = 148$

$9x^2 + 24x + 16 - 148 = 0$

$9x^2 + 24x + 16 - 148 = 0$

$\frac{9x^2}{3} + \frac{24x}{3} - \frac{132}{3} = \frac{0}{3}$

$3x^2 + 8x - 44 = 0$

(3)

(ii) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-8 \pm \sqrt{8^2 + 4 \times 3 \times 44}}{6}$

$= \frac{-8 \pm \sqrt{592}}{6}$

$= \underline{\mathbf{-5.3883 \text{ or } 2.722}}$

(5)

8(a) (i) Using Sine Rule

$$\frac{\text{Sin } 36^\circ}{5} = \frac{\text{Sin ABC}}{8}$$

Therefore $\text{Sine ABC} = \frac{8.\ \text{Sin } 36^\circ}{5}$

$= 0,9404564$

Therefore **ABC = 109,9** (NB Sin x = Sin (180-x) (3)

(ii) Using CHASHOTAO

$\frac{A}{H} = \text{Cos } (70,1 - 36^\circ)$

$\frac{A}{8} = \text{Cos } 34,13^\circ$

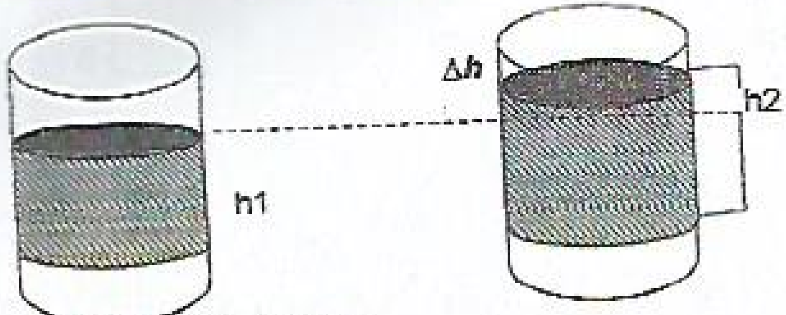
Therefore A = 8 Cos 34,13°

= 6,62

DG = 6,62 – 3,6

= 3,02m

b)



From ratio of Similar Shapes

$$\frac{V_1}{V_2} = \left(\frac{Li}{hz}\right)^3$$

$$\frac{512}{729} = \left(\frac{9}{hz}\right)^3$$

Therefore $h^3 = \frac{9^3 \times 729}{512}$

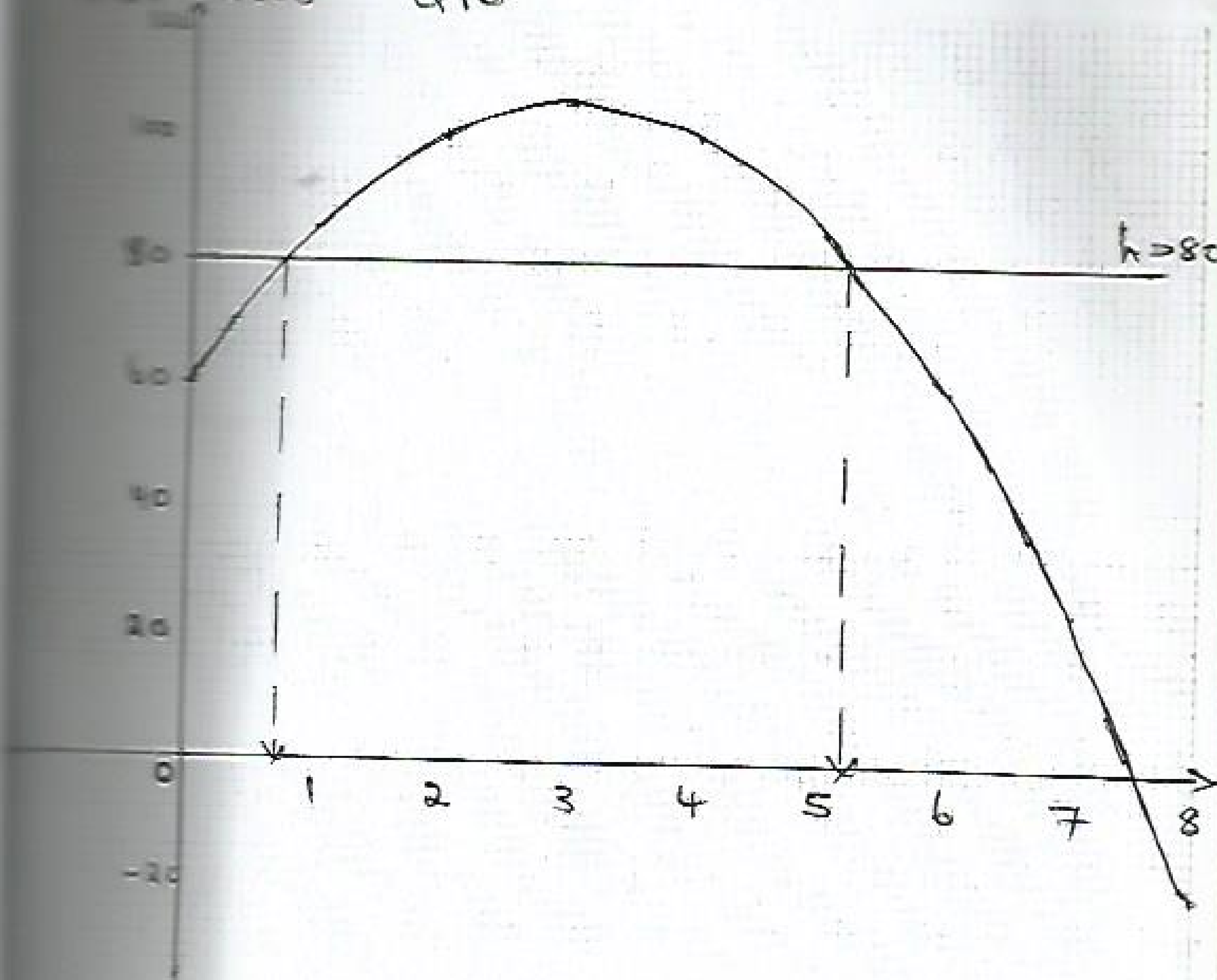
$= 1037,9$

Therefore h = 10.125

Δh = 10.125 – 9

= **1.125 / 11mm** (6)

2008 Q10



(a) $p = 60 + (30 \times 3) - 5 \times 9$

$= \underline{\underline{105}}$

$q = 60 + (30 \times 7) - (5 \times 49)$

$= \underline{\underline{25}}$

c(i) 105m/s

(ii) $\frac{10}{1} = 10 \text{m/s}$

(iii) 0,8 or 5,2

11(a)(i) $\frac{1}{2}(DC + 65)\,30 = 1\,575$

$$DC + 65 = \frac{1\,575}{15}$$

$$DC + 65 = 105$$

$$DC = 105 - 65$$

Therefore $DC = 40cm$

(ii) $V = \text{Area} \times \text{Length}$

$= 1575 \times 150$

$= \underline{236\,250cm^3}$

(iii) $M = DV$

$= 0{,}72 \times 236250$

$= \underline{170\ 100g\ /\ 170/kg}$

(iv) $150 \times 32{,}5 \times 2 + 1575 \times 2 + 4 \times 150 + 65 \times 50$

$= \underline{28\,650cm^2}$ (10)

b) $\frac{28\,650}{5 \times 2\,000}$

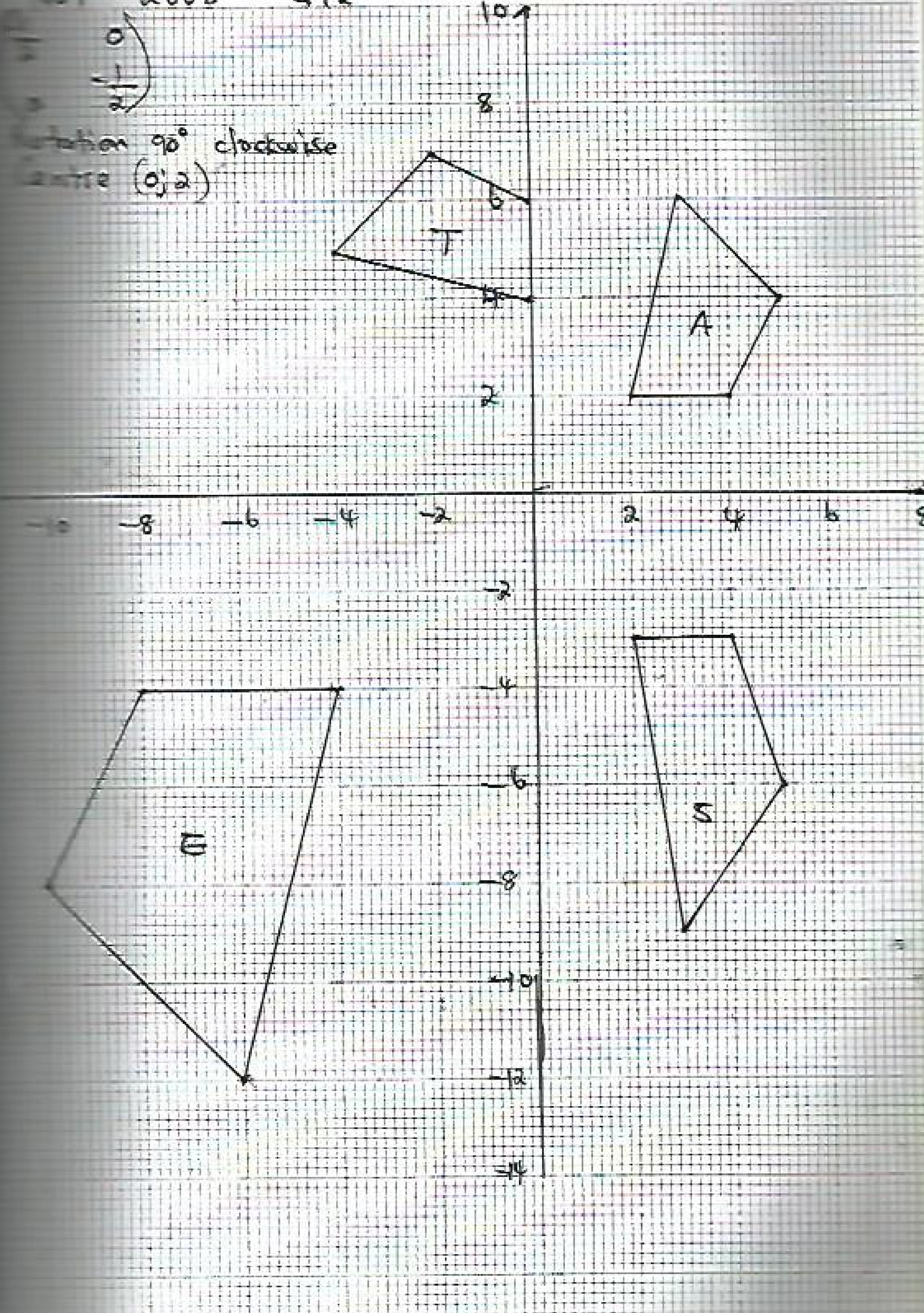
$= \underline{3 \text{ tins}}$

Nov 2008 Q12

$\begin{pmatrix} [illegible] & 0 \\ [illegible] & \frac{1}{2} \end{pmatrix}$

Rotation 90° clockwise

Centre (0;2)



ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MATHEMATICS
PAPER 2 **4028/2**

JUNE 2009 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
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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 12 printed pages.

[Turn over

Section A [64 marks]

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

1 **(a)** Given the formula $A = 2\pi(r^2 + h)$.

(i) calculate the value of A when $\pi = 3\frac{1}{7}$, $r = 1\frac{3}{4}$ and $h = 3\frac{1}{2}$. [2]

(ii) make r the subject of the formula. [2]

(b) Express as a single matrix $\begin{pmatrix} 8 & -4 \\ 5 & 3 \end{pmatrix} - 2\begin{pmatrix} 1 & 3 \\ 4 & 0 \end{pmatrix}$ [2]

(c) If $\mathbf{M} = \begin{pmatrix} 3 & -1 \\ 1 & -2 \end{pmatrix}$,

(i) find the inverse of **M**. [2]

(ii) **hence** solve the following simultaneous equations

$$3x - y = 2,$$
$$x - 2y = -6.$$ [3]

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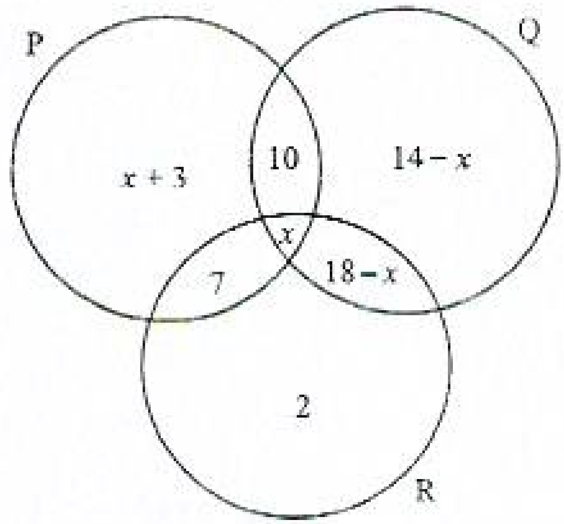
2 **(a)** **(i)** Solve the inequality $8 - 2(2x - 3) \leq 3x$ [2]

(ii) Illustrate your solution on a number line. [1]

(b)



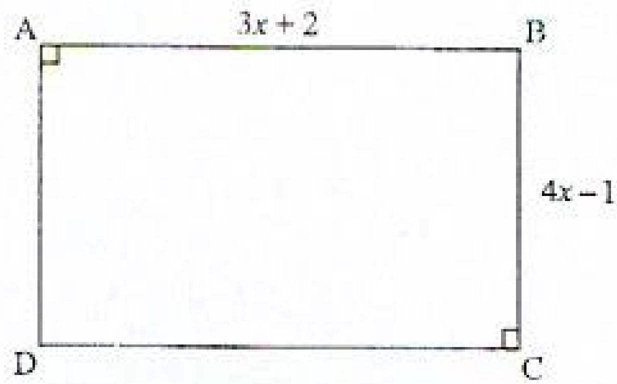
In the Venn diagram P, Q and R are sets such that $\xi = P \cup Q \cup R$. The number of elements is shown in each region.

(i) Find $n(R)$. [1]

(ii) Given that $n(Q) = 40$, find the numerical value of x. [2]

(iii) Hence calculate the value of $n(P \cup (R \cap Q'))$. [2]

3



In the diagram AB = DC = $(3x + 2)$ m, BC = AD = $(4x - 1)$ m and $A\hat{B}C = 90°$.

(a) Find the numerical value of x that would make ABCD a square. [2]

(b) If ABCD is a rectangle, write down, in terms of x,

(i) its perimeter, [2]

(ii) Given that the area of the rectangle ABCD is 10 m^2 form an equation and show that it reduces to $12x^2 + 5x - 12 = 0$, [2]

(iii) solve the equation in **(ii)**, giving your answer correct to two decimal places. [5]

---

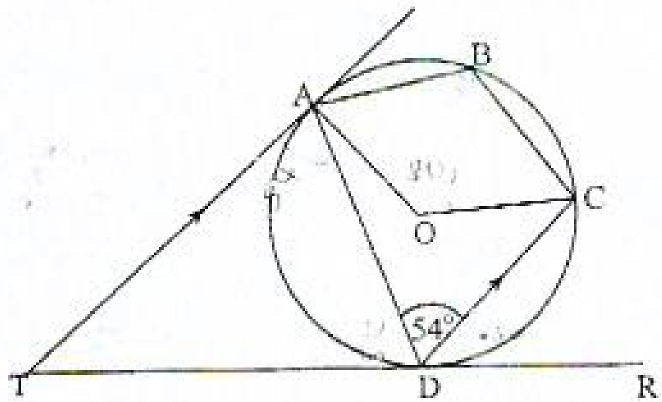
4 **(a)** In a certain town with a population of 840 000, 15% of the people are left-handed.

(i) Calculate the number of left-handed people in the town. [2]

(ii) If among the left-handed people, the ratio of *men*: *women*: *children* is 5: 11: 14, calculate the number of children who are left-handed. [2]

(iii) The population of the town is 125% of what it was 20 years ago. Calculate the population of the town 20 years ago. [2]

(b)



In the diagram, A B C D is a cyclic quadrilateral. The tangents AT and DT to the circle centre O meet at T, TDR is a straight line, AT is parallel to CD and $A\hat{D}C = 54°$.

Calculate

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

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

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

(iv) reflex $A\hat{O}C$,

(v) $D\hat{A}O$. [5]

[2]

[2]

[2]

[5]

[2]

[2]

[2]

5 **(a)** A map is drawn to a scale of 1 : 50 000.

Calculate

(i) the actual distance, in kilometres, represented by 7 cm on the map, [2]

(ii) the area on the map, in square centimetres, which represents an actual area of 3,2 hectares. [2]

(b) The cost C, in US dollars (US$), of hiring a car is partly constant and partly varies as the distance, x kilometres, covered by the car.

(i) Write down an equation which connects C, x and two constants h and k. [1]

(ii) Given that $C = 41{,}5$ when $x = 50$ and $C = 42{,}25$ when $x = 75$, find the value of h and the value of k. [4]

(iii) A tourist hires a car and travels 670 kilometres. Calculate the amount he has to pay in Zimbabwean dollars (Z$) if the exchange rate is US$1: Z$100 000. [3]

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

6 Use a ruler and compasses only for all constructions and show clearly all the construction lines and arcs on a single diagram.

(a) Construct a kite ABCD with AB = AD = 6 cm, BC = DC = 9 cm and $B\hat{A}D = 60°$. Join BD. [6]

(b) Construct

(i) the locus of points equidistant from B and D,

(ii) the locus of points equidistant from BD and DC. [3]

(c) The loci in (b) intersect at P. Using P as centre

(i) draw a circle with BD as tangent,

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

Section B [36 marks]

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

A bus travels from Zano Growth Point to Harare and back the same day. The distance covered on one way is such that 72 km are on dust road and 312 km are on tarred road.

(a) The bus leaves Zano at 0400 hours and arrives in Harare at 1100 hours. Calculate the average speed of the bus for this journey. [2]

(b) The bus covers 10,8 km per litre of diesel on the dust road and 12,5 km per litre on tarred road.

Calculate the amount of fuel needed to cover the

(i) 72 km on dust,

(ii) 312 km on tarred road,

(iii) the whole journey to and fro. [7]

(c) If diesel costs $195 000 per litre, calculate the total cost of diesel needed for the whole journey, giving your answer to the nearest million dollars. [3]

Answer the whole of this question on a single sheet of graph paper.

8 Quadrilateral ABCD has vertices A(3; 2), B(6; 0), C(6; −1), and D(3; −1). Using a scale of 2 cm to represent 2 units on each axis, draw axes for the values of x and y in the ranges $-10 \le x \le 8$ and $-6 \le y \le 8$.

(a) Draw and label quadrilateral ABCD.

(b) ABCD is mapped onto quadrilateral $A_1B_1C_1D_1$ by an enlargement of scale factor −2, centre (1; 0). Draw and label $A_1B_1C_1D_1$.

(c) ABCD is mapped onto quadrilateral $A_2B_2C_2D_2$ by a transformation represented by the matrix $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$.

(i) Calculate the coordinates of the points A_2, B_2, C_2 and D_2.

(ii) Draw and label $A_2B_2C_2D_2$.

(iii) Describe fully the single transformation which maps ABCD onto $A_2B_2C_2D_2$.

(d) ABCD is mapped onto quadrilateral $A_3B_3C_3D_3$ by a stretch of factor 3 with the x-axis invariant. Draw and label $A_3B_3C_3D_3$.

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

The following is a table of values for the function $y = x^2 + 4x - 22$.

x	-8	-7	-6	-4	-2	0	2	3	4
y	10	-1	-10	-22	-26	-22	-10	-1	10

(a) Using a scale of 2 cm to represent 2 units on the x-axis and 2 cm to represent 5 units on the y-axis, draw the graph of $y = x^2 + 4x - 22$ for $-8 \le x \le 4$ and $-30 \le y \le 15$. [4]

(b) Use your graph to

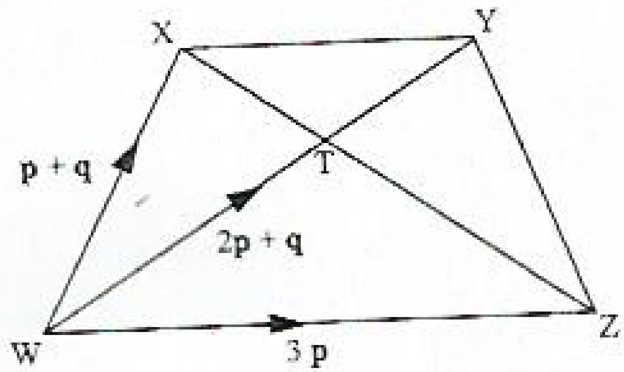
(i) write down the minimum value of y, [1]

(ii) state the range of values of x for which the function is positive, [2]

(iii) find the gradient of the curve at the point where $x = 0$. [2]

(c) By drawing a suitable straight line, solve the equation
$x^2 + 4x - 22 = -x - 8$. [3]

10



In the diagram $\overrightarrow{WX} = \mathbf{p} + \mathbf{q}$, $\overrightarrow{WY} = 2\mathbf{p} + \mathbf{q}$ and $\overrightarrow{WZ} = 3\mathbf{p}$. WY and XZ intersect at T such that WT = hWY and XT = kXZ where h and k are consta

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

(i) $\overrightarrow{XZ}$,

(ii) $\overrightarrow{XY}$,

(iii) $\overrightarrow{YZ}$.

(b) Express $\overrightarrow{WT}$ in terms of h, **p** and/or **q**.

(c) Express $\overrightarrow{WT}$ in terms of k, **p** and/ or **q**.

(d) Using your results from **(b)** and **(c)** find the numerical value of h an numerical value of k.

(e) Use your results in (d) to express $\overrightarrow{TZ}$ in terms of **p** and **q** only.

(f) Given that $|\overrightarrow{WZ}| = n|\overrightarrow{XY}|$, write down

(i) the value of the constant n,

(ii) the geometrical relationship between $\overrightarrow{XY}$ and $\overrightarrow{WZ}$.

Answer the whole of this question on a single sheet of graph paper.

Weight Class (kg)	Frequency	Cummulative Frequency
26 – 30	4	4
31 – 35	6	10
36 – 40	12	22
41 – 45	10	32
46 – 50	7	p
51 – 55	1	40

The incomplete table shows the grouped frequency of the weights, to the nearest kilogram, of a group of 40 people.

(a) Write down **(i)** the value of p,

(ii) the modal class. [2]

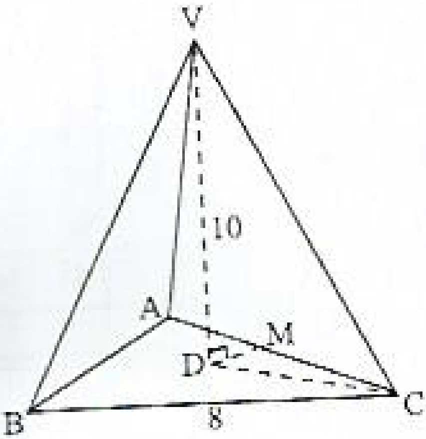
(b) Using a horizontal scale of 2 cm to represent 5 kilogrammes and a vertical scale of 2 cm to represent 5 people, draw a cumulative frequency curve (ogive) to show this information. [5]

(c) Use your ogive to find an estimate of the median weight. [2]

(d) One person is picked at random. Find the probability that this person is in the 36 to 40 kg range. [1]

(e) Given also that 30% of the people are female, find the probability that two people chosen at random, from the group, are both female. [2]

12



In the diagram, VABC is a right pyramid whose base ABC is an equilateral triangle of side 8 cm. The height of the pyramid is 10 cm, D is the centre of the triangle ABC and M is the midpoint of AC.

(a) show that DM = 2,309 cm.

(b) Calculate

(i) VM,

(ii) $V\hat{M}D$,

(iii) the volume of the pyramid,

(iv) the area of one sloping face.

$$\left[\text{Volume of pyramid } = \frac{1}{3} \text{ base area } \times \text{ height}\right]$$

6/67

MATHEMATICS JUNE 2009/2
MARK SCHEME

1(a) (i) $A = \frac{44}{7} \times \frac{105}{16}$

$= \underline{41\tfrac{1}{4}}$

(ii) $r^2 = \frac{A}{2\pi r} = h$

Therefore $r = \sqrt{\frac{A}{2\pi} - h}$

---

b) $\begin{bmatrix} 6 & -10 \\ -3 & 3 \end{bmatrix}$

---

c(i) $-\tfrac{1}{5}\begin{bmatrix} -2 & 1 \\ -1 & 3 \end{bmatrix}$

(ii) $-\tfrac{1}{5}\begin{bmatrix} -2 & 1 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} 2 \\ -6 \end{bmatrix}$

$x = 2$
$\underline{y = 4}$ (11)

2(a) (i) $8 + 6 \leq 3x + 4x$
$x \geq 2$

(ii)

(b)(i) 27

(ii) $10 + x + 18 - x + 14 - x = 40$
$42 - x = 40$
$\underline{x = 2}$

(iii) **26** (8)

3(a) $3x + 2 = 4x - 1$

$2 + 1 = 4x - 3x$

$\underline{3 = x}$

(b) (i) $2(3x + 2 + 4x - 1)$

$\underline{14x + 2m}$

(ii) $(3x + 2)(4x - 1) = 0$

$12x^2 + 5x - 12 = 0$

Using x $= \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\dfrac{-5 \pm \sqrt{5^2 + 4 \times 12 \times 12}}{2 \times 12}$

Therefore $\underline{x = 0.81 \text{ or } -1.23}$

4(a)(i) 126 000

(ii) $\dfrac{14}{30} \times 126000$

$= \underline{\mathbf{58\ 800}}$

(iii) $\dfrac{100}{125} \times 840\ 000$

$= \underline{\mathbf{627\ 000}}$

b(i) 54°

(ii) 72°

(iii) 252°

(iv) 36° (11)

5(a) (i) 3.5km

(ii) 0.128cm^2

b) (i) $C = h + kx$

(ii) $41.5 = h + 50k$

$42.25 = h + 75k$

Therefore $h = 40$

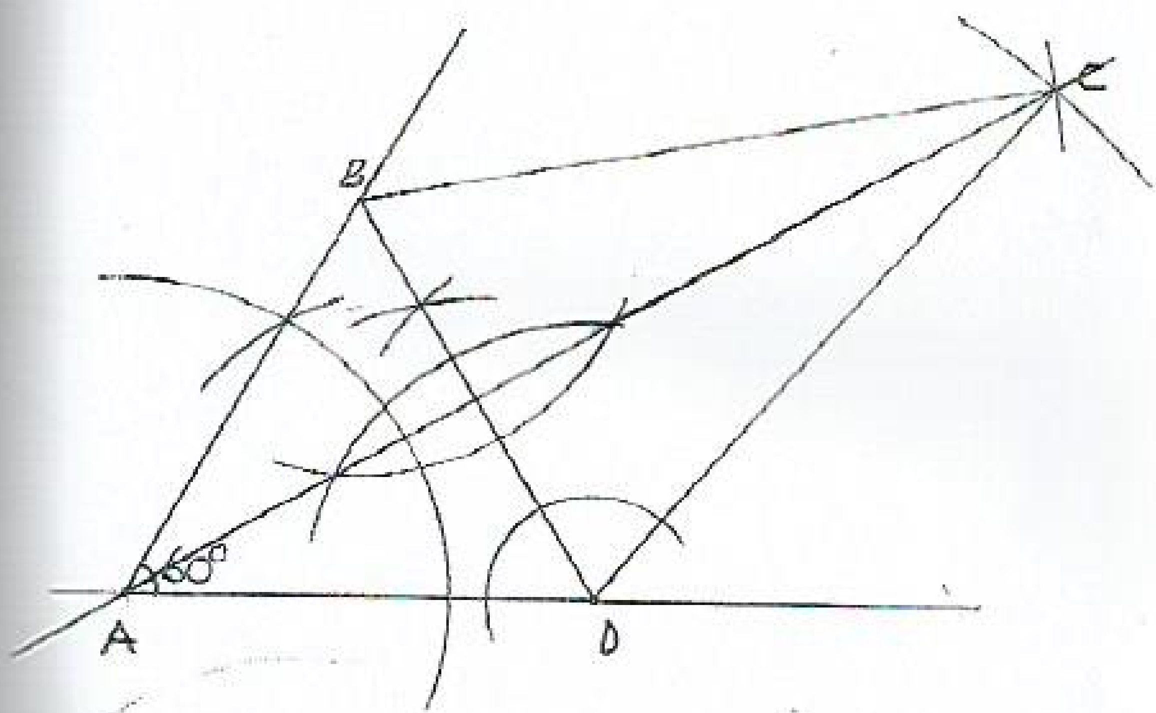
$\underline{k = 0{,}03 \,/\, {}^3/_{100}}$

(iii) $C = 40 + 670 \times {}^3/_{100}$

$= \underline{\mathbf{\$60{,}1}}$ / $\underline{\mathbf{Z\$6\ 010\ 000}}$ (12)

JUNE 2009 Q6

a) On the diagram:



b. (i) perpedicular bisector of BD

(ii) Bisect angle D.

7(a) Speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{384}{7}$

$= \underline{\mathbf{54{,}86\ km/h}}$

b(i) $\frac{72}{108}$

$= \underline{\mathbf{6{,}667}}$

(ii) $\frac{312}{12{,}5}$

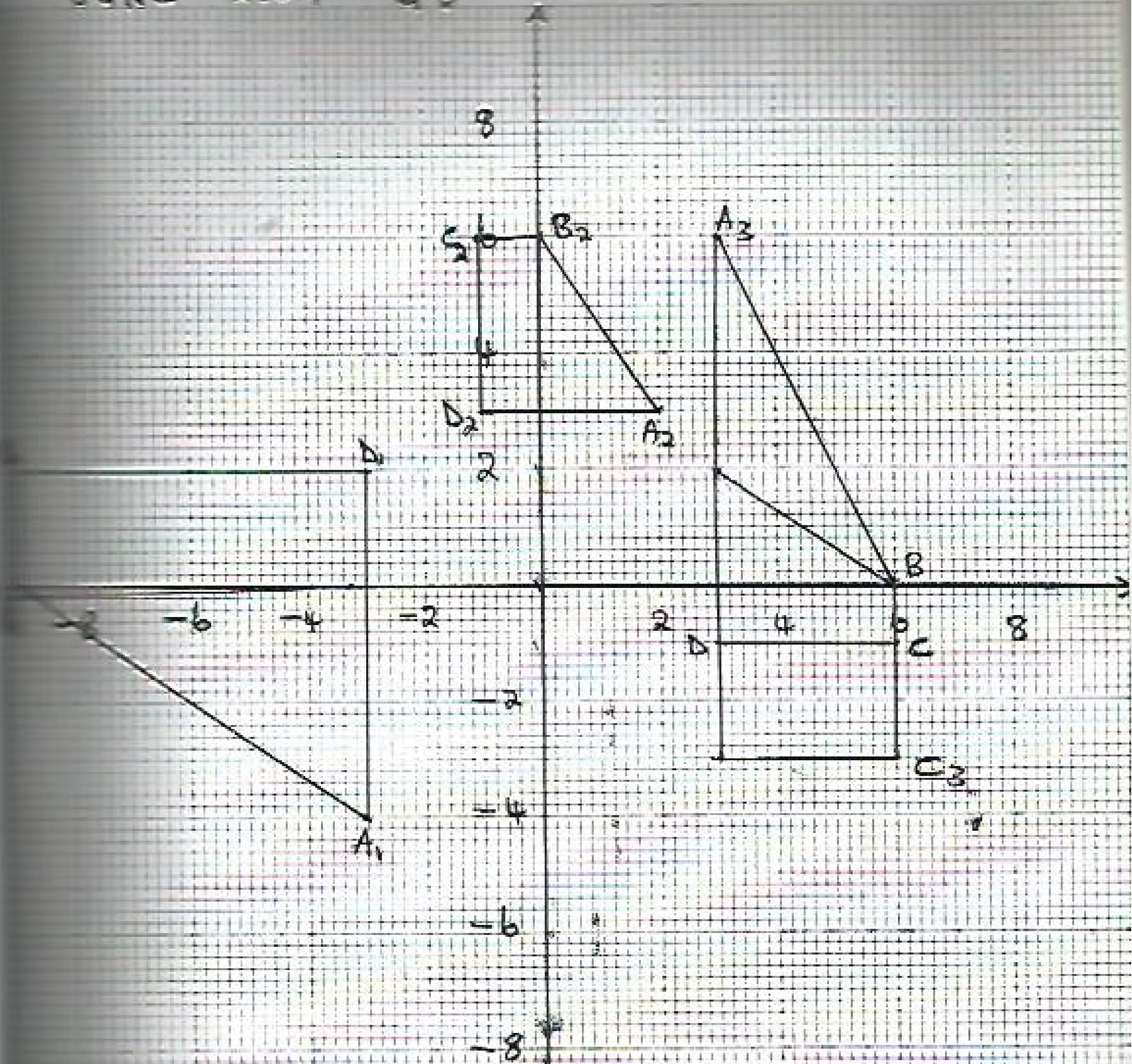
$= \underline{\mathbf{24{,}25}}$

(iii) 62,35

(12)

c) 12 000 000 / 12m

JUNE 2009 Q8

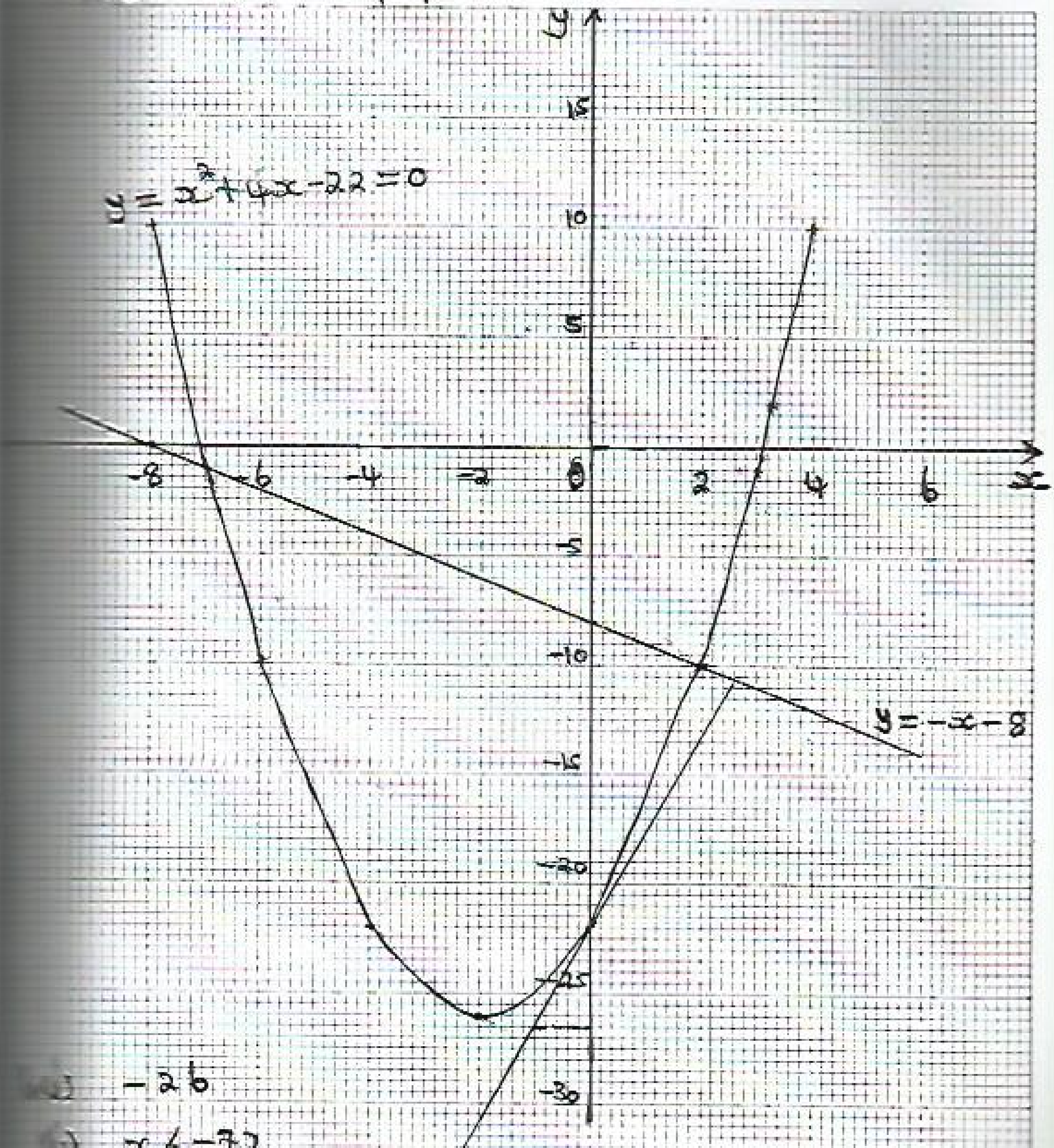


(ii) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 3 & 6 & 6 & 3 \\ 2 & 0 & -1 & -1 \end{pmatrix}$

$= \begin{bmatrix} 2 & 0 & -1 & -1 \\ 3 & 6 & 6 & 3 \end{bmatrix}$

(iii) Reflection in the line $y = x$

JUNE 2009 Q 9



(i) -26

(ii) $x < -7{,}2$

$x > 3{,}2$

(iii) $\frac{42}{10}$

$\underline{4{,}2}$

$x = -7$ or 2

10(a) (i) $\overline{XZ} = 2p - q$

(ii) $\overline{XY} = p$

(iii) $\overline{YZ} = p - q$

(b) $WT = k(2p - q)$

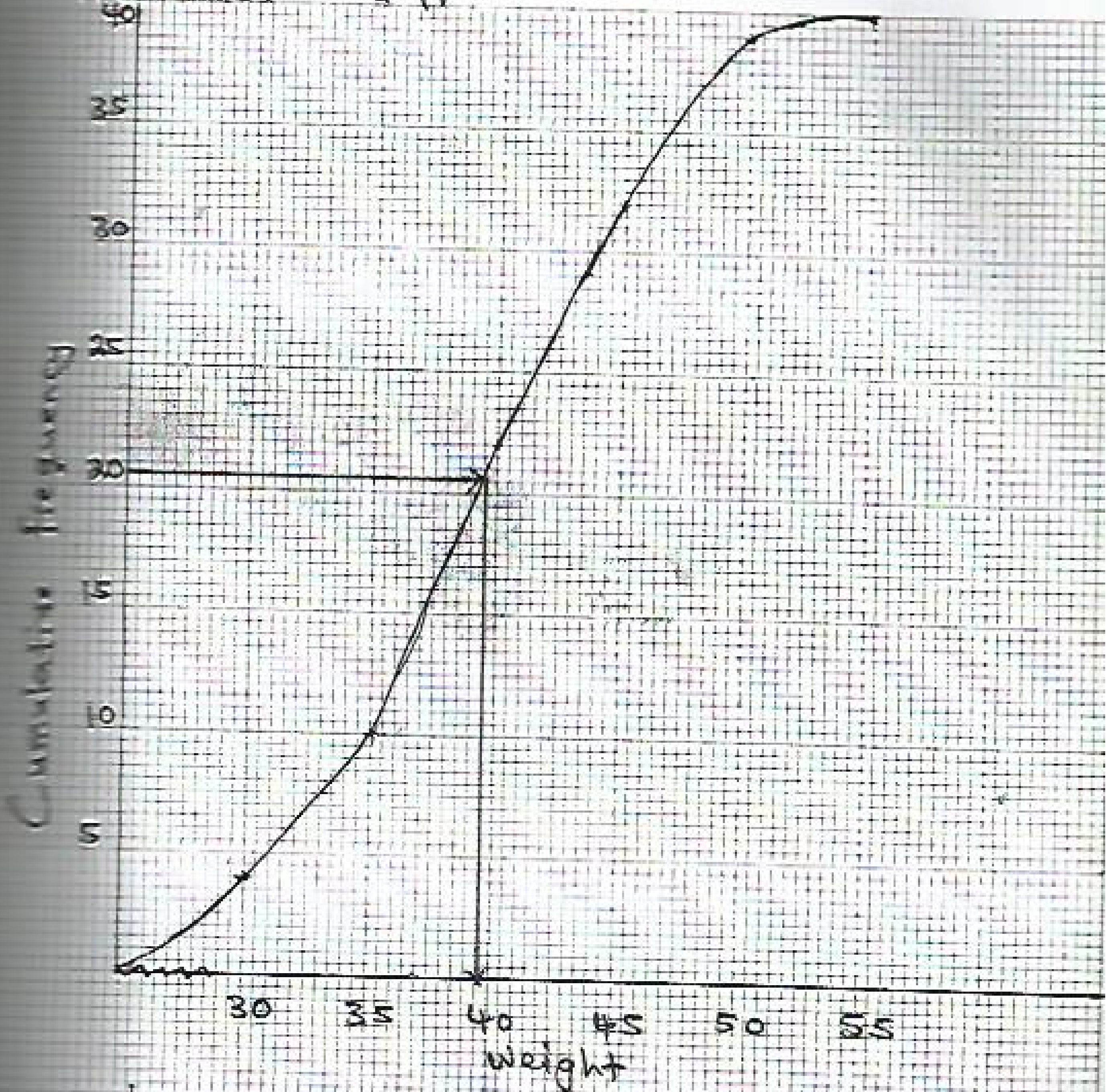
(c) $WT = (1 - 2k)p + (1 - k)q$

d) $-2h = 1 - 2k$
$h = 4 - k$
$k = ¼$
$h = ¾$

e) $TZ = {}^{3}/_{2}p - 3, q$

f) (i) $n = 3$
(ii) parallel (12)

JUNE 2009 Q 11



a(i) $p = 40 - 1 = 39$

(ii) $36 - 40$

c $\frac{1}{2}(40+1)^{th}$ term

$= 20.5^{th}$ term

$\therefore$ Median $= 39.6$

d) $\frac{12}{40} = \frac{3}{10}$

e) $\frac{12}{40} \times \frac{11}{39} = \frac{11}{130}$

12(a) DM = 4 tan 30° (CHASHOTAO)

= 2.309

(b)(i) VM = $\sqrt{10^2 + 2{,}309^2}$

= **<u>10,26cm</u>**

(ii) VMD = **<u>77°</u>**

(iii) $^1/_3$ x ½ x 8 x 8 x Sin 60° x 10

= 92,38

= **92.4cm³**

(iv) Area = VAC = ½ x 8 x 10,26

= **<u>41,05cm²</u>**

(12)

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MATHEMATICS 4008/2
PAPER 2

NOVEMBER 2009 SESSION 2 hours 30 minutes

Additional materials:
Answer paper
Geometrical instruments
Graph paper (3 sheets)
Mathematical tables
Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES
Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

Electronic calculators must not be used.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 may be used to evaluate explicit numerical expressions.

This question paper consists of 13 printed pages and 3 blank pages.

Section A [64 marks]

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

1 **(a)** Simplify $8 - 24 \div 6 + 3 \times 4$.

(b) Expand $(1-2x)(x+3)$.

(c) **(i)** Find the L.C.M. of

$15y^2, 25xy^3$ and $(x^3 - x^2)$.

(ii) Evaluate $(\text{Log}_9 81) \times (2\text{Log}_4 8)$.

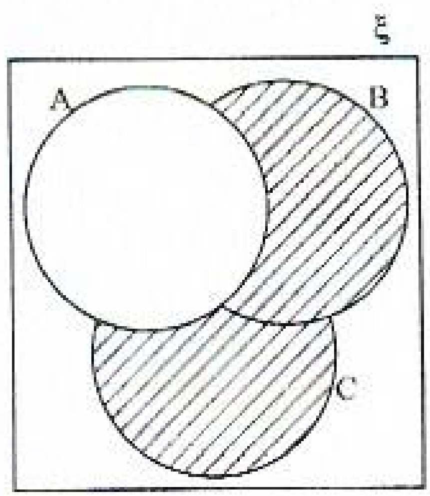
---

2 **(a)** Solve the equations

(i) $7(h + 3) - 2(h - 4) = 4$,

(ii) $3^{(m+4)} = 9^{(m-1)}$.

(b) Write down, in set notation, the set represented by the shaded region in the Venn diagram.



(c) It is given that

$\xi = \{x : 2 \le x \le 20, x \text{ is an integer}\}$,
$P = \{x : x \text{ is a prime number}\}$ and
$Q = \{x : 4 \le x < 17\}$.

(i) List the elements of P. [2]

(ii) Find $n(Q^1 \cap P)$. [2]

---

3 **(a)** Simplify $\frac{n-3}{6} \div \frac{n^2-9}{4}$. [2]

(b) Given that $\mathbf{A} = (2 \;\; 3)$ and $\mathbf{B} = \begin{pmatrix} 4 & -1 \\ 5 & 6 \end{pmatrix}$,

find

(i) **AB**,

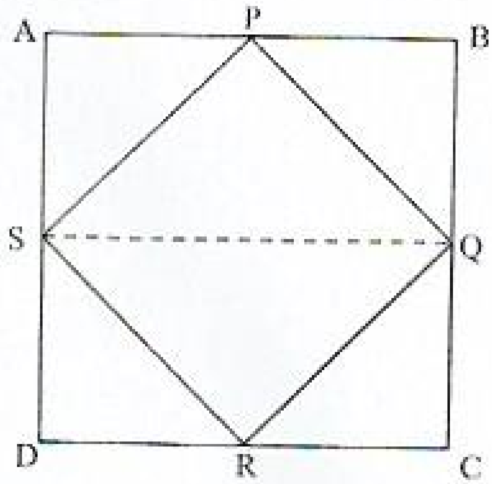
(ii) $\mathbf{B}^{-1}$. [3]

(c) If $\begin{pmatrix} -2 & p \\ p+3 & -4p \end{pmatrix}$ is singular, find the two possible values of p. [2]

(d) A company invested money in a bank at 270% simple interest per annum. Given that after 8 months, the total value of its investment was \$840 million, calculate the amount invested. [3]

[Turn over

4 (a)



The diagram shows two squares ABCD and PQRS. Given that AB = 12 cm, calculate

(i) the perimeter of PQRS,

(ii) the area of ΔQRS.

(b) Sibongile's weekly wage W(in thousands of dollars), is partly constant and partly varies as the number of hours N of overtime she works per week.

(i) Express W in terms of N and constants h and k.

(ii) Given that when W = 80, N = 10 and when W = 60, N = 6, find the value of h and the value of k.

(iii) Sibongile's normal working time is 44 hours in a week.

Find the total number of hours worked in a week in which she was paid $90 thousand.

(a) The volume, V, of material needed to make a cylindrical tube of internal radius r, external radius R and length h is given by the formula

$$V = \pi\left(R^2 - r^2\right)h.$$

(i) Taking π to be $\frac{22}{7}$, find the value of V when R = 4 cm, r = 3 cm and h = 150 cm. [2]

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

(b) A solid cuboid of density 0,7 g/cm³ measures 8 cm by 7 cm by x cm and has a total surface area of 442 cm².

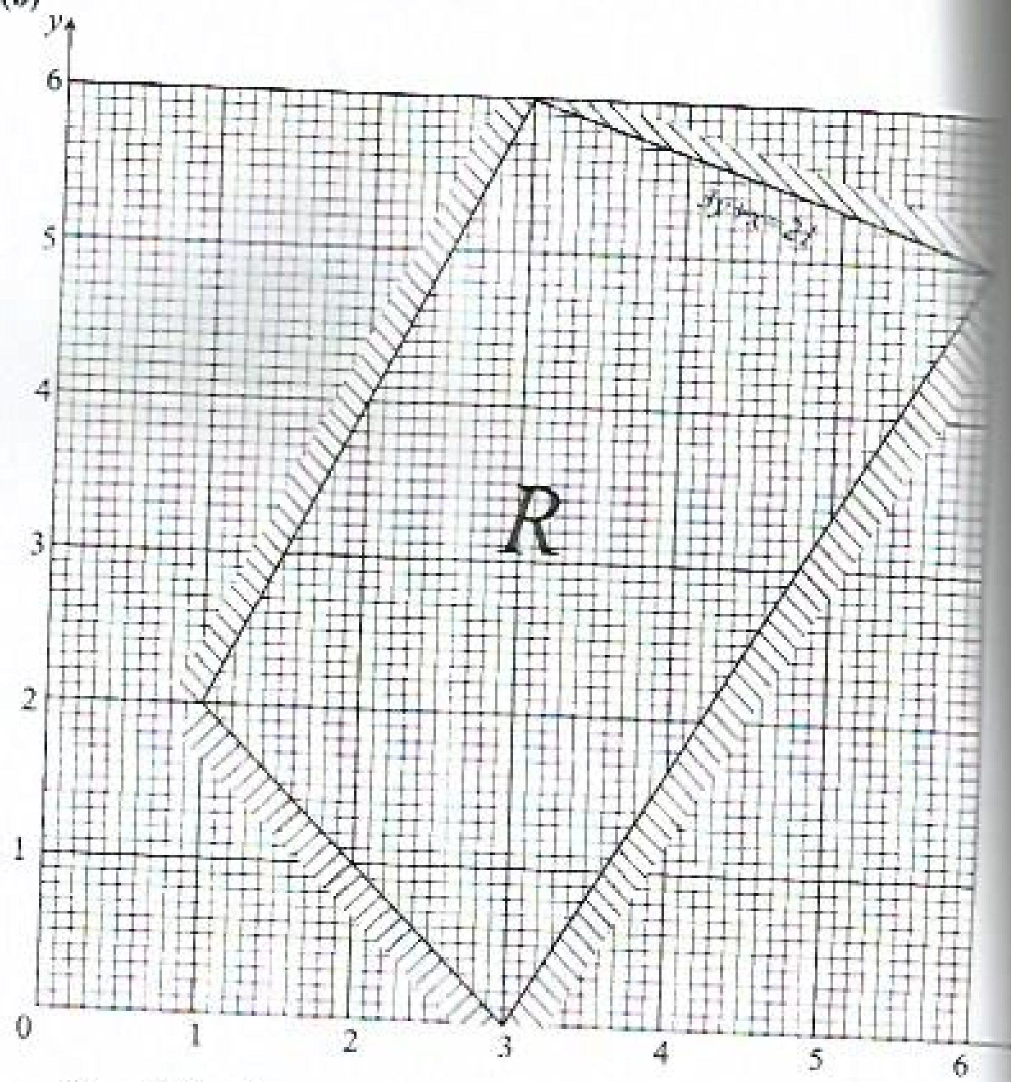
Calculate

(i) the value of x, [3]

(ii) the mass of the solid. [2]

6 (a) Factorise completely $3p^2 + 7p - 6$.

(b)



(i) Using the graph, write down three inequalities other than $3y + x \leq 21$ which satisfy the region $\boldsymbol{R}$. [6]

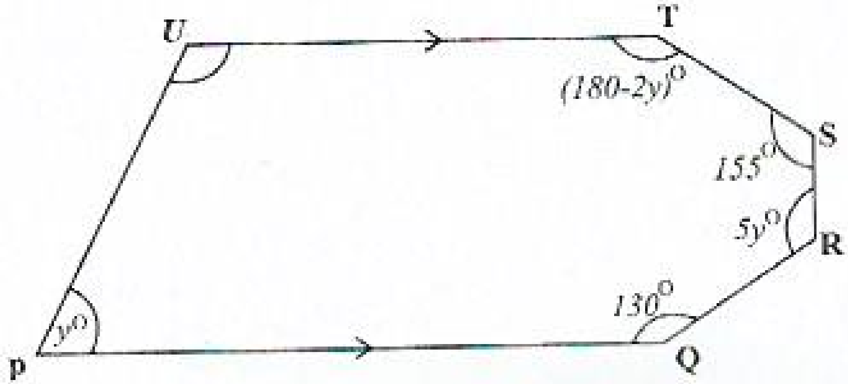
(ii) Find the maximum value of $5y - x$ for integer values of x and y in $\boldsymbol{R}$.

Section B [36 marks]

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

Each question carries 12 marks.

(a)



In the hexagon **PQRSTU**, the lines **PQ** and **UT** are parallel. $\mathrm{U\hat{P}Q} = y°$
$\mathrm{P\hat{Q}R} = 130°$, $\mathrm{Q\hat{R}S} = 5y°$, $\mathrm{R\hat{S}T} = 155°$ and $\mathrm{S\hat{T}U} = (180 - 2y)°$.

(i) Write down an expression, in terms of y, for $\mathrm{P\hat{U}T}$. [1]

(ii) Using the sum of interior angles of the hexagon, form an equation in terms of y and solve it. [3]

(iii) Hence, write down the numerical value of $\mathrm{Q\hat{R}S}$. [1]

(b) (i) Show that the equation

$$\frac{1}{2x-5} + \frac{2}{3} = \frac{1}{x+3}$$

reduces to $4x^2 - x - 6 = 0$. [2]

(ii) Hence solve the equation $4x^2 - x - 6 = 0$, giving your answers correct to two decimal places. [5]

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

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

A landmine-infested area is in the form of a quadrilateral PQRS with $PQ = 14$ km, $QR = 12$ km, $PS = 17$ km, $P\hat{Q}R = 90°$ and $Q\hat{P}S = 120°$

(a) Using a scale of 1 cm to represent 2 km, construct quadrilateral PQRS.

(b) For safety reasons, resettled families are to be at least 6 km from QR.

Construct the locus of points 6 km from QR.

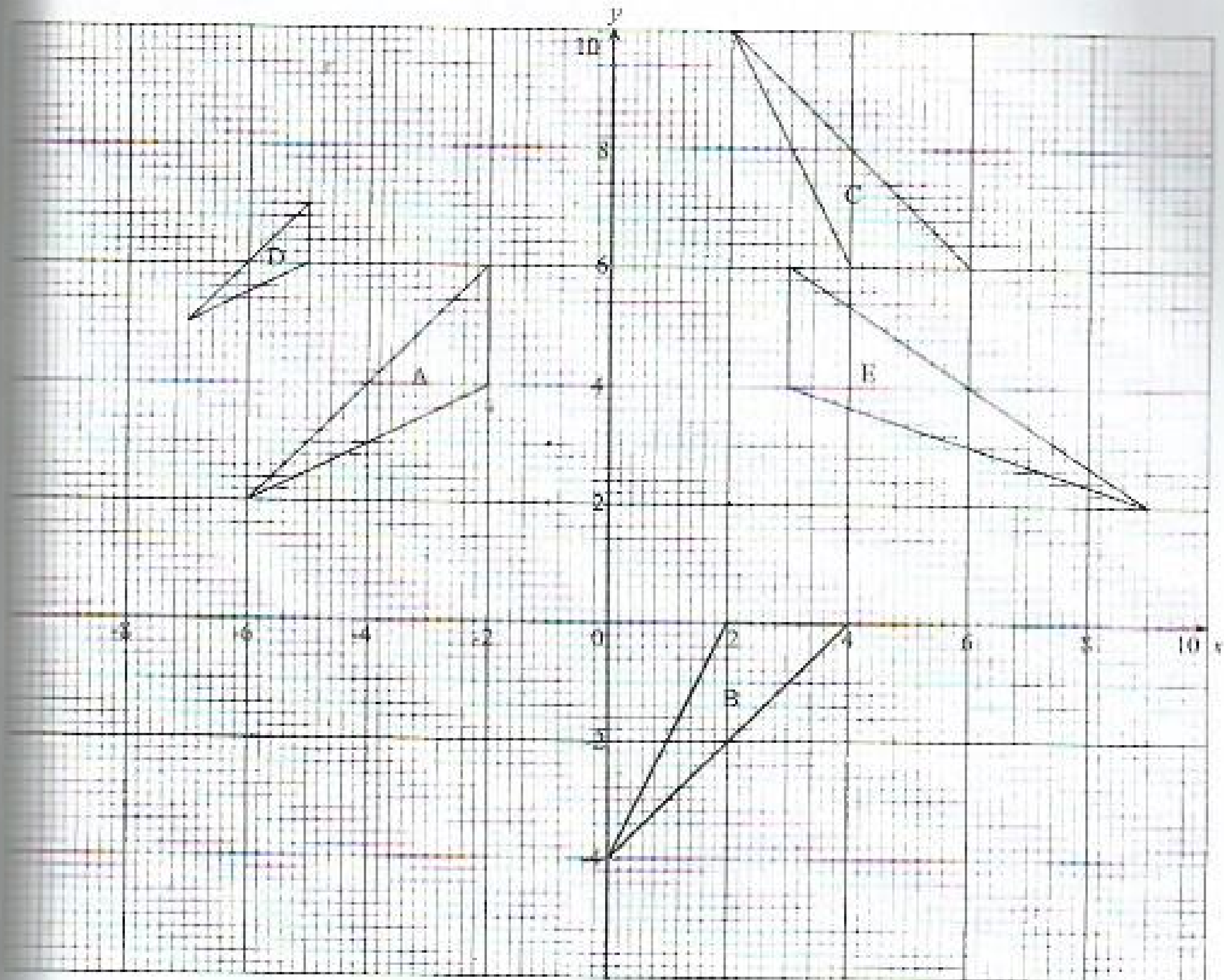
(c) Two landmines were located such that they were each equidistant from PS and SR and 10 km from P.

(i) Construct the locus of points equidistant from PS and SR.

(ii) Construct the locus of points 10 km from P.

(d) (i) Label M_1 and M_2 the two positions of the landmines.

(ii) Find the actual distance between the landmines.



Use the diagram to answer the following questions.

(a) ΔB is a reflection of ΔA.

(i) Write down the equation of the mirror line. [2]

(ii) Given that (k; 8) is one of the invariant points under this reflection, find the value of k. [1]

(b) Describe fully the single transformation which maps ΔA onto ΔC. [3]

[Turn over

(c) ΔD is the image of ΔA under an enlargement, centre origin followed by a translation.

Write down

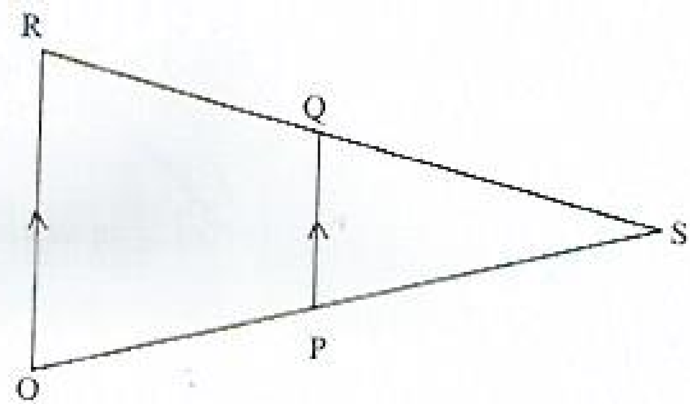
(i) the scale factor of the enlargement,

(ii) the translation vector.

(d) Describe fully the single transformation which maps ΔA onto ΔE.

---

10 **(a)**



In the diagram, OR is parallel to PQ and $\frac{PQ}{OR} = \frac{2}{3}$. OP and RQ produced meet at S. $\overrightarrow{OP} = \boldsymbol{p}$ and $\overrightarrow{PQ} = \boldsymbol{q}$.

(i) Express in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$.

(a) $\overrightarrow{OR}$,

(b) $\overrightarrow{RQ}$.

(ii) Write down, in its lowest terms, the ratio

(a) $\frac{QS}{RS}$,

(b) $\frac{\text{area of } \Delta \text{ PQS}}{\text{area of trapezium OPQR}}$.

Answer the whole of this question on a single sheet of graph paper.

Weight Class (kg)	Frequency	Cummulative Frequency
26 – 30	4	4
31 – 35	6	10
36 – 40	12	22
41 – 45	10	32
46 – 50	7	p
51 – 55	1	40

The incomplete table shows the grouped frequency of the weights, to the nearest kilogram, of a group of 40 people.

(a) Write down (*i*) the value of p,

(*ii*) the modal class. [2]

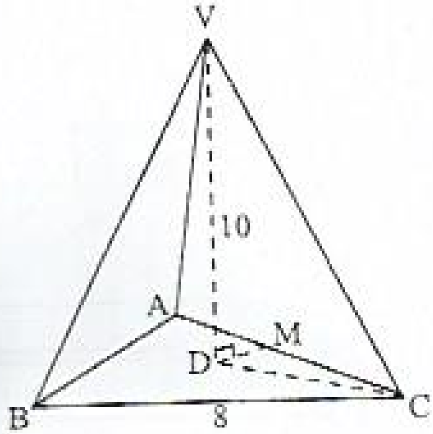
(b) Using a horizontal scale of 2 cm to represent 5 kilogrammes and a vertical scale of 2 cm to represent 5 people, draw a cumulative frequency curve (ogive) to show this information. [5]

(c) Use your ogive to find an estimate of the median weight. [2]

(d) One person is picked at random. Find the probability that this person is in the 36 to 40 kg range. [1]

(e) Given also that 30% of the people are female, find the probability that two people chosen at random, from the group, are both female. [2]

12



In the diagram, VABC is a right pyramid whose base ABC is an equilateral triangle of side 8 cm. The height of the pyramid is 10 cm, D is the centre of the triangle ABC and M is the midpoint of AC.

(a) show that DM = 2,309 cm.

(b) Calculate

(i) VM,

(ii) $V\hat{M}D$,

(iii) the volume of the pyramid,

(iv) the area of one sloping face.

$$\left[\text{Volume of pyramid } = \frac{1}{3} \text{ base area } \times \text{ height}\right]$$

6,6,7.

MATHEMATICS JUNE 2009/2
MARK SCHEME

1(a) (i) $A = \underline{\frac{44}{7}} \times \underline{\frac{105}{16}}$

$= \underline{41\tfrac{1}{4}}$

(ii) $r^2 = \frac{A}{2\pi r} = h$

Therefore $r = \sqrt{\frac{A}{2\pi} - h}$

---

b) $\begin{bmatrix} 6 & -10 \\ -3 & 3 \end{bmatrix}$

---

c(i) $-\frac{1}{5}\begin{bmatrix} -2 & 1 \\ -1 & 3 \end{bmatrix}$

(ii) $-\frac{1}{5}\begin{bmatrix} -2 & 1 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} 2 \\ -6 \end{bmatrix}$

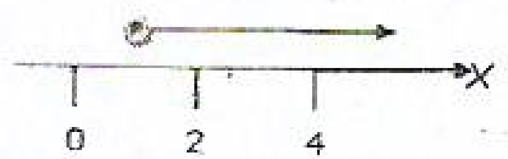
$x = 2$

$\underline{y = 4}$ (11)

2(a) (i) $8 + 6 \le 3x + 4x$

$x \ge 2$

(ii)



(b)(i) 27

(ii) $10 + x + 18 - x + 14 - x = 40$

$42 - x = 40$

$\underline{x = 2}$

(iii) 26 (8)

3(a) $3x + 2 = 4x - 1$

$2 + 1 = 4x - 3x$

$\underline{3 = x}$

(b) (i) $2(3x + 2 + 4x - 1)$

$\underline{14x + 2m}$

(ii) $(3x + 2)(4x - 1) = 0$

$12x^2 + 5x - 12 = 0$

Using x $= \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\dfrac{-5 \pm \sqrt{5^2 + 4 \times 12 \times 12}}{2 \times 12}$

Therefore $\underline{x = 0.81 \text{ or } -1.23}$

4(a)(i) 126 000

(ii) $\dfrac{14}{30} \times 126000$

$= \underline{58\ 800}$

(iii) $\dfrac{100}{125} \times 840\ 000$

$= \underline{627\ 000}$

b(i) 54°

(ii) 72°

(iii) 252°

(iv) 36° (11)

5(a) (i) 3.5km

(ii) 0.128cm^2

b) (i) $C = h + kx$

(ii) $41.5 = h + 50k$

$42.25 = h + 75k$

Therefore $h = 40$

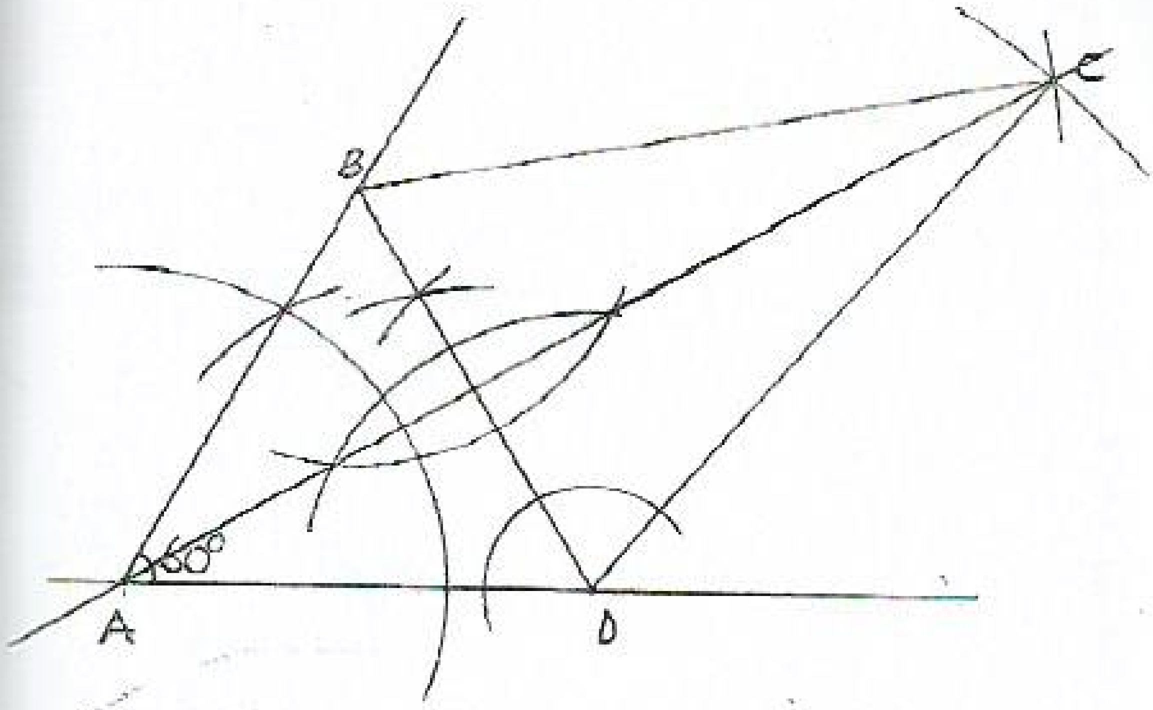
$\underline{k = 0.03 / {}^{3}/_{100}}$

(iii) $C = 40 + 670 \times {}^{3}/_{100}$

$=$ **$60,1** / **Z$6 010 000** (12)

JUNE 2009 Q6

a) On the diagram:



b. (i) perpedicular bisector of BD

(ii) Bisect angle D.

7(a) Speed $= \frac{\underline{\text{Distance}}}{\text{Time}}$

$= \frac{384}{7}$

$= \underline{\mathbf{54,86\ km / h}}$

b(i) $\frac{72}{108}$

$= \underline{\mathbf{6,667}}$

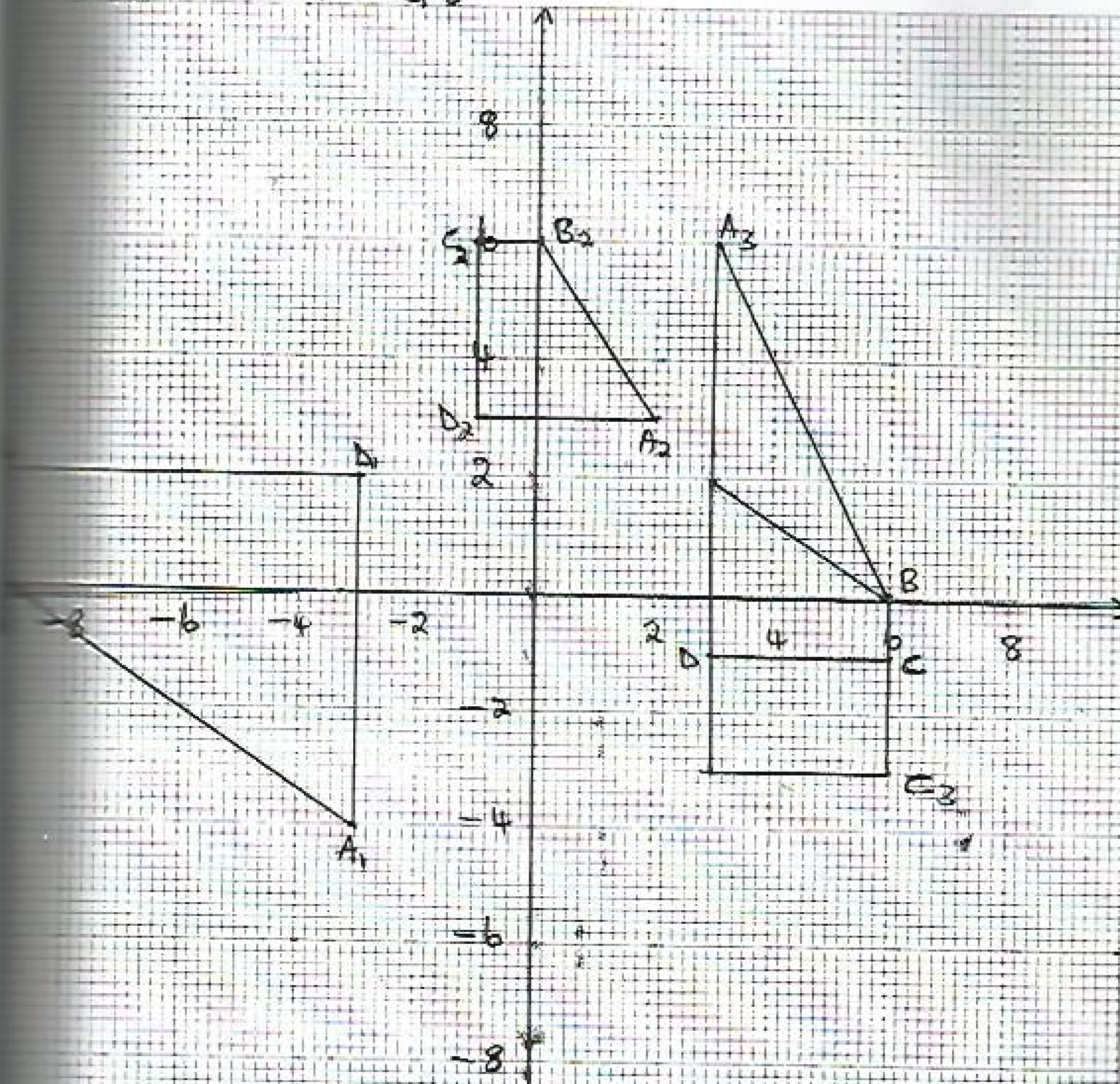
(ii) $\frac{312}{12,5}$

$= \underline{\mathbf{24,25}}$

(iii) 62,35

c) 12 000 000 / 12m (12)

JUNE 2009 Q8

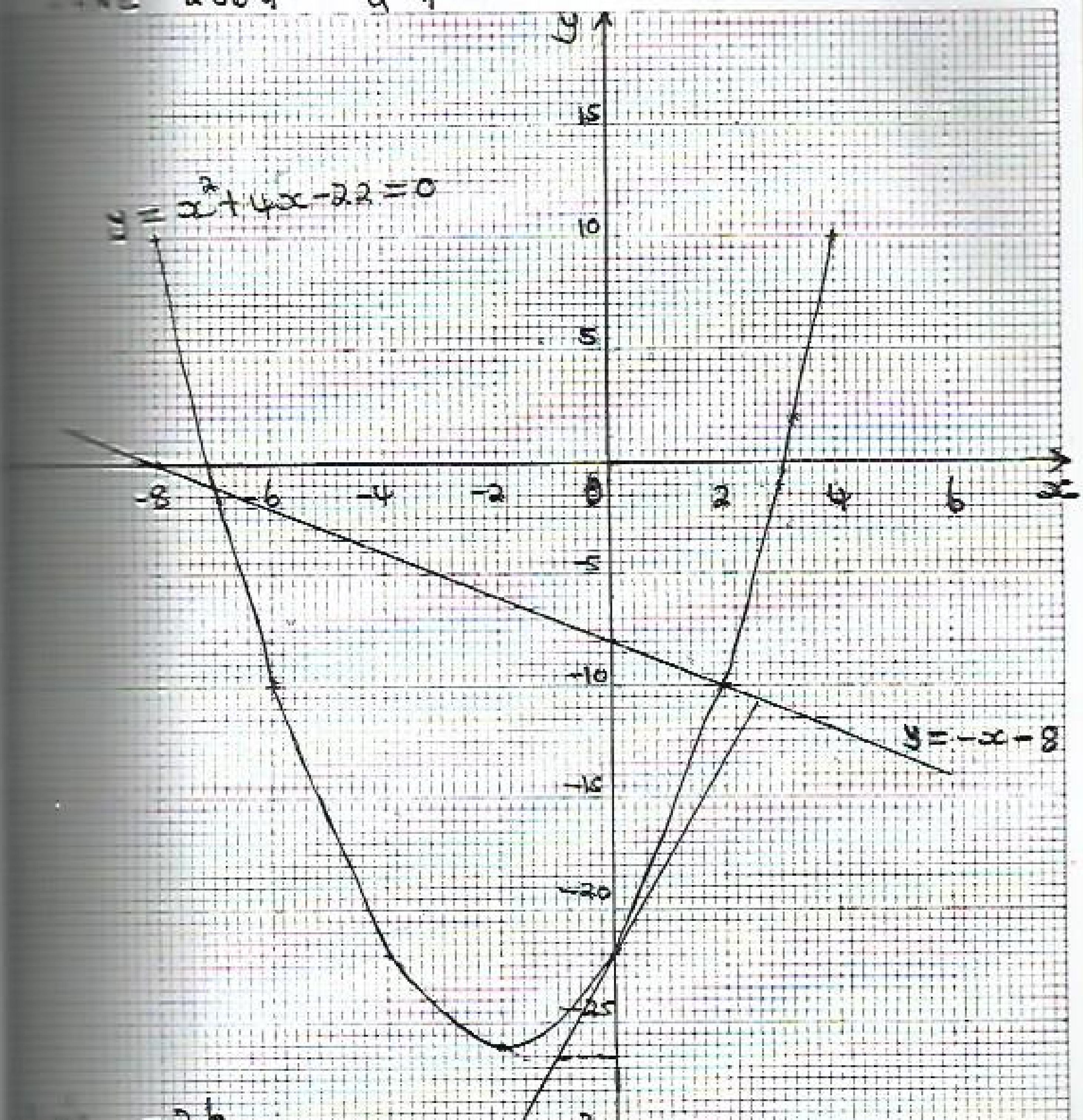


(ii) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 3 & 6 & 6 & 3 \\ 2 & 0 & -1 & -1 \end{pmatrix}$

$= \begin{bmatrix} 2 & 0 & -1 & -1 \\ 3 & 6 & 6 & 3 \end{bmatrix}$

(iii) Reflection in the line $y = x$

JUNE 2009 Q 9



(ii) -26

(b) $x < -3.2$

$x > 3.2$

(iii) $\frac{42}{10}$

$\underline{4.2}$

$x = -7$ or 2

10(a) (i) $\overline{XZ} = 2p - q$

(ii) $\overline{XY} = P$

(iii) $\overline{YZ} = p - q$

(b) $WT = k(2p - q)$

(c) $WT = (1 - 2k)p + (1 - k)q$

d) $2h = 1 - 2k$

$h = 4 - k$

$k = \frac{1}{4}$

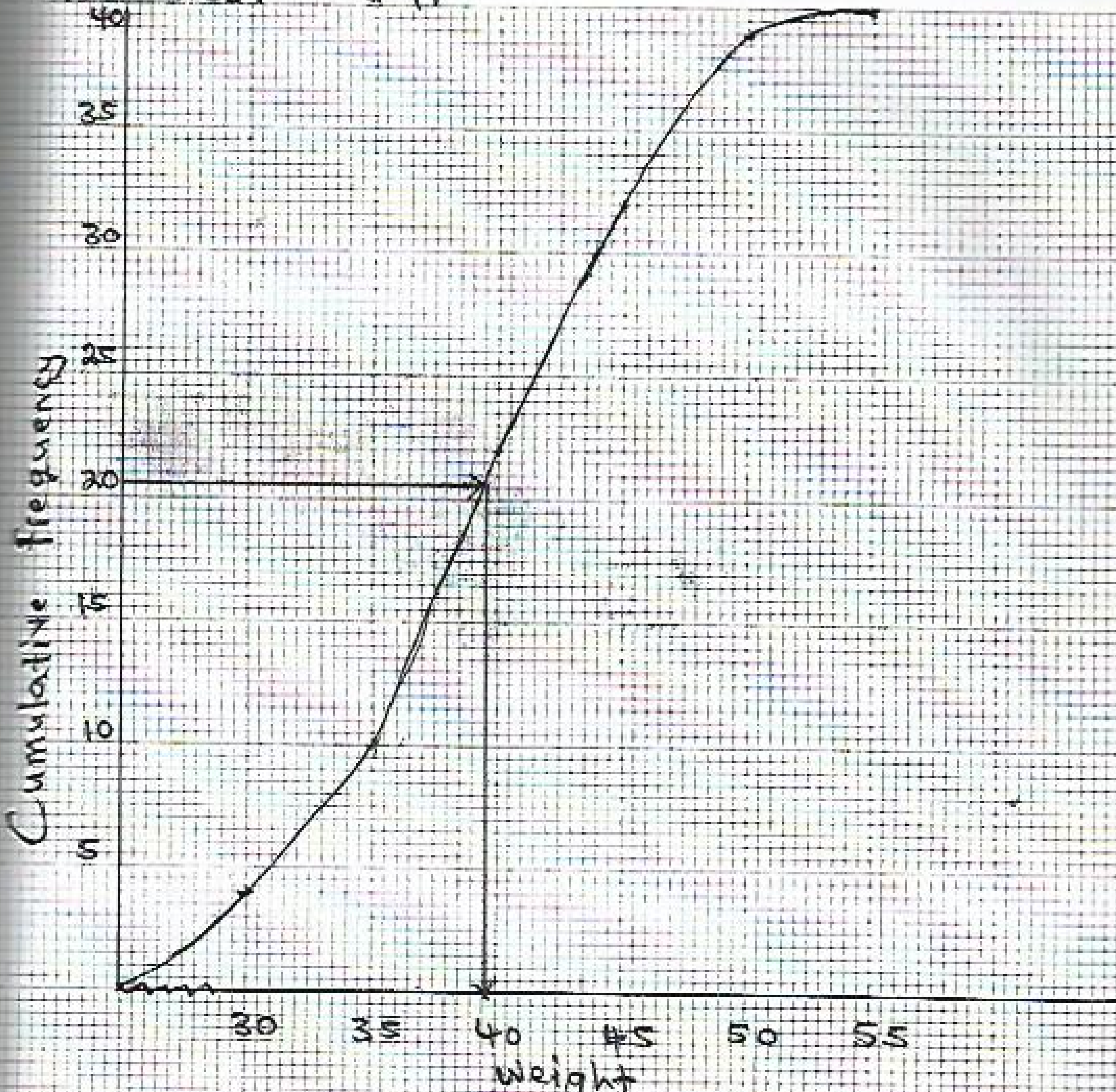
$h = \frac{3}{4}$

e) $TZ = \frac{3}{2}p - 3, q$

f) (i) $n = 3$

(ii) parallel (12)

JUNE 2009 Q 11



a(i) $p = 40 - 1 = 39$

(ii) $36 - 40$

c $\frac{1}{2}(40+1)^{th}$ term

$= 20.5^{th}$ term

$\therefore$ Median $= 39.6$

d) $\frac{12}{40} = \frac{3}{10}$

e) $\frac{12}{40} \times \frac{11}{39} = \frac{11}{130}$

12(a) DM $= 4 \tan 30°$ (CHASHOTAO)

$= 2.309$

(b)(i) VM $= \sqrt{10^2 + 2{,}309^2}$

$=$ **<u>10,26cm</u>**

(ii) VMD $=$ **<u>77°</u>**

(iii) $\frac{1}{3} \times \frac{1}{2} \times 8 \times 8 \times \sin 60° \times 10$

$= 92{,}38$

$=$ **92.4cm³**

(iv) Area = VAC $= \frac{1}{2} \times 8 \times 10{,}26$

$=$ **<u>41,05cm²</u>**

(12)

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/2

PAPER 2

NOVEMBER 2009 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

Electronic calculators must not be used.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 may be used to evaluate explicit numerical expressions.

This question paper consists of 13 printed pages and 3 blank pages.

Section A [64 marks]

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

1 **(a)** Simplify $8 - 24 \div 6 + 3 \times 4$.

(b) Expand $(1-2x)(x+3)$.

(c) **(i)** Find the L.C.M. of

$15y^2, 25xy^3$ and $\left(x^3 - x^2\right)$.

(ii) Evaluate $(\text{Log}_9 81) \times (2\text{Log}_4 8)$.

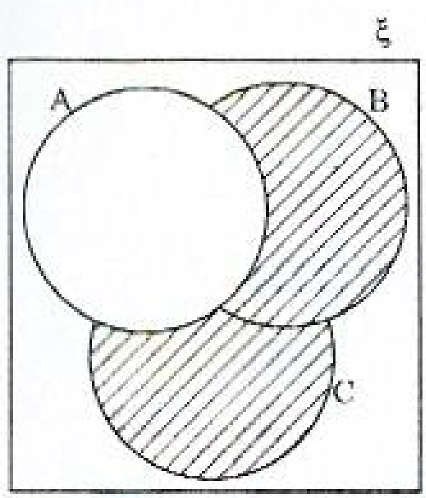
---

2 **(a)** Solve the equations

(i) $7(h + 3) - 2(h - 4) = 4$,

(ii) $3^{(m+4)} = 9^{(m-1)}$.

(b) Write down, in set notation, the set represented by the shaded region in the Venn diagram.



(c) It is given that

$$\xi = \{x : 2 \le x \le 20, x \text{ is an integer}\},$$
$$P = \{x : x \text{ is a prime number}\} \text{ and}$$
$$Q = \{x : 4 \le x < 17\}.$$

(i) List the elements of P. [2]

(ii) Find $n(Q' \cap P)$. [2]

---

3 **(a)** Simplify $\frac{n-3}{6} \div \frac{n^2-9}{4}$. [2]

(b) Given that $\mathbf{A} = (2 \quad 3)$ and $\mathbf{B} = \begin{pmatrix} 4 & -1 \\ 5 & 6 \end{pmatrix}$,

find

(i) **AB**,

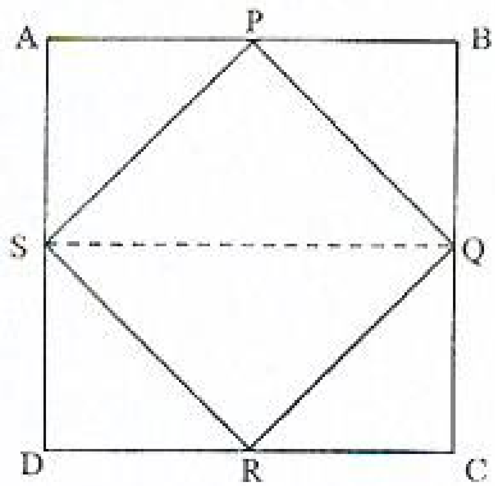
(ii) $\mathbf{B}^{-1}$. [3]

(c) If $\begin{pmatrix} -2 & p \\ p+3 & -4p \end{pmatrix}$ is singular, find the two possible values of p. [2]

(d) A company invested money in a bank at 270% simple interest per annum. Given that after 8 months, the total value of its investment was \$840 million, calculate the amount invested. [3]

[Turn over

4 (a)



The diagram shows two squares ABCD and PQRS. Given that AB = 12 cm, calculate

(i) the perimeter of PQRS,

(ii) the area of ΔQRS.

(b) Sibongile's weekly wage W(in thousands of dollars), is partly constant and partly varies as the number of hours N of overtime she works per week.

(i) Express W in terms of N and constants h and k.

(ii) Given that when W = 80, N = 10 and when W = 60, N = 6, find the value of h and the value of k.

(iii) Sibongile's normal working time is 44 hours in a week.

Find the total number of hours worked in a week in which she was paid $90 thousand.

(a) The volume, V, of material needed to make a cylindrical tube of internal radius r, external radius R and length h is given by the formula

$$V = \pi\left(R^2 - r^2\right)h.$$

(i) Taking π to be $\frac{22}{7}$, find the value of V when R = 4 cm, r = 3 cm and h = 150 cm. [2]

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

(b) A solid cuboid of density 0,7 g/cm^3 measures 8 cm by 7 cm by x cm and has a total surface area of 442 cm^2.

Calculate

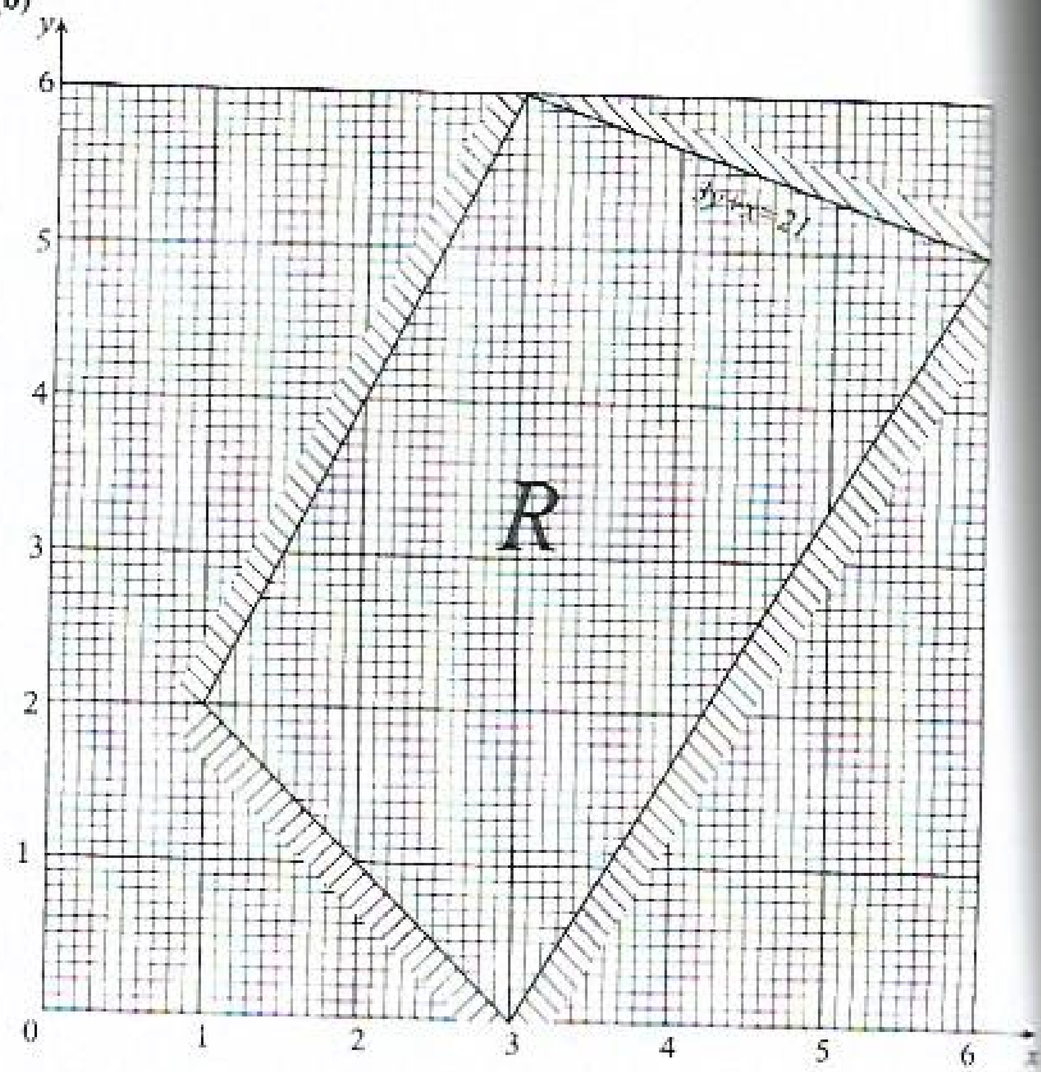
(i) the value of x, [3]

(ii) the mass of the solid. [2]

---

6 **(a)** Factorise completely $3p^2 + 7p - 6$.

(b)



(i) Using the graph, write down three inequalities other than $3y + x \leq 21$ which satisfy the region R. [6]

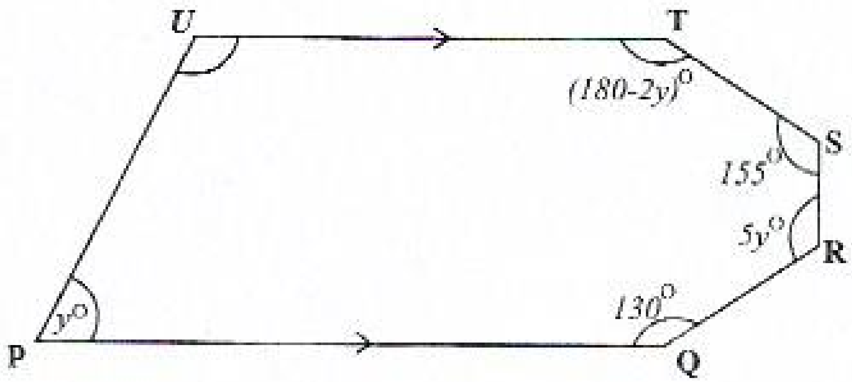
(ii) Find the maximum value of $5y - x$ for integer values of x and y in R.

Section B [36 marks]

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

Each question carries 12 marks.

7 **(a)**



In the hexagon **PQRSTU**, the lines **PQ** and **UT** are parallel. $U\hat{P}Q = y°$ $P\hat{Q}R = 130°$, $Q\hat{R}S = 5y°$, $R\hat{S}T = 155°$ and $S\hat{T}U = (180 - 2y)°$.

(i) Write down an expression, in terms of y, for $P\hat{U}T$. [1]

(ii) Using the sum of interior angles of the hexagon, form an equation in terms of y and solve it. [3]

(iii) Hence, write down the numerical value of $Q\hat{R}S$. [1]

(b) (i) Show that the equation

$$\frac{1}{2x-5} + \frac{2}{3} = \frac{1}{x+3}$$

reduces to $4x^2 - x - 6 = 0$. [2]

(ii) Hence solve the equation $4x^2 - x - 6 = 0$, giving your answers correct to two decimal places. [5]

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

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

A landmine-infested area is in the form of a quadrilateral PQRS with $PQ = 14$ km, $QR = 12$ km, $PS = 17$ km, $P\hat{Q}R = 90°$ and $Q\hat{P}S = 120°$

(a) Using a scale of 1 cm to represent 2 km, construct quadrilateral PQRS.

(b) For safety reasons, resettled families are to be at least 6 km from QR.

Construct the locus of points 6 km from QR.

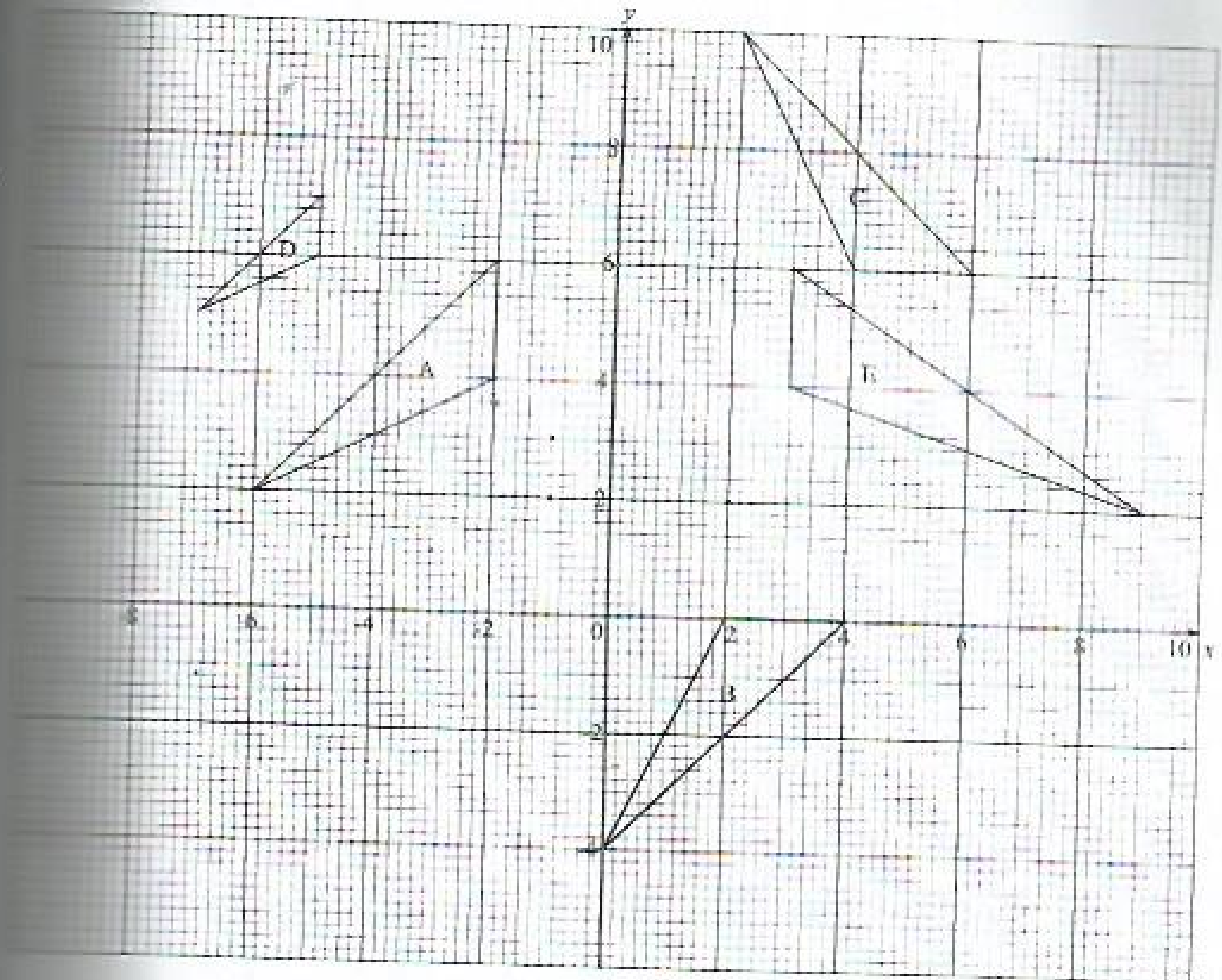
(c) Two landmines were located such that they were each equidistant from PS and SR and 10 km from P.

(i) Construct the locus of points equidistant from PS and SR.

(ii) Construct the locus of points 10 km from P.

(d) (i) Label M_1 and M_2 the two positions of the landmines.

(ii) Find the actual distance between the landmines.



Use the diagram to answer the following questions.

(a) ΔB is a reflection of ΔA.

(i) Write down the equation of the mirror line. [2]

(ii) Given that (k; 8) is one of the invariant points under this reflection, find the value of *k*. [1]

(b) Describe fully the single transformation which maps ΔA onto ΔC. [3]

[Turn over

(c) ΔD is the image of ΔA under an enlargement, centre origin followed by a translation.

Write down

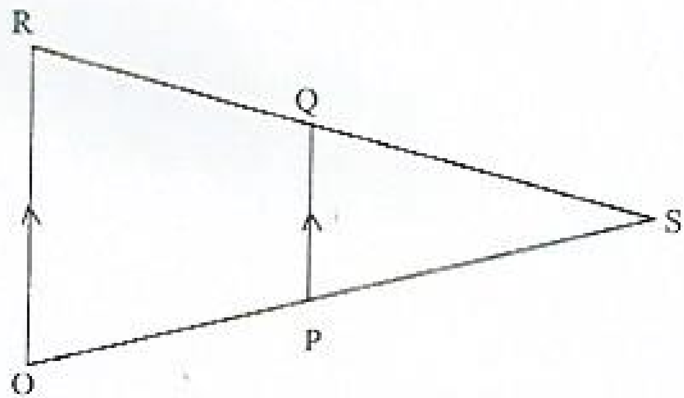
(i) the scale factor of the enlargement,

(ii) the translation vector.

(d) Describe fully the single transformation which maps ΔA onto ΔE.

---

10 (a)



In the diagram, OR is parallel to PQ and $\frac{PQ}{OR} = \frac{2}{3}$. OP and RQ produced meet at S. $\overrightarrow{OP} = \boldsymbol{p}$ and $\overrightarrow{PQ} = \boldsymbol{q}$.

(i) Express in terms of $\boldsymbol{p}$ and/or $\boldsymbol{q}$.

(a) $\overrightarrow{OR}$, [1]

(b) $\overrightarrow{RQ}$. [2]

(ii) Write down, in its lowest terms, the ratio

(a) $\frac{QS}{RS}$, [1]

(b) $\frac{\text{area of } \Delta \text{ PQS}}{\text{area of trapezium OPQR}}$. [2]

(b) (i) A shop that makes and sells curtains supplied the following price quotation to a customer:

Curtaining material/metre……………	\$700 000-00
Labour	10% of the total cost of the material
Quotation valid for 2 weeks	

A customer bought 150 metres of material and had the curtains made at the shop.

Calculate the amount she paid altogether. [2]

(ii) Three weeks later she requested another quotation and she got the following:

Curtaining material/metre	\$840 000-00
Labour	15% of the total cost the material
Quotation valid for 2 weeks.	

She bought another 150 metres of material and had the curtains made at the shop.

Calculate

(a) the total amount she paid then, [1]

(b) the percentage increase, correct to **three** significant figures. [3]

[Turn over

11 **Answer the whole of this question on a sheet of graph paper.**

A boy playing on a swing has his velocity V m/s at time t seconds given by $V = t^2 - 4t + 4$.

The following is an incomplete table of values for $V = t^2 - 4t + 4$

t(s)	0	0,5	1	1,5	2	3	4
V(m/s)	4	p	1	0,25	0	1	4

(a) Find the value of p.

(b) Using a scale of 2 cm to represent 0,5 seconds on the horizontal and 2 cm to represent 1 m/s on the vertical axis, draw the graph of $v = t^2 - 4t + 4$ for $0 \leq t \leq 4$.

(c) Use your graph to estimate

(i) the time when the velocity was 1,5 m/s,

(ii) the acceleration when $t = 3$.

(d) Using the same axes, draw the graph of $v = 10t$.

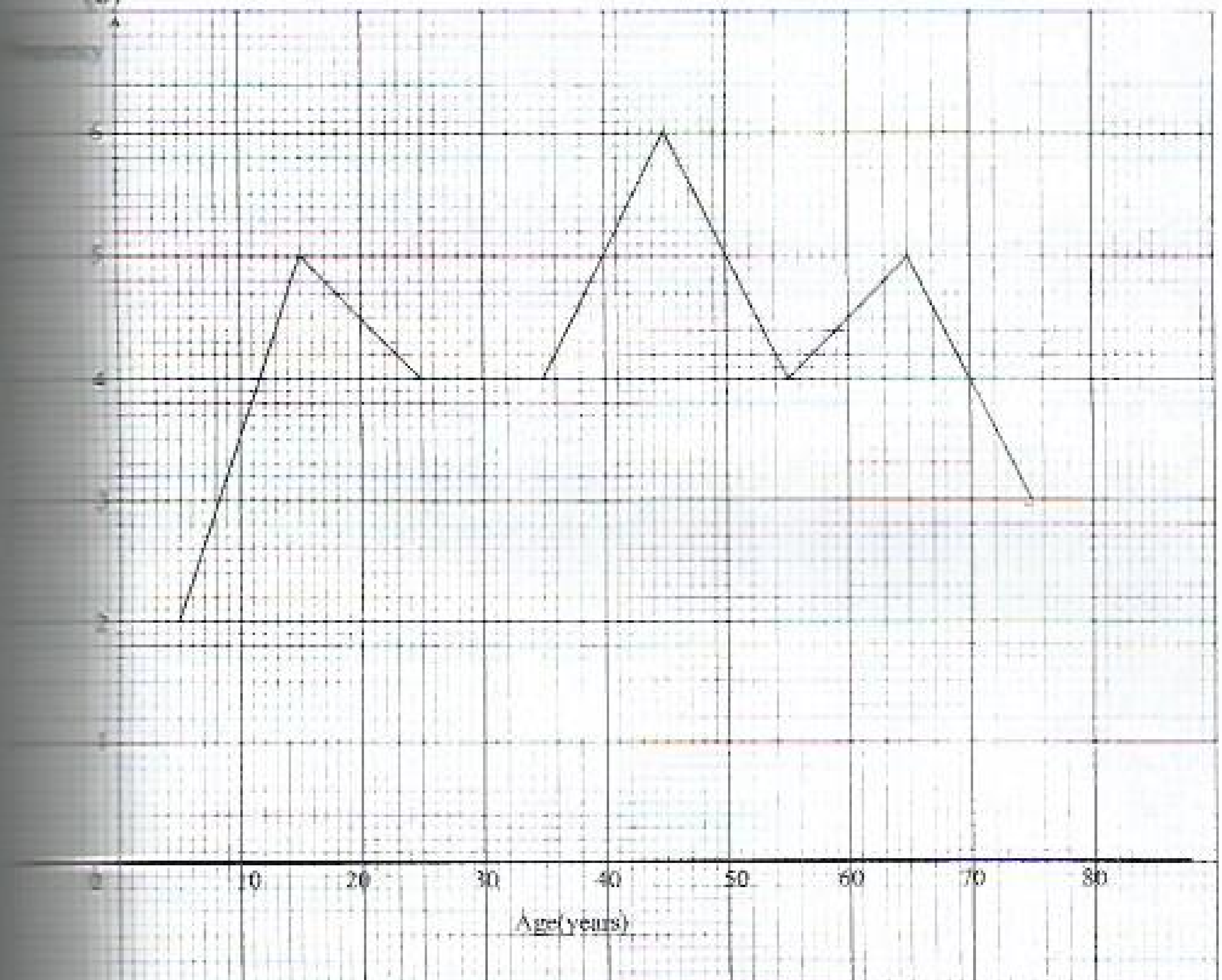
(e) The function $v = 10t$ represents the velocity of a falling object.

(i) Use your graph to find the time when the boy and the object had the same speed.

(ii) Given that the boy and the object collided at the same time they had the same speed, use your graph to find the distance the object had travelled.

(a) Natsai's average mark for two tests is 63,5%. Find his mark in the third test if his average for the three tests is 66%. [3]

(b)



The frequency polygon shows the age distribution of a group of people living in a certain village. Their ages range from 0 to 80 years.

(i) Find the number of people living in this village. [2]

(ii) State the modal age group. [2]

(iii) Calculate the percentage of people who are older than 50 years. [2]

(iv) Two people were chosen at random from the village to be questioned about the damage to a neighbour's hut.

Calculate the probability that they were each older than 10 years but less than or equal to 30 years, giving your answer as a fraction in its lowest terms. [3]

MATHEMATICS NOVEMBER 2009/2

1(a) $8 - 4 + 12$

16 (2)

(b) $3 - 5x - 2x^2$ (2)

c) (i) $x - 1$

$75\,x^2y^3\,(x - 1)$ (3)

(ii) 2

3

6 (3)

2(a)(i) $7h + 21 - 2h + 8 = 4$

(ii) 3^2

Therefore m = 6

b) $A^1 n\ (BUC)$

c)(i) {2 , 3 , 7 , 11 , 13 , 17 , 19 }

(ii) 4

Q^1 = [2, 3, 7 , 18 , 19 , 20]

3(a) $\dfrac{4}{(n - 3)\,(n + 3)}$

$\dfrac{2}{3(n + 3)}$ (2)

(b) AB = (23 16)

$B^{-1} = \dfrac{1}{29}\begin{bmatrix} 6 & 1 \\ -5 & 4 \end{bmatrix}$ (5)

(c) p = 0 0r 5 (2)

d) $p + \dfrac{270}{100} \times \dfrac{8p}{12} = 840$

Therefore p = $300

4(a)i) $4\sqrt{6^2 + 6^2}$

- **33,94**

(ii) Area $= ½\sqrt{72} \times \sqrt{72}$

$= \underline{\mathbf{36cm^2}}$ (4)

(b) (i) $W = h + KN$

(ii) $80\,000 = h + 10k$

$60\,000 = h + 6k$

Therefore $k = 5\,000$

$h = 30\,000$

(iii) N = 12 / 52 hours (7)

5(a)(i) $\pi\ (4^2 - 3^2)\ 150$

$\underline{\mathbf{3\,300\ cm^3}}$

(ii) $\dfrac{V}{\pi h} = R^2 - r^2$

$R = \sqrt{\dfrac{V}{\pi h} + r^2}$ (5)

---

b(i) $x\ (8 + 7 + 8 + 7) + 2\ (8 \times 7) = 442$

$\underline{\mathbf{x = 11cm}}$

(ii) $0.7 \times 8 \times 7$

<u>431.2g</u> (5)

6(a) $(p + 3)\ (3p - 2)$

$x = \$300m$

(b(i) $x + y = 3$

$x + y \geq 3$

$y = 2x$

$y \leq 2x$

$y = \dfrac{5x}{3} - 5$

$y > \dfrac{5x}{3} - 5$

(ii) 27

7(a)(i) $180 - y^{o}$

(ii) $y + 130 + 5y + 155 + 180 - 2y$

$3y = 720 - 645$

$y = 25^{o}$

(iii) 125^{o}

---

b) (i) $3(x + 3) + 2(2x - 5)(x + 3) = 3(2x - 5)$

$\longrightarrow \quad 4x^2 + x - 6 = 0$

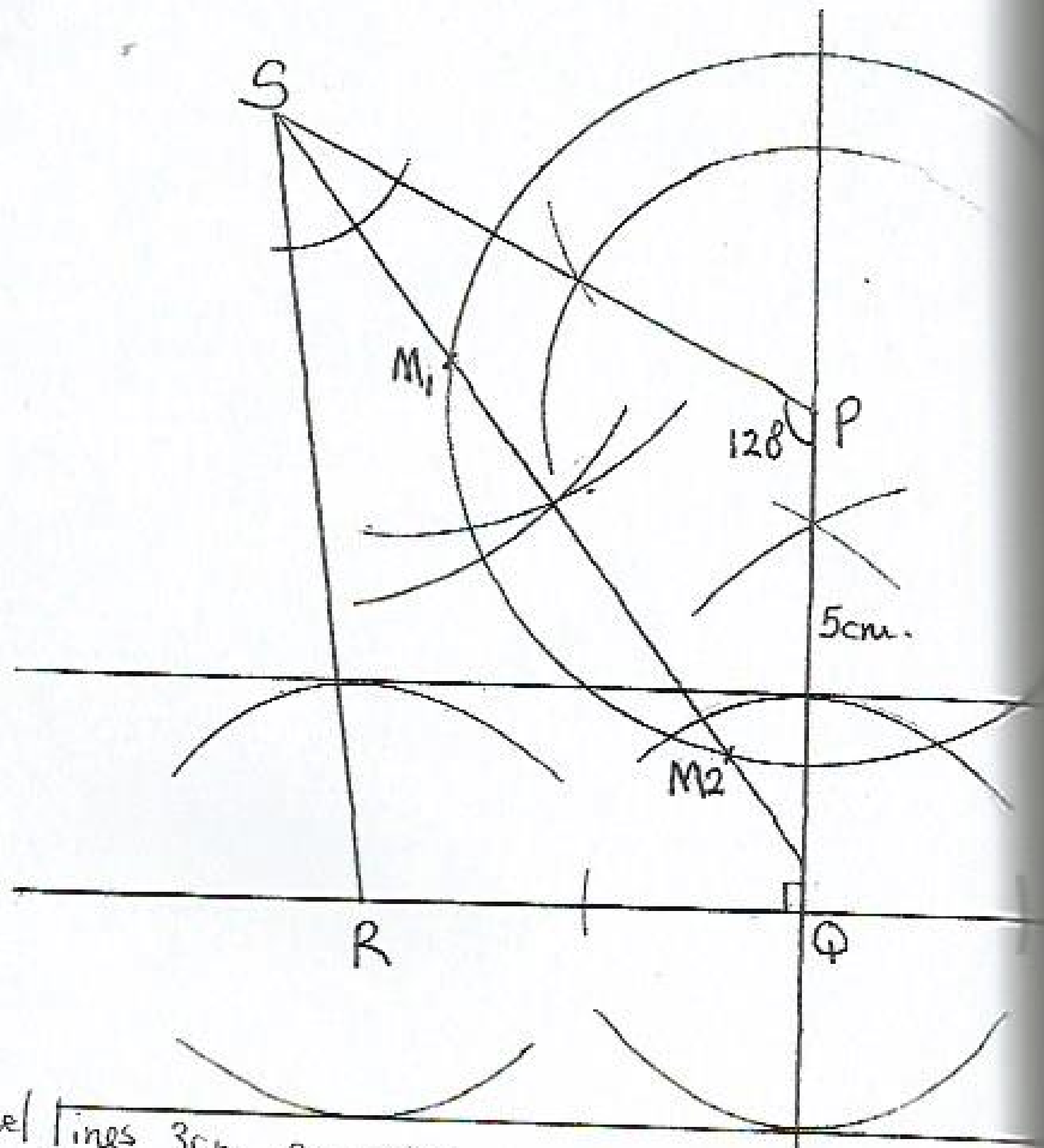
(ii) Using the formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

x = 1.36 or -1.11

Scale 1cm = 2km.

a



b) parallel lines 3cm from QR

c. (i) Bisect Angle $\hat{S}$.

(ii) Circle radius 5cm Centre P.

d (i) Intersection of c(i) and (ii).

(ii) 6.0cm × 2km = 12km.

(a) (i) $y = x + 2$

(ii) $k = 6$

(b) -rotatión

-90° clockwise

-centre$(2|2)$

(c) (i) $\frac{1}{2}$

(ii) $\begin{pmatrix} -4 \\ 4 \end{pmatrix}$

(d) -stretch

-y axis invariant

-stretch factor $^3/_2$

10(a)i) a) $^3/_2\, q$

b) $p + q$

(ii) *a)* $^2/_3$

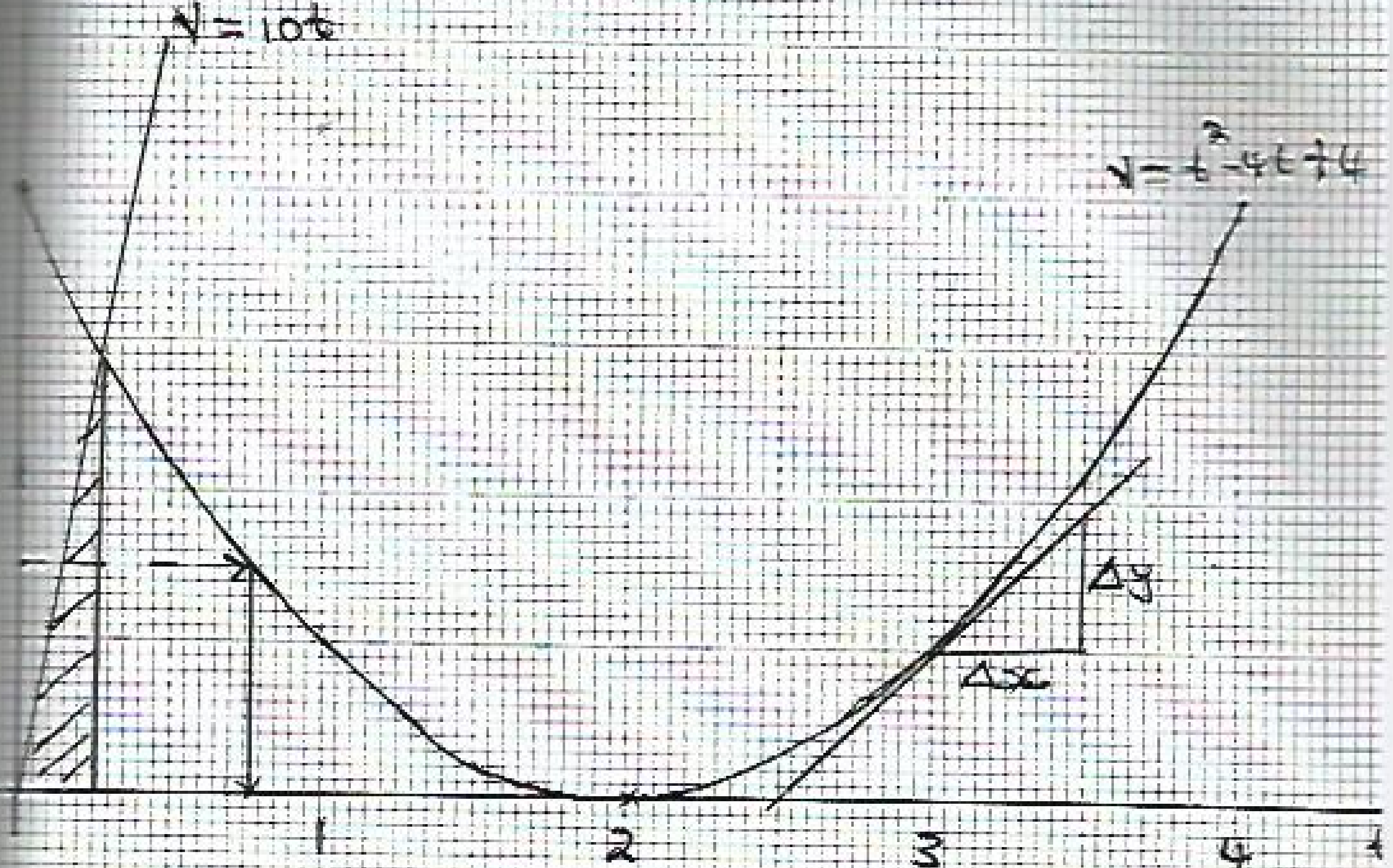
(b) $^4/_5$

b(i) $115 500 000

(ii) (a) $144 900 000

(b) 25,5%

NOV 2009 Q11



b) $p = 0,5^2 - 4(0,5) + 4$

$= 0,25 - 2 + 4$

$= \underline{2,25}$

c) i) 0,8 seconds

ii) $\frac{1}{0,5} = 2\,m/s^2$

d) On the graph

e) i) 0,26 seconds

ii) Distance = Area

$= \frac{1}{2}bh$

$= \frac{1}{2} \times 0,26 \times 2,9$

$= \underline{0,4\,m}$

12. (a) let the mark be x

$$3 \times 66 = x + 63,5 \times 2$$

$$198 = 127 + x$$

$$x = 198 - 127$$

$$=71$$

The third mark is 71%

(b) (i) $2 + 5 + 4 + 4 + 6 + 4 + 5 + 3 = 33$

(ii) 40 to 50 years

(iii) $4 + 5 + 3 = {}^{12}/_{33} \times 100$

$$= 36,4\%$$

(iv) $\frac{9}{33} \times \frac{8}{32} = \frac{3}{44}$

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MATHEMATICS
PAPER 2

4028/2

JUNE 2010 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of ma.ks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 12 printed pages.

Section A [64 marks]

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

1 (a) Remove brackets and simplify the expression $3(5-x)-2x(x+3)$. [2]

(b) Integers x, y and z are such that

$x \le 6$, $y \ge -2$ and $-6 \le z \le 4$.

Find (i) the **least** possible value of yz^2

(ii) the **greatest** possible value of $x-y$.

[4]

(c) Factorise completely $125p^3 - 5p$.

[3]

[Total :9]

2 (a) Express 252 as a product of its prime factors.

[2]

(b) 120 kg of a certain metal has a volume of 0,4 m³. Find the density of the metal, giving your answer in g/cm³.

[2]

(c) It is given that $\xi = \{1;2;3;5;7;8;9;\}$,

A = {3; 5}, B = {1; 3; 7; 9} and C = {1; 7 ; 9}

(i) Draw a fully labelled Venn diagram to show **all** the elements in each subset.

[3]

(ii) Write down the elements of the following subsets

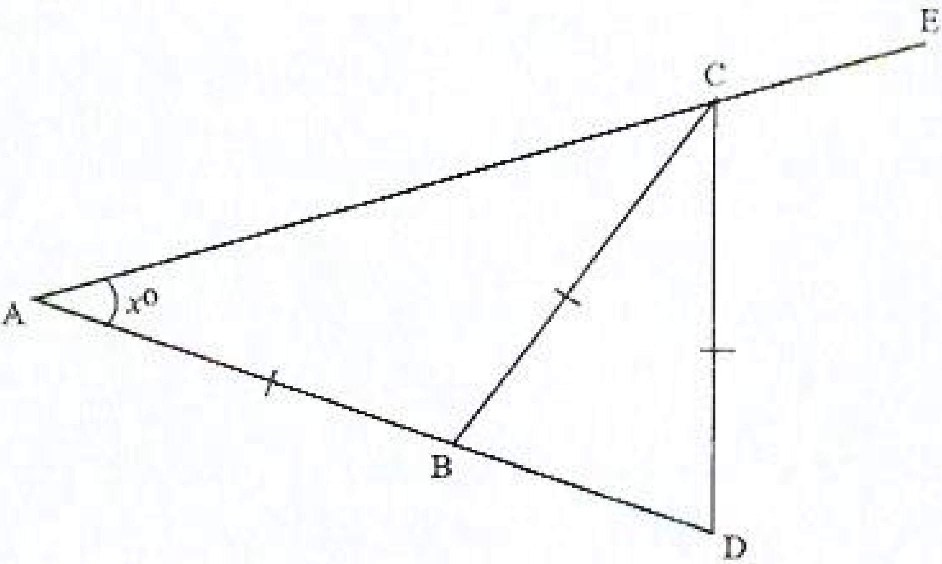
(a) $A \cap B \cap C'$,

(b) $(A \cup B)' U C$.

[3]

[Total:10]

(a)



In the diagram, ACE and ABD are straight lines, AB = BC = CD and $B\hat{A}C = x^{\circ}$.

(i) Express in terms of x

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

(b) $D\hat{C}E$,

(c) $B\hat{C}D$. [3]

(ii) If AC = AD, find the numerical value of x. [2]

(b) Given that $\mathbf{M} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$, $\mathbf{N} = \begin{pmatrix} 4 & -2 \\ 3 & 0 \end{pmatrix}$ and $3\mathbf{M} + \mathbf{N} = \mathbf{M}$, find

(i) the matrix **M**, [3]

(ii) $\mathbf{N}^2$. [2]

[Total:10]

4 Two variables R and V are connected by the equation $R = kV + c$, where k and c are constants.

(a) Write down the type of variation between R and V.

(b) If the graph of $R = kV + c$ is drawn with R on the vertical axis, write down, in terms of k and/or c the coordinates of the point where the graph crosses

(i) the vertical axis,

(ii) the horizontal axis.

(c) Make V the subject of the equation $R = kV + c$.

(d) Given that $R = 14$ when $V = 6$ and that $R = 8$ when $V = 2$,

(i) form a pair of simultaneous equations in k and c,

(ii) **hence** find the numerical value of k and the numerical value of c

[Tot

---

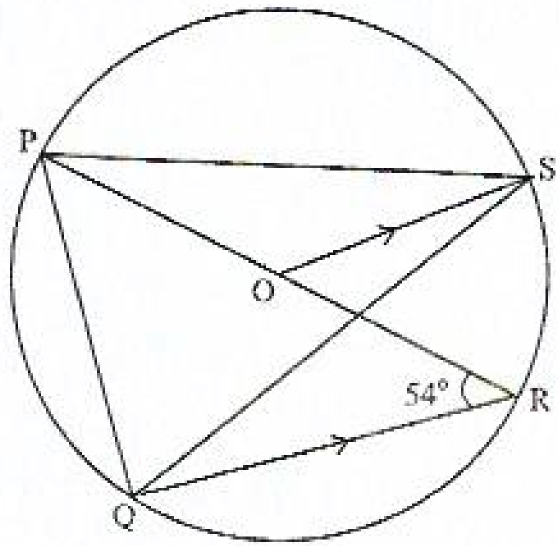
5 (a) In a school with 1 050 pupils, $\frac{4}{7}$ of the pupils were boys. One quarter of the boys were suspended for misbehaviour.

(i) Find the number of boys suspended.

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

(iii) If two pupils were chosen at random from the remaining pupils to testify, find the probability that the two pupils were of the same sex.

(b)



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

Calculate

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

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

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

[Total:11]

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

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

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

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

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

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

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

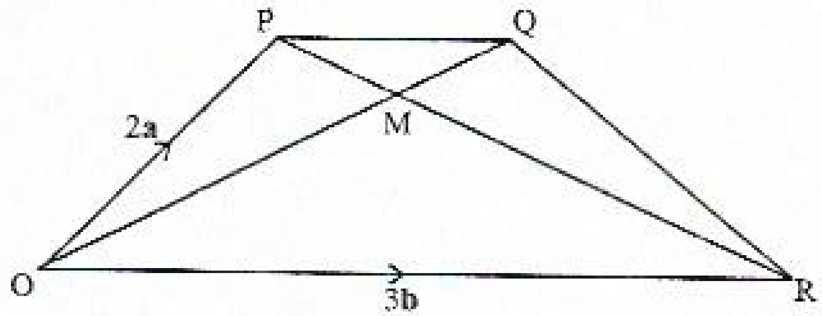
(ii) Draw a circle with centre P and radius PC. [1]

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

[Total:13]

Section B [36 marks]

Answer any three questions in this section.



In the diagram, PQ is parallel to OR, $PM = \frac{1}{3}PR$, $\overrightarrow{OP} = 2\mathbf{a}$ and $\overrightarrow{OR} = 3\mathbf{b}$.

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

(i) $\overrightarrow{PR}$,

(ii) $\overrightarrow{PM}$,

(iii) $\overrightarrow{OM}$. [4]

(b) (i) Given that PQ = hOR, write down in terms of h, **a** and/or **b** an expression for

(a) $\overrightarrow{PQ}$,

(b) $\overrightarrow{OQ}$.

(ii) Given also that OQ = kOM, write down another expression for $\overrightarrow{OQ}$ in terms of **a**, **b** and k. [3]

(c) Using the two expressions for $\overrightarrow{OQ}$, form an equation and use it to find the value of k and the value of h. [3]

(d) Write down $\overrightarrow{OQ}$ in terms of **a** and **b** only. [1]

(e) Find the ratio $\dfrac{\text{area of } \Delta OPQ}{\text{area of trapezium } OPQR}$. [1]

[Total:12]

Answer the whole of this question on a single sheet of graph paper.

8 Using a scale of 2 cm to represent one unit on both axes, draw the *x and y* axes for $-4 \le x \le 5$ and $-5 \le y \le 5$.

(a) The letter V has a vertex at A(−2 ; 2) and the ends at B(−3; 5) and C(−1; 5).
Draw and label the shape ABC.

(b) The shape ABC is mapped onto $A_1B_1C_1$ with coordinates A_1(1,2; 0,4), B_1(4,2; 1,4) and C_1(3; 3) by a certain transformation.

(i) Draw and label shape $A_1B_1C_1$

(ii) Describe completely the **single** transformation which maps shape ABC onto $A_1B_1C_1$.

(c) Shape ABC is enlarged by a scale factor $-\frac{1}{2}$ with the origin as centre onto $A_2B_2C_2$.

Draw and label $A_2B_2C_2$.

(d) A shear with y – axis invariant and scale factors 2 maps shape ABC onto $A_3B_3C_3$.

Draw and label $A_3B_3C_3$.

[Total:12]

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

The table below shows the marks obtained by 40 students in a Mathematics test.

Mark (x)	$8 < x \le 10$	$10 < x \le 11$	$11 < x \le 12$	$12 < x \le 14$	$14 < x \le 16$	$16 < x \le 19$
Frequency	5	5	7	14	6	3

The following is a cumulative frequency table for this distribution.

Mark (x)	$x \le 10$	$x \le 11$	$x \le 12$	$x \le 14$	$x \le 16$	$x \le 19$
Cumulative Frequency	5	10 **q**	17	31	37	40

(a) Find the value of **q**. [1]

(b) State the modal class. [1]

(c) Using a scale of 1 cm to represent 1 mark on the x-axis and 2 cm to represent 5 students on the y-axis, draw the cumulative frequency curve for the marks. [3]

(d) Use your graph to estimate

(i) the median mark,

(ii) the number of students who got 15 or more marks. [4]

(e) Calculate an estimate of the mean mark. [3]

[Total:12]

10 (a) (i) Solve the inequality $-3 < 2x - 7 \leq 7$.

(ii) Illustrate your solutions on a number line.

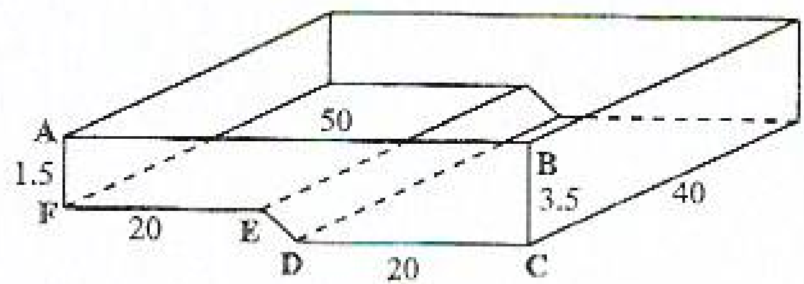
(b) Triangle ABC is such that BC = x metres and the perpendicular distance of A from BC is $(3x - 5)$ metres. Given that the area of the triangle ABC is 4 m^2,

(i) form an equation in x and show that it reduces to $3x^2 - 5x - 8 = 0$.

(ii) solve this equation for x, giving your answers correct to 2 decimal places,

(iii) **hence** write down the distance of A from BC.

[Total



The diagram shows a swimming pool of uniform cross-section ABCDEF, of length 50 m and breadth 40 m.

AB = 50 m, BC = 3,5 m, DC = FE = 20 m, AF = 1,5 m and
$B\hat{A}F = A\hat{F}E = B\hat{C}D = A\hat{B}C = 90°$

(a) Calculate

(i) the cross sectional area ABCDEF, [3]

(ii) the capacity of the swimming pool, giving your answer in kilolitres, [1]

(iii) the length of DE. [2]

(b) The vertical walls of the pool are to be painted. Given that 7 litres of paint is needed to cover 10 m^2 of wall surface and that the paint is sold in 5 litre tins at a cost of $27 000 per tin.

(i) the total area to be painted, [2]

(ii) the number of tins of paint to be bought, [3]

(iii) the amount of money needed to buy the paint. [1]

[Total:12]

Answer the whole of this question on a sheet of graph paper

12 (a) The following is an incomplete table of values for the function

$$y = \frac{3}{x+2}.$$

x	-6	-5	-4	-3	$-2{,}5$	-1	0	1	2
y	$-\frac{3}{4}$	-1	p	-3	-6	3	$1\frac{1}{2}$	1	$\frac{3}{4}$

(i) Calculate the value of p. [1]

(ii) Using a scale of 2 *cm* to represent 1 unit on both axes draw the graph of $y = \frac{3}{x+2}$ for $-6 \le x \le 2$. [4]

(b) On the same axes draw the graph of the function

$y = 2x + 3$ to intersect with the graph of $y = \frac{3}{x+2}$. [2]

(c) Write down, in the form $ax^2 + bx + c = 0$ (where a, b and c are constants), the equation whose roots are the x coordinates of the points of intersection of the two graphs. [2]

(d) By drawing a suitable tangent, find the gradient of the graph $y = \frac{3}{x+2}$ at the point (1; 1). [3]

[Total:12]

MATHEMATICS JUNE 2010

1(a) $15 - 3x - 2x^2 - 6x$

$\underline{15 - 9x - 2x^2}$ (2)

b(i) $-2 \times (-6)^2$

$= \underline{-72}$ (2)

(ii) $6 - -2$

$6 + 2$

$\underline{8}$ (2)

c) $5p\,(5p - 10\,(5p + 1)$ (3)

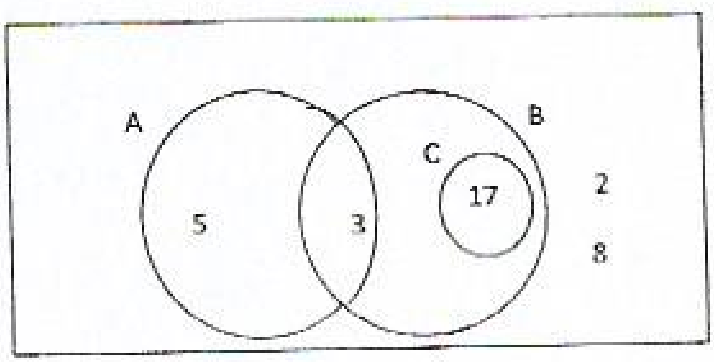
2(a) $2 \times 2 \times 3 \times 3 \times 7$ /

$4 \times 9 \times 7$ (2)

(b) $D = \dfrac{M}{V}$ (1)

$\underline{= 30\ g/cm^3}$

(c) (i)



(3)

(ii) 3 (1)

(iii) { 1 ; 2 ; 7 ; 8 ; 9 } (2)

3(a)(i) (a) $CBD = 2x^\circ$ (1)

(b) $DCE = 3x^2$ (1)

(c) $BCD = 180^\circ - 4x^\circ$ (1)

(ii) $x + 2x + 2x = 180$

Therefore $x = 36^\circ$ (2)

(b)(i)

$$\begin{pmatrix} -2 & 1 \\ -\frac{3}{2} & 0 \end{pmatrix}$$

$$\begin{aligned} 3a + 4 &= a \\ 3b - 2 &= b \\ 3c + 3 &= c \\ 3d &= d \end{aligned} \qquad (3)$$

(ii) $\begin{pmatrix} 10 & -8 \\ 12 & -6 \end{pmatrix}$ (2)

4(a) Partial variation

(b) (i) (O ; C)

(ii) $\left(\frac{-C}{K} \; ; \; 0 \right)$

(c) KV = R - C

Therefore V = $\frac{R - C}{K}$

(d) (i) $14 = 6k + C$

$8 = 2k + C$

(ii) **<u>Therefore C = 5 and k = 1 ½</u>**

5(a)(i) $\frac{1}{4} = \frac{4}{7} \times 1050$

<u>= 150</u>

(ii) Girls = 450

= <u>½</u>

(iii) $\frac{450}{900} \times \frac{449}{899}$ = <u>0,4994</u>

(b)(i) ROS = 54°

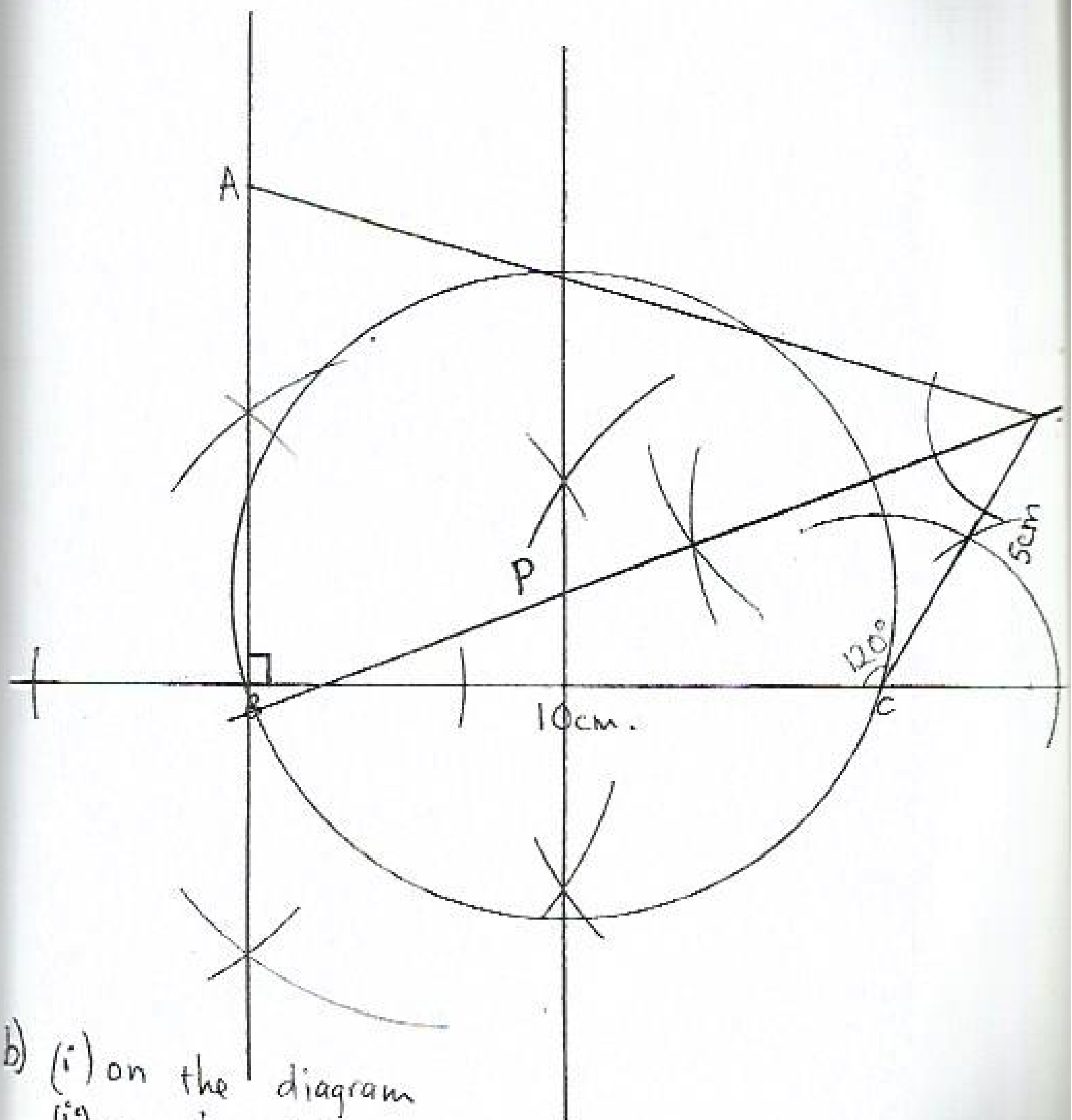
(ii) RPS = 27°

(iii) 90° - 27°

<u>= 63°</u> (11)

JUNE 2010 Q6.

a) (i) on the diagram.
(ii) perpendicular bisector of BC
(iii) Bisect Angle D.



b) (i) on the diagram
(ii) on the diagram
(iii) PC = 5,2cm.

7(a)(i) $-2a + 3b$

(ii) $-\frac{2}{3}a + b$

(iii) $2a - \frac{2}{3}a + b$

$= \underline{\frac{4}{3}a + b}$

(b)(i) (a) $3hb$

(b) $2a + 3hb$

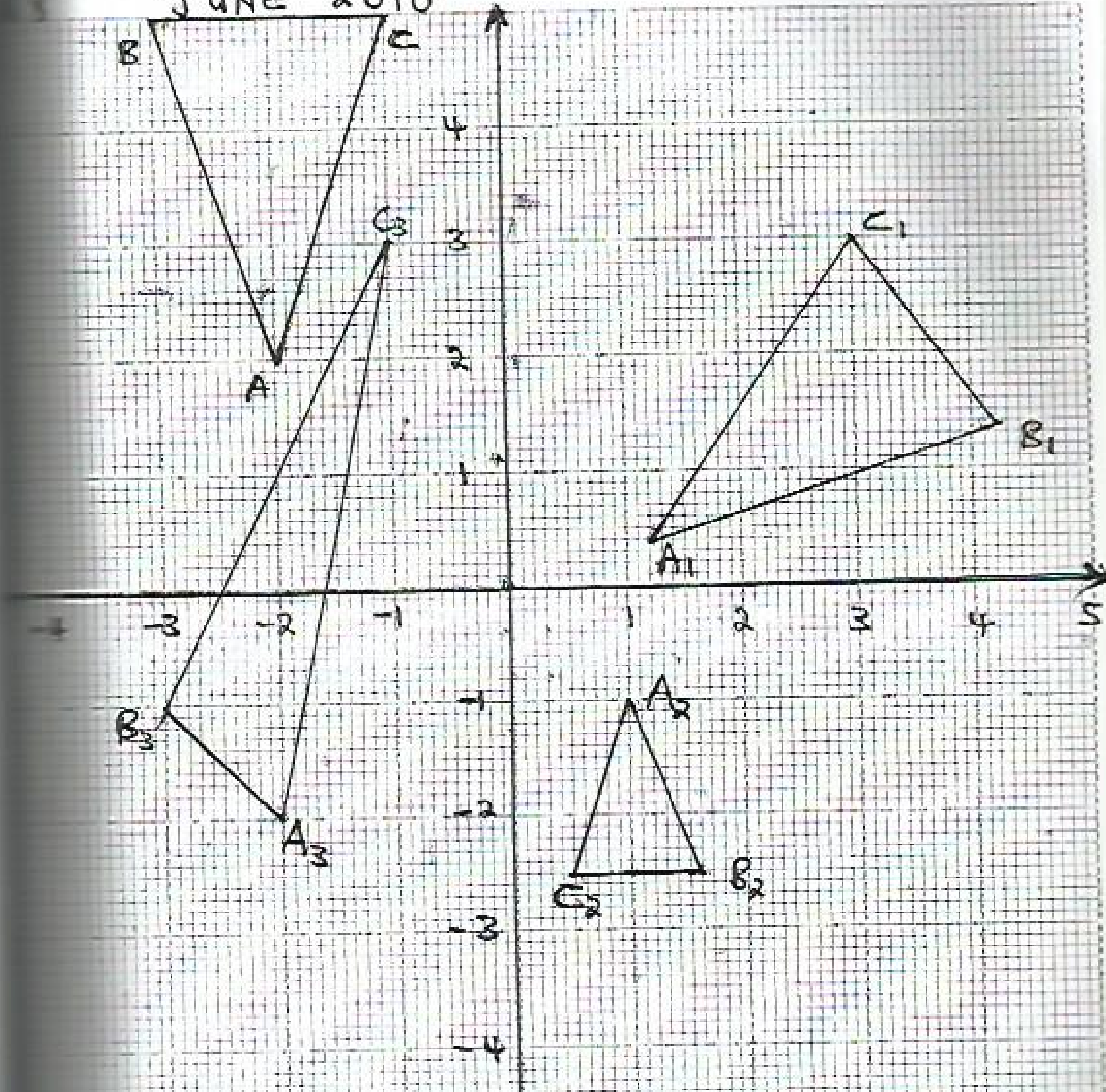
(ii) $\frac{4}{3}k(a + b)$

c) $2 = \frac{4}{3}k$ ——(i)

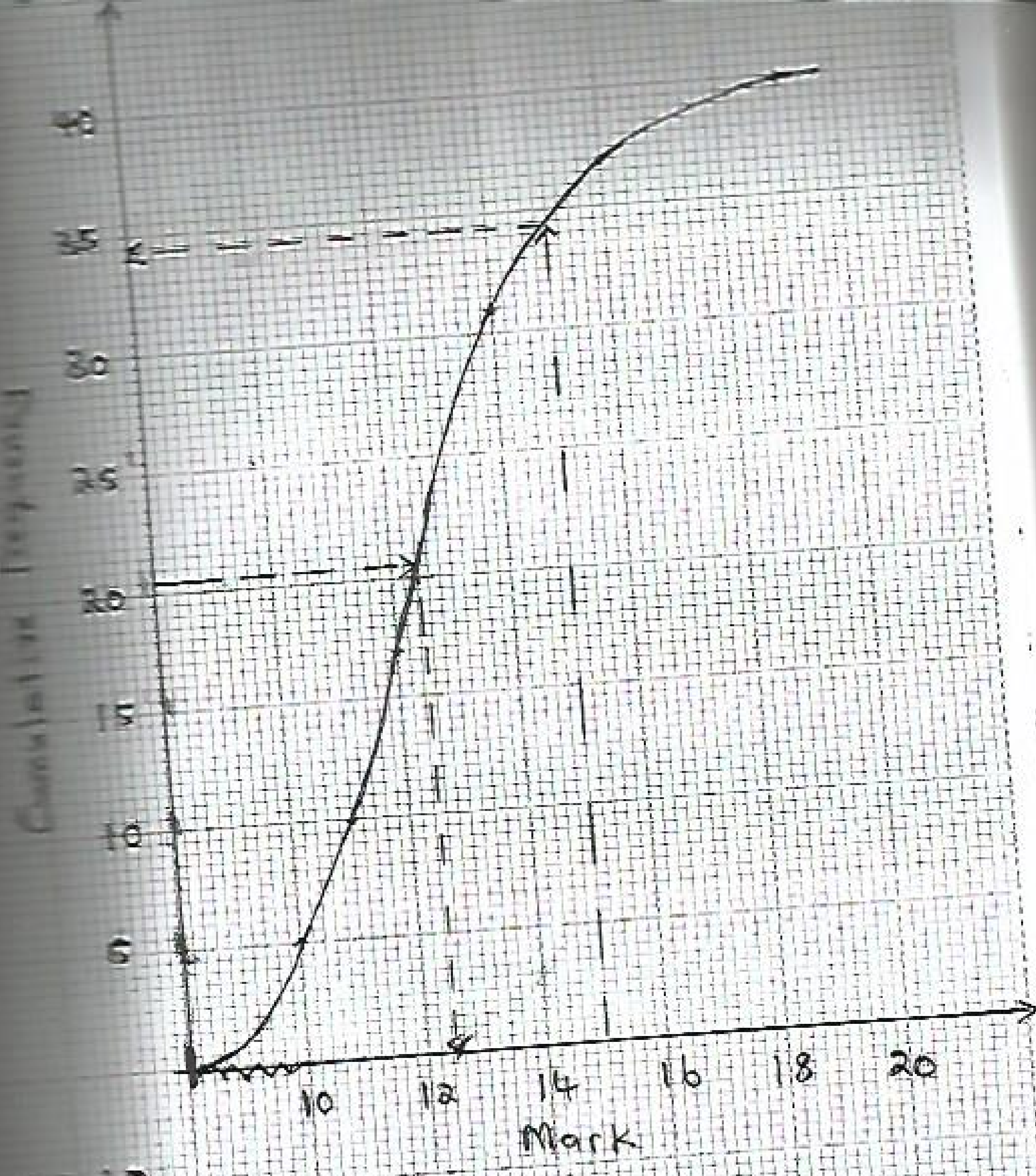
$3h = k$ (ii)

Therefore $k = \frac{3}{2}$ and $h = \frac{1}{2}$

JUNE 2010



(b) Reflection in the line $y = 2x + 2$



$x = 10$

$12 < x \leq 14$

Median $= \frac{1}{2}(41) = 20{,}5^{th}$

$= 12{,}2$

15 or more $= 40 - 35$

$= \underline{5}$

Mean $= \dfrac{9 \times 5 + 10{,}5 \times 5 + 11{,}5 \times 7 + 13 \times 14 + 15 \times 6 + [illegible]}{40}$

$12{,}56$

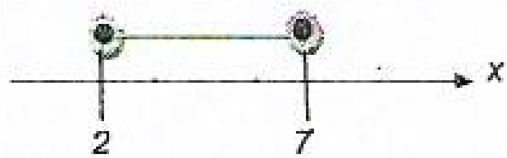
10(a)(i) $7 - 3 < 3x$ or $2x \leq 7 + 7$

$4 < 2x$ $\quad$ $2x \leq 14$

$2 < x$ or $x \leq 7$

$\underline{2 < x \leq 7}$

(ii)



b(i) $\frac{1}{2} x (3x - 5) = 4$

(ii) Using the formula
$x = \underline{\mathbf{2{,}74 \text{ or } 1{,}074}}$

(iii) **3,224** **(12)**

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11 (a) (i) $20 \times (1.5 + 3.5) + \frac{1}{2} \times 10\,(1.5 + 3.5)$
$= \underline{\mathbf{125m^2}}$

(ii) 125×40
$= \underline{\mathbf{5\ 000}}$

(iii) $DE = \sqrt{2^2 + 10^2}$

$= \sqrt{104}$

$= \underline{\mathbf{10{,}2}}$

(b) (i) $2 \times 150 + 50$
$= \underline{\mathbf{350m^2}}$

(ii) ${}^{7}/_{5} \times {}^{1}/_{10} = \mathbf{49}$

(iii) $49 \times 27\ 000 = \$1\ 323\ 000$

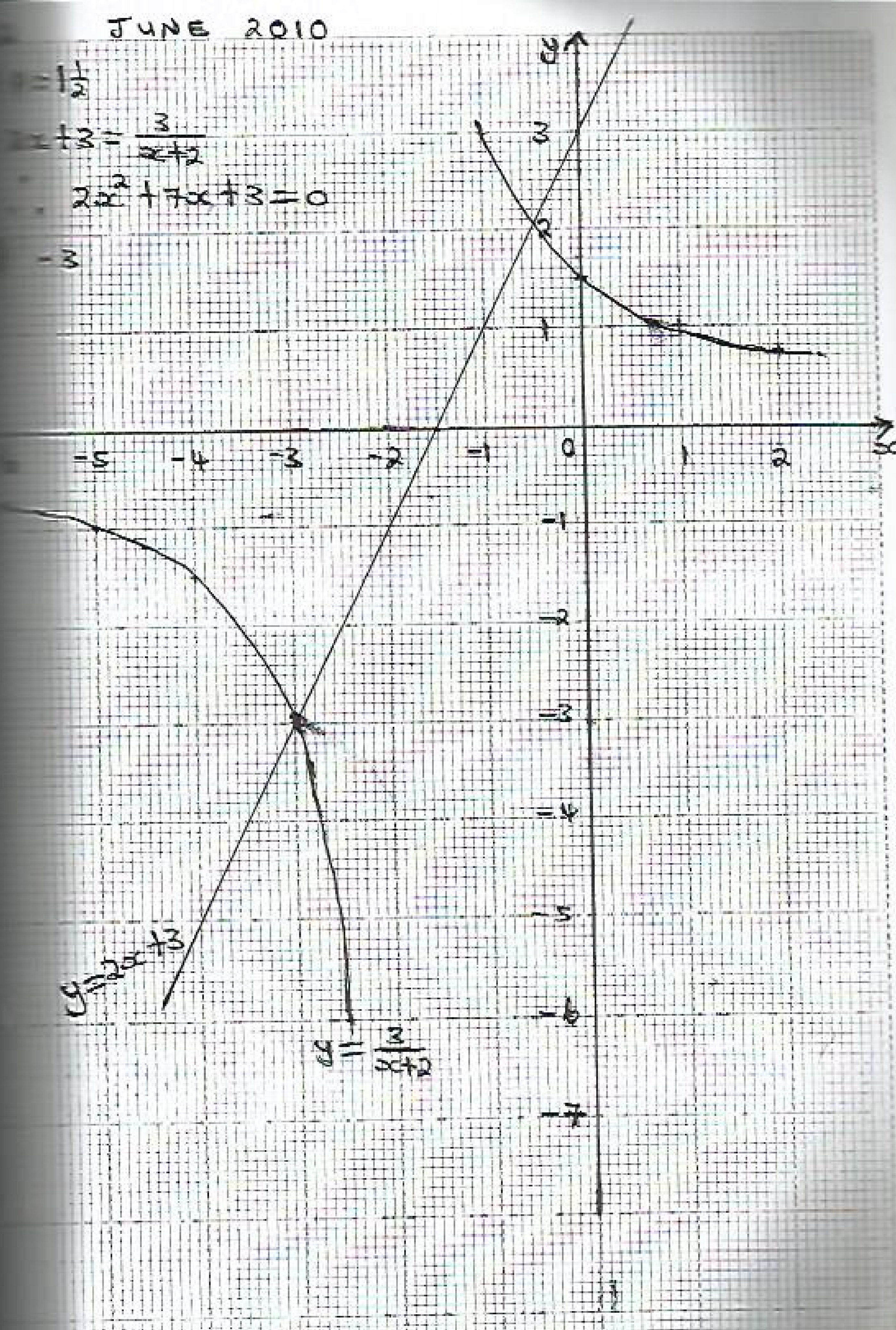
JUNE 2010

$= 1\frac{1}{2}$

$2x+3=\frac{3}{x+2}$

$2x^2+7x+3=0$

-3



000520

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4028/2

PAPER 2

NOVEMBER 2010 SESSION 2 hours 30 minutes

Additional materials:

Answer paper
Geometrical instruments
Graph paper (3 sheets)
Mathematical tables
Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 calculator may be used to evaluate explicit numerical expressions.

This question paper consists of 12 printed pages.

Section A [64 marks]

Answer all questions in this section.

1 (a) Find the value of $\frac{1}{3}+1\frac{7}{9}+2\frac{2}{3}$.

(b) During a sale, the price of a camera was reduced from \$160 to \$148.80.

Calculate the percentage decrease in price.

(c) Given that $f(x)=x^2-4x+3$, find all the values of x for which $f(x)=0$.

---

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

Hence or otherwise, solve the equation

$$\frac{1}{x-1}+\frac{2}{x+1}=\frac{3}{x}.$$

(b) Solve the inequality

$y-4<3y+2\le 6-y$.

Hence list the integral values of y that satisfy the inequality. [4]

(c) In an Olympiad test, there were 26 questions. Eight points were given for each correct answer and five points were deducted for each wrong answer.

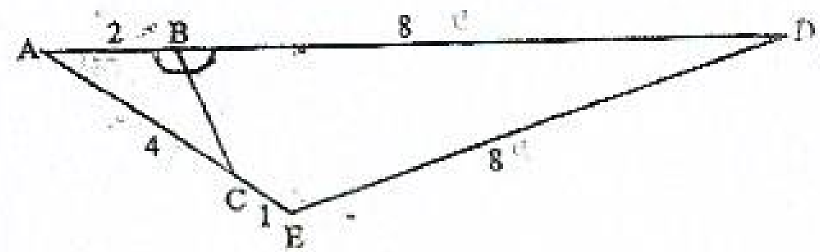
Tamara answered all questions and scored zero. Find the number of questions she had got correct.

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

(i) Find the value of s if $g = 9{,}8$; $u = 20$ and $t = 2$.

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

(b)



In the diagram, ADE is a triangle, B is a point on AD such that AB = 2 cm and BD = 8 cm. C is a point on AE such that AC = 4 cm and CE = 1 cm, DE = 8 cm.

(i) Name the triangle that is similar to Δ ABC.

(ii) Calculate the length of BC. [4]

(a) It is given that P varies directly as T and inversely as V.

(i) Write down an equation connecting P, V, T and a constant k.

(ii) Given that $P = 2 \times 10^5$ when $V = 1 \times 10^{-3}$ and $T = 300$, calculate the value of k.

(iii) Calculate P if V = 0,0025 and T = 300. [5]

(b) Given that $M = \begin{pmatrix} 3 & -2 \\ -1 & 4 \end{pmatrix}$, $N = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ and $R = \begin{pmatrix} 3 & -1 \end{pmatrix}$,

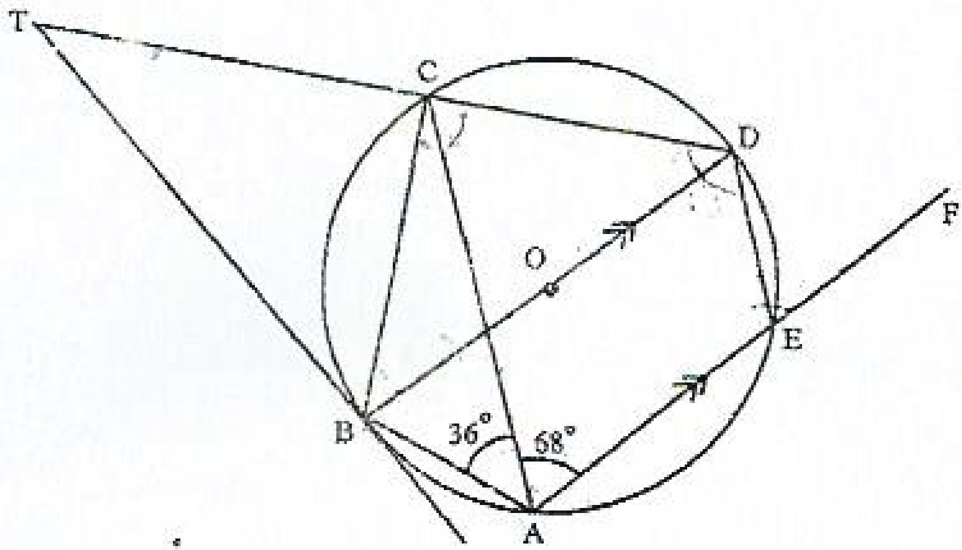
find (i) MN

(ii) M^{-1}

(iii) RN. [6]

[Turn over

5 (a)



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

Find the size of

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

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

(iii) $D\hat{E}F$,

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

(b) In a recipe for an apple pie, 500 g of apples and 200 g of flour are needed in making an apple pie for 4 people.

(i) If an apple pie was to be made for 6 people, calculate the quantity of apples needed.

(ii) If the apple pie was to be made for 3 people, calculate the quantity of flour needed.

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

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

All constructions must be done on a single diagram.

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

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

(b) Draw the locus of points

(i) 30 m from AB,

(ii) equidistant from A and B,

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

(c) The farmer wishes to dig a well inside the plot such that it is at least 30 m from AB, at least 60 m from B and nearer to A than to B.

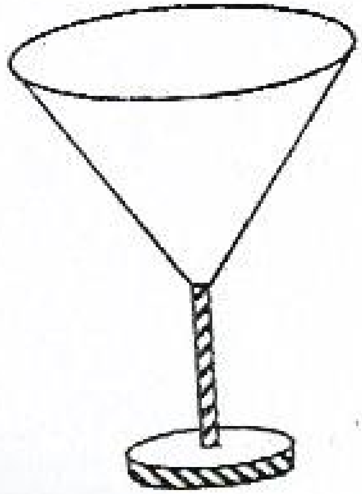
Shade the region in which the well must be. [2]

[Turn over

SECTION B [36 marks]

Answer three questions in this section

7 (a)



The diagram shows a wine glass in the shape of a cone mounted on a stand. The depth of the cone is equal to its diameter at the top.

(i) Write down an expression for the volume of the cone in terms of its radius r and π.

(ii) If the wine glass can hold 20 ml of wine when full, calculate the radius of the wine glass at the top.

(iii) Wine is bought in bottles of volume 750 ml. Calculate the number of wine glasses that can be filled from one bottle. [5]

[Volume of cone = $\frac{1}{3}$ base area x height. $\pi = \frac{22}{7}$]

(b) The base of a triangle is x cm and its height is $(x-7)$ cm.

(i) Write down an expression for the area of the triangle.

(ii) If the area of the triangle is 6 cm^2, form an equation in x and show that it reduces to $x^2 - 7x - 12 = 0$. [3]

(c) Solve the equation $x^2 - 7x - 12 = 0$, giving your answers correct to 2 decimal places. [4]

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

The following is a table of values for the graph of the function

$y = 7 - 5x - x^2$

x	-7	-6	-5	-4	-3	-2	-1	0	1	2
y	-7	1	7	11	13	13	11	7	1	-7

(a) Using a scale of 2 cm to represent 1 unit on the horizontal axis and 2 cm to represent 5 units on the vertical axis, draw the graph of the function $y = 7 - 5x - x^2$ *for* $-7 \leq x \leq 2$. [4]

(b) Use your graph to answer the following questions.

(i) State the maximum value of the function $y = 7 - 5x - x^2$.

(ii) Solve the equation $7 - 5x - x^2 = 0$.

(iii) Solve the equation $-5x - x^2 = 2$.

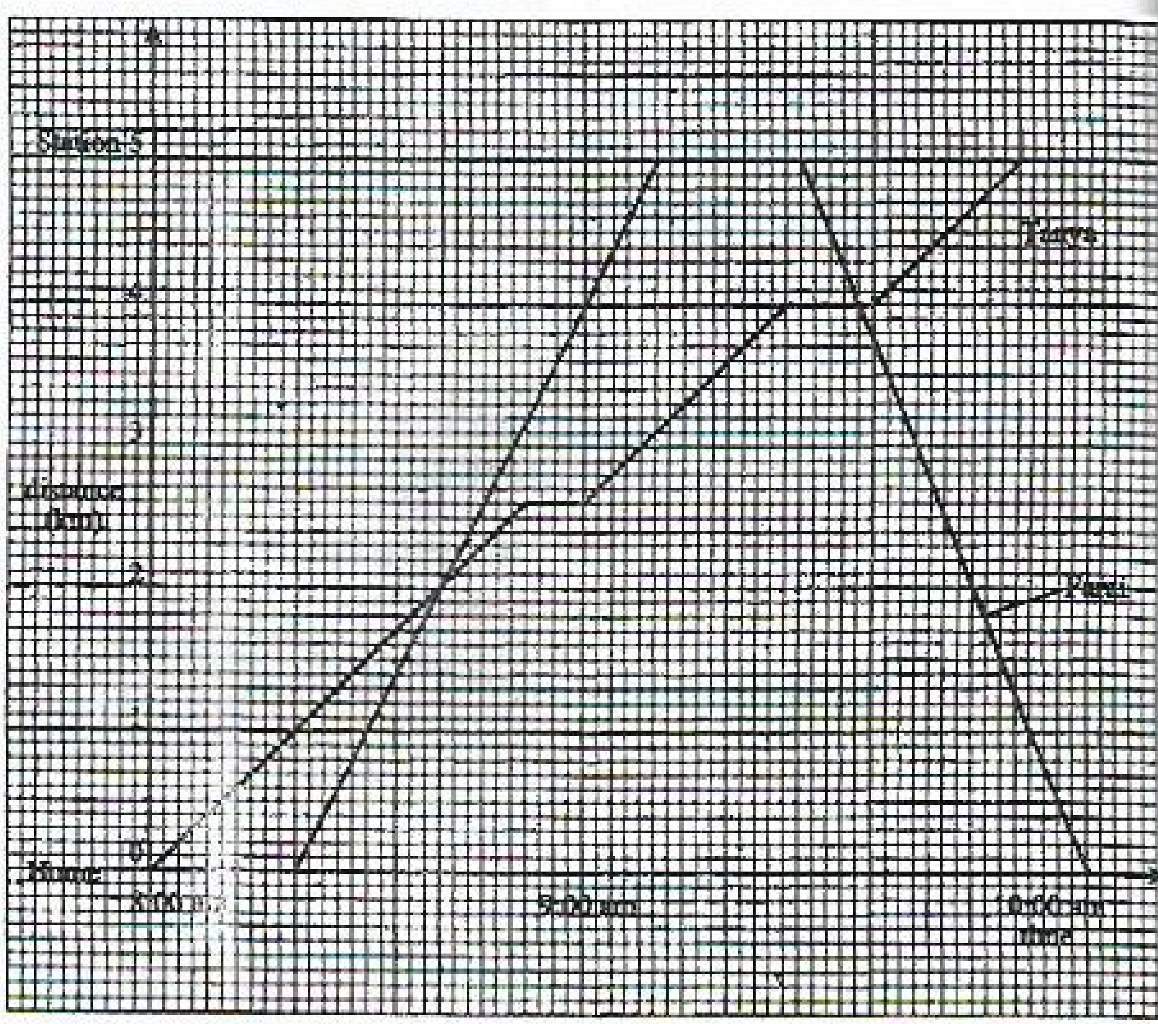
(iv) Find the gradient of the curve at the point where $x = 0$. [8]

[5]

[3]

[4]

9 **(a)** The diagram shows the distance-time graph of a cyclist, Farai and a pedestrian, Tanya, who travelled from their home to the train station which was 5 km away. After sometime Farai came back home.



Use the diagram to answer the following questions.

(i) Find Farai's speed on the outward journey. [2]

(ii) State 1. the time when, Tanya arrived at the station,

2. the time when Farai overtook Tanya on the way to the station,

3. the distance that Tanya had covered when she was overtaken,

4. the total time that Farai was resting,

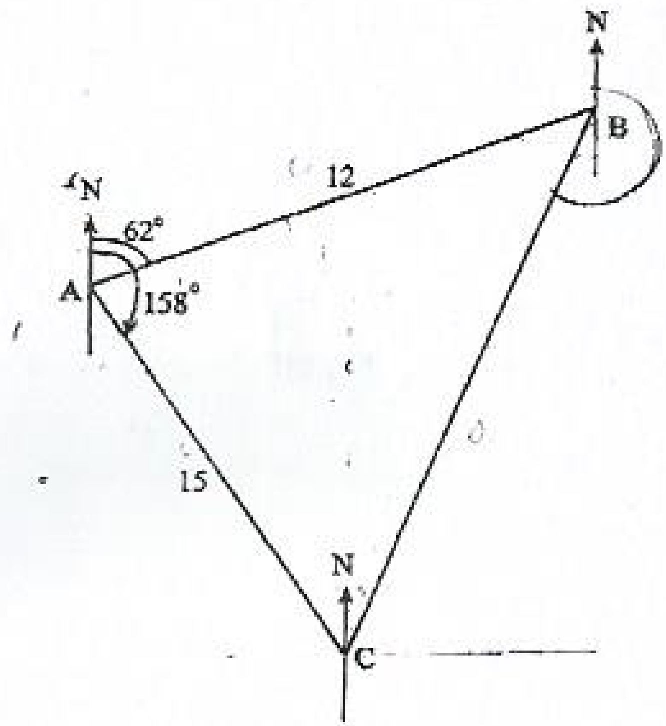
5. the distance that Tanya had left to cover when Farai met her the second time. [5]

(iii) Calculate Tanya's average speed for the whole journey. [2]

(b) Two cards were picked at random from a pack of 52 playing cards with replacement.

Find the probability that one was a Court card (i.e. J, K or Q) and the other was an Ace (A). [3]

10



In the diagram, A, B and C are three points on level ground. B is 12 km from A on a bearing of 062° and C is 15 km from A on a bearing of 158°.

Calculate (i) the distance from B to C,

(ii) AĈB to the nearest degree,

(iii) the bearing of C from B.

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

A builder wishes to build houses and flats on 6 000 m^2 plot of land.

(a) The City Council insists that there must be more than 6 houses and that there must be more flats than houses.

Taking x to represent the number of houses and y to represent the number of flats, write down two inequalities, other than $x > 0$ and $y > 0$, which satisfy these conditions. [2]

(b) The builder allows 300 m^2 for each flat and 400 m^2 for each house. Write down another inequality which satisfies this condition and show that it reduces to $4x + 3y \leq 60$. [1]

(c) The point $(x; y)$ represents x houses and y flats. Using a scale of 2 cm to represent 5 units on both axes, draw the x and y axes for $0 \leq x \leq 20$ *and* $0 \leq y \leq 20$.

Construct and show by shading the **unwanted** regions, the region in which $(x\ ; y)$ must lie. [5]

(d) Use your graph to find

(i) the maximum number of flats that can be built,

(ii) the maximum number of houses that can be built,

(iii) the values of x and y which give the maximum number of dwelling units. [4]

[5]

[3]

[4]

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

12 The vertices of Δ PQR are P(3; 1), Q(4; 1) and R(4; 3).

(a) Taking 2 cm to represent one unit on both axes, draw the x and y axes for $-3 \leq x \leq 5$ *and* $-6 \leq y \leq 5$. Draw and label Δ PQR.

(b) A certain transformation maps Δ PQR onto $\Delta P_1Q_1R_1$ where $P_1(-2; -3)$, $Q_1(-1; -3)$ and $R_1(-1; -1)$.

(i) Draw and label $\Delta P_1Q_1R_1$.

(ii) Describe completely the **single** transformation which maps Δ PQR onto $\Delta P_1Q_1R_1$.

(c) $\Delta P_2Q_2R_2$ is the image of Δ PQR under a reflection in the line $y = x$. Draw and label $\Delta P_2Q_2R_2$.

(d) Δ PQR is enlarged with centre (0; 1) and scale factor $-\frac{1}{2}$ onto $\Delta P_3Q_3R_3$.

Draw and label $\Delta P_3Q_3R_3$.

(e) A stretch represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$ maps Δ PQR onto $\Delta P_4Q_4R_4$.

Draw and label $\Delta P_4Q_4R_4$.

MATHEMATICS NOVEMBER 2010 SESSION
MARK SCHEME
4028/2

1(a) use BOMDAS

$^1/_3 + 1\,^7/_9 \div 2\,^2/_3$

[1] $= {^1/_3} + \left[1\,^7/_9 \div 2\,^2/_3\right]$

$= {^1/_3} + \left[{^{16}/_9} \div {^8/_3}\right]$

$= {^1/_3} + {^{16}/_9} \times {^3/_8}$

[3] $= {^1/_3} + {^6/_9}$

$= 1$ (3)

---

[3] (1b) $\dfrac{160 - 148{,}8}{160} \times 100$

$= \dfrac{11.2}{160} \times 100$

$= \underline{7\%}$ (3)

---

[3] (1c) If $f(x) = 0$, It becomes quadratic

Hence Solve $n^2 - 4n + 3 = 0$

$n^2 - n - 3n + 3 = 0$

$x(x - 1) - 3(n - 1) = 0$ [By factoring]

[2] $(n - 1)(n - 3) = 0$

Therefore $n - 1 = 0$ *or* $n - 3 = 0$

$\longrightarrow \underline{n = 1 \text{ or } 3}$ (4)

Q2(a) $\dfrac{1}{x - 1} = \dfrac{2}{x + 1}$

$= \dfrac{(x + 1) + 2(x - 1)}{(x + 1)(x - 1)}$ [Using the LCM]

$= \dfrac{(x + 1) + (2x - 2)}{(x + 1)(x - 1)}$

$= \dfrac{(x + 1) + 2x - 2}{(x + 1)(x - 1)}$

$$= \frac{x + 2x + 1 - 2}{(x + 1)(x - 1)}$$ (Collect like terms)

$$= \underline{\frac{3x - 1}{(x + 1)(x - 1)}}$$ **(2)**

$$\frac{3x - 1}{x^2 - 1} = \frac{3}{x}$$

$x(3x - 1) = 3(x^2 - 1)$ (Cross Multiply)
$3x^2 - x = 3x^2 - 3$
$3x^2 - 3x^2 = x - 3$ [Collect like terms]
Therefore $x - 3 = 0$
$x = 0 + 3$
Therefore $\underline{x = 3}$ **(2)**

$y - 4 < 3y + 2 \leq 6 - y$

(i) $y - 4 < 3y + 2$
$y - 3y < 4 + 2$
$-2y < 6$
$\frac{-2y}{-2} < \frac{6}{-2}$
$\underline{y > -3}$

(ii) $3y + 2 \leq 6 - y$
$3y + y \leq 6 - 2$
$4y \leq 4$
$\frac{4y}{4} \leq \frac{4}{4}$
$\underline{y \leq 1}$

$\underline{-3 < y \leq 1}$

$\mathbf{y = \{ -2; -1; 0; 1\}}$ (4)

(c) let x = questions answered correctly
y = questions answered wrongly
Therefore *(i)* $x + y = 26$
(ii) $8x - 5y = 0$
$8x - 5(26 - x) = 0$ [By substitutions]
$8x - 130 + 5x = 0$
$13x = 130$
$x = \frac{130}{13}$
Therefore **10 Correct** (4)

3(a) $S = \underline{ut} - ½ gt^2$
(i) $S = 20(2) - ½ (9,8 \times 2^2)$
$= 40 - 19.6$
$= \underline{20.4}$ (2)

(ii) $S = ut - \frac{1}{2}gt^2$

$S - ut = -\frac{1}{2}gt^2$

$\frac{S - ut}{-\frac{1}{2}t^2} = \frac{-\frac{1}{2}gt^2}{-\frac{1}{2}t^2}$

Therefore $= \frac{S - ut}{-\frac{1}{2}t^2}$

$= \frac{2(tu - s)}{t^2}$ **(5)**

(b) (i) $\triangle$ AED (1)

(ii) $BC = 4 \times \frac{8}{10}$ [Ratio of Similar Shapes] (3)

4(a) (i) $P \partial \frac{T}{V}$

$P = \frac{KT}{V}$ (1)

(ii) $P = 2 \times 10^5$

$V = 1 \times 10^{-3}$

$T = 300$

$2 \times 10^5 = \frac{k \times 300}{1 \times 10^{-3}}$

Therefore $k = \frac{2 \times 10^5 \times 1 \times 10^{-3}}{300}$

$= \frac{2 \times 1 \times 10^2}{3 \times 10^2}$

$= \frac{2}{3} \times 10^0$

$= \frac{2}{3}$ (2)

(iii) $P = \frac{\frac{2}{3} \times 0{,}0025}{300}$

$= 8 \times 10^6$ **(2)**

(b) (i) $\begin{pmatrix} 1 \\ 23 \end{pmatrix}$

(ii) $\frac{1}{10}\begin{pmatrix} 4 & 2 \\ 1 & 3 \end{pmatrix}$

(iii) RN $= (3 - 1)\begin{pmatrix} 5 \\ 7 \end{pmatrix}$

$= \underline{8}$

5(a) (i) 54°

(ii) 54°

(iii) 180° – (36 + 68)
= $\underline{76°}$

(iii) ACB = 14°

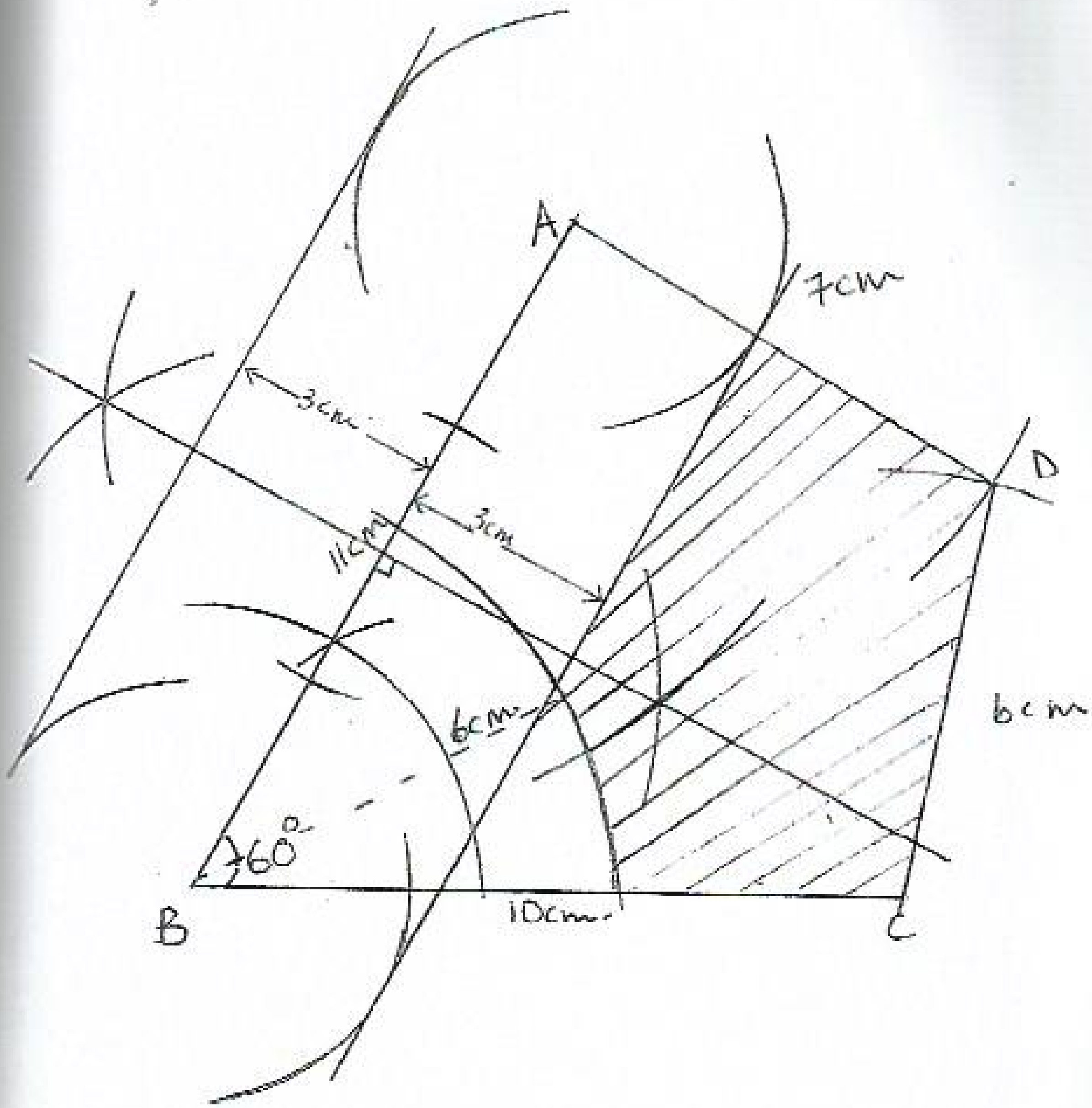
b(i) $\frac{6}{4} \times 500$
= $\underline{750g}$

(ii) $\frac{3}{4} \times 200$
= $\underline{150g}$

(10)

Nov 2010 Q6.

Scale 1cm = 10m.



a) on the diagram

b i) Parallel lines 3cm from AB

ii) Perpendicular bisector of AB.

iii) Arc 6cm from B.

c) on the diagram.

Q7 (i) $V = \underline{{}^2/_3\, \pi r^3}$

(ii) ${}^2/_3\, \pi r^3 = 20$

Therefore $r = \sqrt[3]{\dfrac{20 \times 3}{2\pi}}$

$= \underline{2.121 \text{ cm}}$

(iii) 37 (5)

(b)(i) $A = \underline{\tfrac{1}{2}\, n\, (x - 7)}$ (Using ½ base x height)

(ii) Equate that to 6

$\tfrac{1}{2} x (x - 7) = 6$

$x^2 - 7x = 12$

$\underline{x^2 - 7x - 12 = 0}$ (3)

7c) Using the formula

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

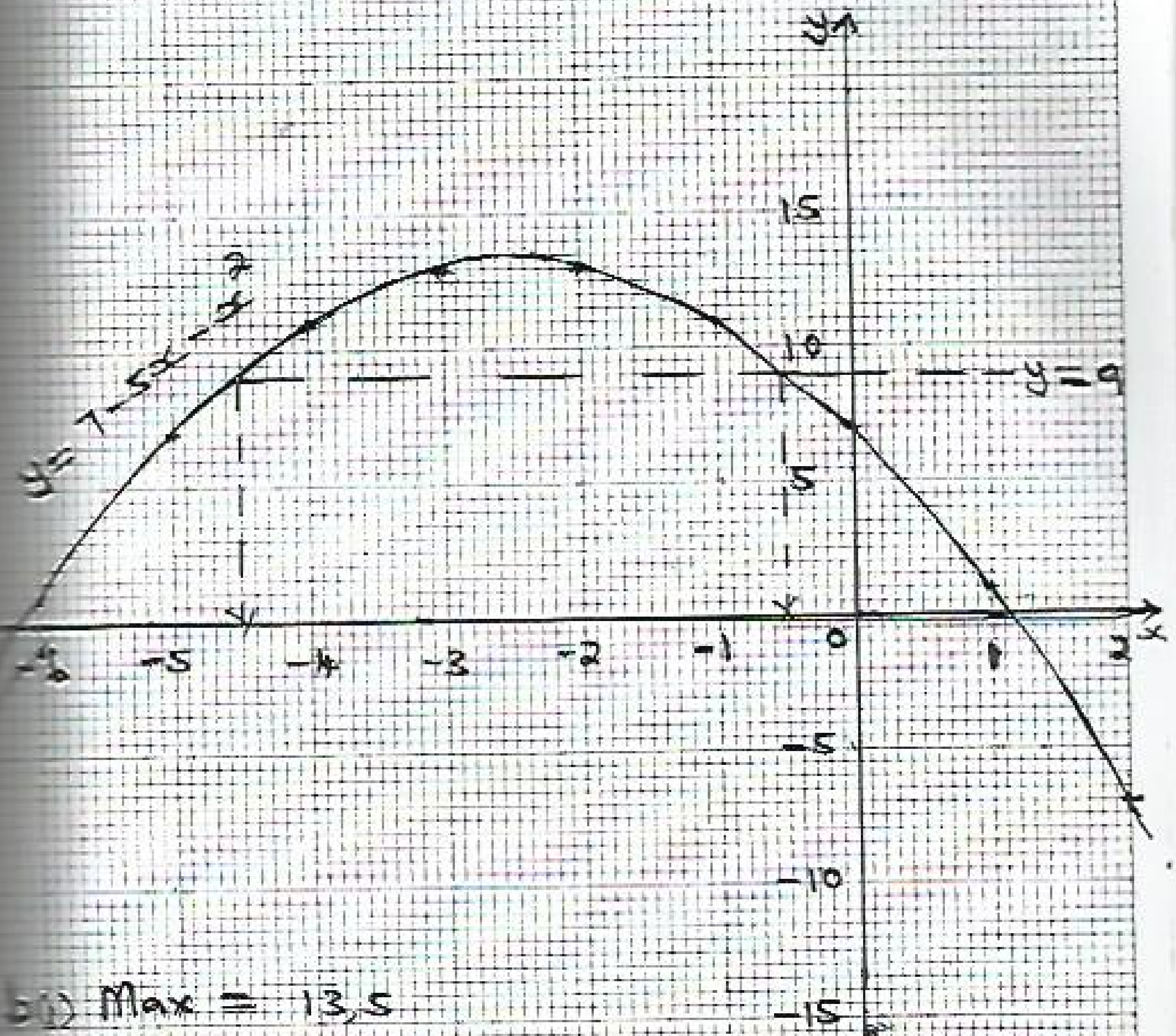
$$= \frac{-(-7) \pm \sqrt{7^2 - 4 \times 1 \times -12}}{2 \times 1}$$

$$= \frac{7 \pm \sqrt{97}}{2}$$

$$= \frac{7 + 9.849}{2} \text{ or } \frac{7 - 9.849}{2}$$

$= \underline{8.4245 \text{ or } -1.4245}$

Nov 2010



b(i) Max = 13,5

(ii) $x = -6{,}2$ or $1{,}2$

0,5

(iii) $x = -4{,}5$ or $-0{,}375$

(iv) Grad $= \dfrac{-3}{0{,}6} = -5$

9(a) (i) $^3/_1 = \underline{3}$

(ii) a) 10.00 am or 1000
b) 8:40am or 0840
c) 2km
d) 20 mins
e) 1 km

(iii) $^5/_2 = 2\frac{1}{2}$ km/h

---

b) $\left[\frac{12}{52} \times \frac{4}{52}\right] \times 2$

(12)

---

10 (i) 96°

Therefore $BC^2 = 12^2 + 15^2 - 2\,(12 \times 12)\cos 96$
$= 12^2 + 15^2 + 2 \times 15 \times 12 \cos 84$
$= 406{,}6$

Therefore $BC = \sqrt{406{,}6}$

$= \underline{\mathbf{20{,}16km}}$

(ii) $\sin ACB = \dfrac{12 \sin 96}{20{,}16}$

$= 0.591977318$

Therefore ACB $=$ $\underline{36{,}297^\circ}$ / $\underline{36{,}3^\circ}$

(iii) $180^\circ + (36{,}3 - 22)$
$= 180 + 14{,}3$
$= \underline{194{,}3^\circ}$

(12)

Q11 Nov 2010

(a) $x \geq 6$

$y \geq x$

(b) $400x + 300y \leq 6000$

$4x + 3y \leq 60$

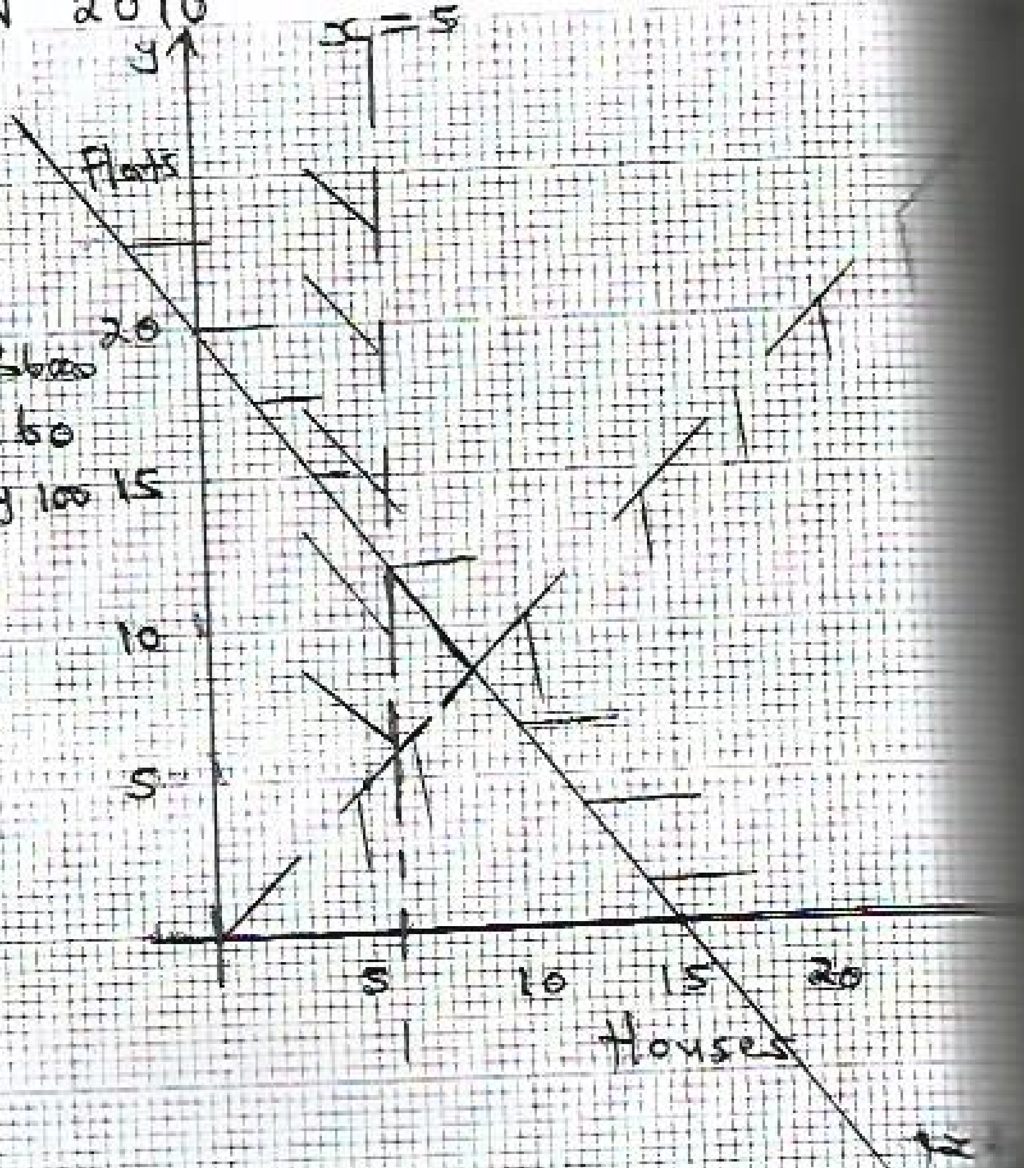
ie Divide by 100

(c) (i) $y = 12$

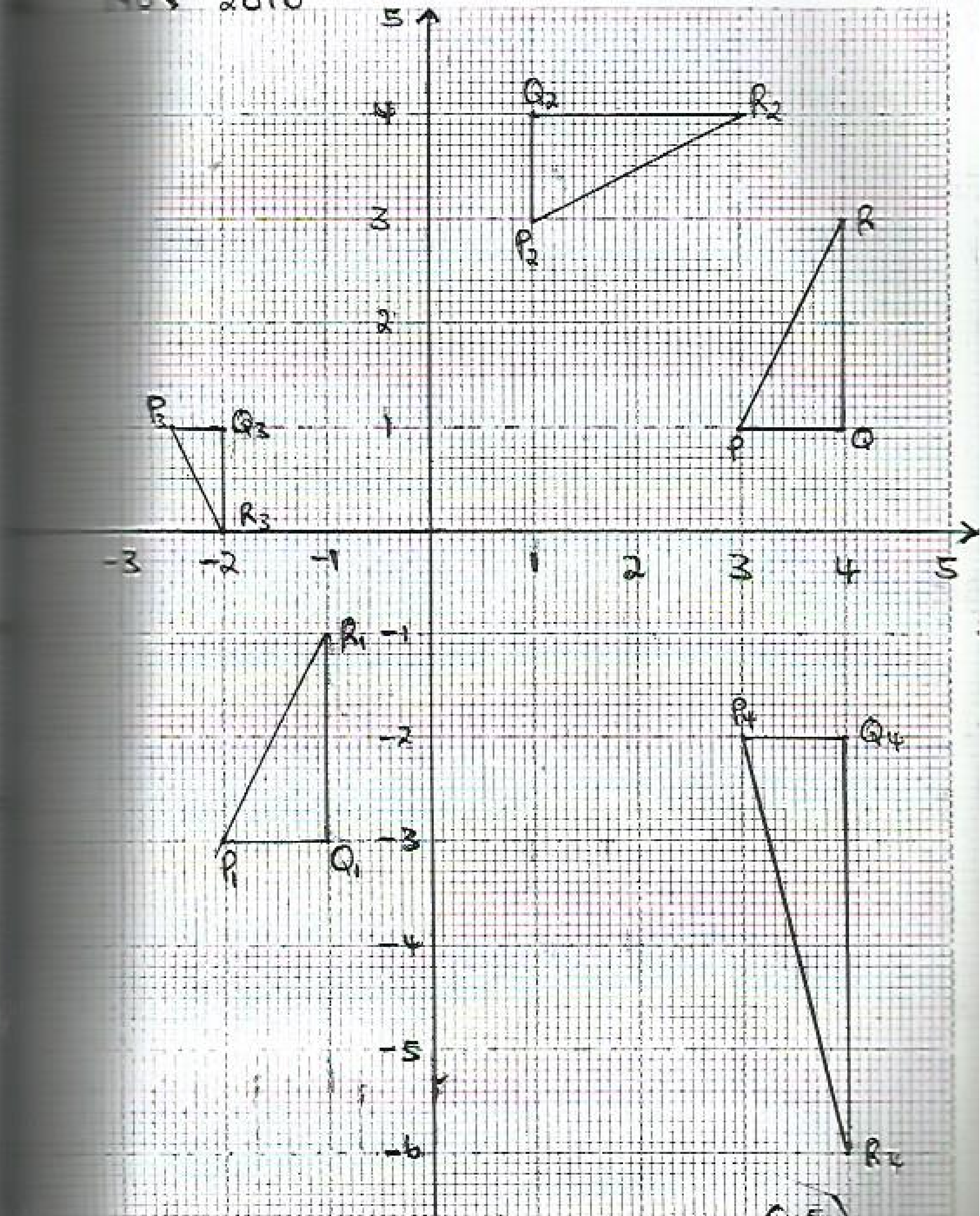
(ii) $x = 8$

(iii) $y = 12$

$x = 6$



Nov 2010



b(i) Translation $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS **4008/2**

PAPER 2

JUNE 2011 SESSION 2 hours 30 minutes

Additional materials:
Answer paper
Geometrical instruments
Graph paper (3 sheets)
Mathematical tables
Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

…name, Centre number and candidate number in the spaces provided on the …/answer booklet.

… all questions in Section A and any **three** questions from Section B.

… answers on the separate answer paper provided.
… more than one sheet of paper, fasten the sheets together.

… **calculators must not be used.**

… must be clearly shown. It should be done on the same sheet as the rest of the …
… essential working will result in loss of marks.
… of accuracy is not specified in the question and if the answer is not exact, the … should be given to three significant figures. Answers in degrees should be given … place.

INFORMATION FOR CANDIDATES

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

This question paper consists of 11 printed pages and 1 blank page.

[Turn over

Section A [64 marks]

Answer all the questions in this section.

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

(b) Find the exact value of

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

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

(c) Three farmers share 120 hectares of land in the ratio 3 : 4 : 5.

Calculate the area of the largest piece of land.

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

$27x^2yz$,
$72xy^3z^2$ and
$108xyz^3$.

---

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

(i) Express r in terms of p.

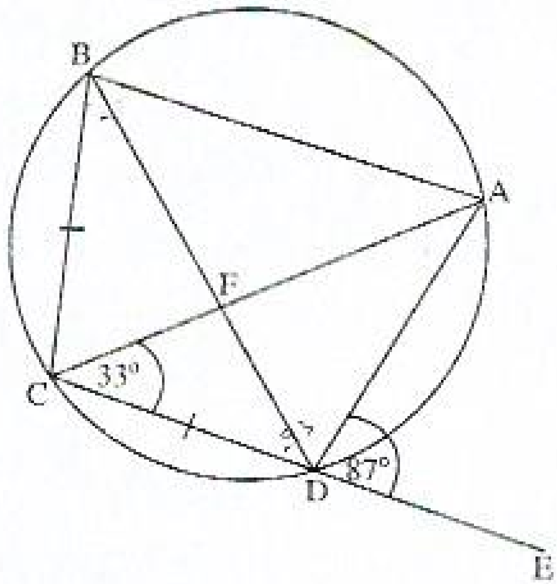
(ii) Given also that $p = -3$, find the numerical value of r.

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

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

(c) Express 150 g as a percentage of 3 kg.

(a)



The diagram shows points A, B, C and D on the circumference of a circle such that BC = CD. AC and BD intersect at F and CD is produced to E. $A\hat{C}D = 33°$ and $A\hat{D}E = 87°$. Calculate

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

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

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

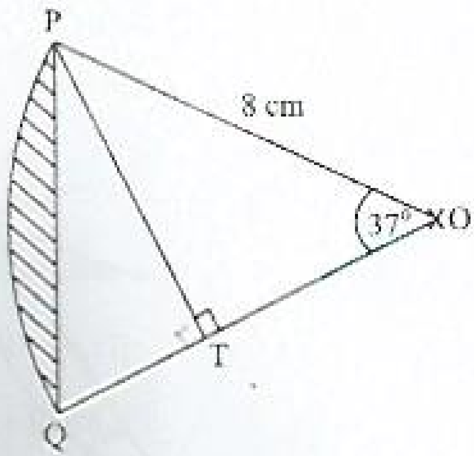
(iv) $A\hat{D}B$,

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

[6]

[Turn over

(b)



Take π to be 3.142.

The diagram shows a sector of a circle centre O. $P\hat{O}Q = 37°$, PO = 8 cm and PT is perpendicular to QO. Calculate

(i) PT,

(ii) area of the sector,

(iii) area of triangle PQO,

(iv) the area of the shaded segment.

4 (a) Factorise completely

(i) $3np - 6nq + ap - 2aq$,

(ii) $12 - 4g - g^2$.

(b) In a survey of 72 girls, it was found that every girl watched at least one of the following TV programmes, Teen Scene or Fashion Show. Fifty girls watched Teen Scene and 62 girls watched Fashion Show. Find the number of girls who watched

(i) both programmes,

(ii) Fashion Show only.

(a) (i) Convert 112_3 to a number in base 5.

(ii) Evaluate $1101_2 + 1011_2$, giving your answer in base 2. [3]

(b) (i) Show that $2\log_5(3x+2) - \log_5 2 = 1$ reduces to $3x^2 + 4x - 2 = 0$.

(ii) Solve the equation $3x^2 + 4x - 2 = 0$, giving your answers correct to two decimal places. [9]

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

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

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

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

(b) Boterekwa is 8 km from Shinga and equidistant from Tugwi and Hlangu.

(i) Construct the locus of points 8 km from Shinga and the locus of points equidistant from Tugwi and Hlangu

(ii) Mark and label B_1 and B_2 the possible positions of Boterekwa. [4]

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

Section B [36 marks]

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

Each question carries 12 marks.

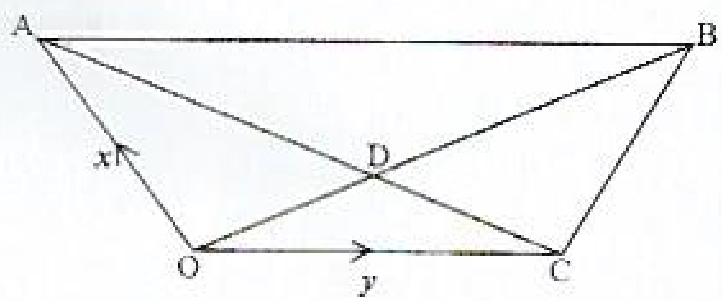
7 (a) Given that $\mathbf{A} = \begin{pmatrix} 3 & -4 \\ 1 & -2 \end{pmatrix}$,

(i) find the inverse of matrix **A**,

(ii) hence or otherwise solve the equations

$3x - 4y = -3,$
$x - 2y = -2.$

(b)



The diagram shows a trapezium OABC where OC is parallel to AB with $\overrightarrow{OA} = \boldsymbol{x}$ and $\overrightarrow{OC} = \boldsymbol{y}$. Diagonals OB and AC intersect at D such that AD : DC = 3 : 2.

Express, in terms of $\boldsymbol{x}$ and/or $\boldsymbol{y}$,

(i) (a) $\overrightarrow{AC}$,

(b) $\overrightarrow{AD}$.

(ii) Given that $\overrightarrow{AB} = k\overrightarrow{OC}$, express $\overrightarrow{OB}$ in terms of k, $\boldsymbol{x}$ and $\boldsymbol{y}$.

(iii) Given also that $\overrightarrow{OB} = h\overrightarrow{OD}$, express $\overrightarrow{OB}$ in terms of h, $\boldsymbol{x}$ and $\boldsymbol{y}$.

(iv) Using results from (ii) and (iii) above, find the numerical value of h and the numerical value of k.

...swer the whole of this question on a sheet of graph paper.

...angle ABC has vertices A(2; 1), B(4; 1) and C(4; 4). Using a scale of 1 cm to ...ent 1 unit on both axes, draw the x and y-axes for $-4 \le x \le 14$ and ...$\le y \le 12$.

... Draw and label clearly triangle ABC. [1]

... Triangle $A_1B_1C_1$ is a reflection of triangle ABC in the line $y = -2$. Draw and label clearly triangle $A_1B_1C_1$. [3]

... Triangle $A_2B_2C_2$ has vertices $A_2(6; 4)$ $B_2(10; 4)$ and $C_2(10; 10)$.

(i) Draw and label clearly triangle $A_2B_2C_2$.

(ii) Describe fully the **single** transformation that maps triangle ABC onto triangle $A_2B_2C_2$.

[4]

... Triangle ABC is rotated through 90° anticlockwise about (0; 0) onto triangle $A_3B_3C_3$.

(i) Draw and label clearly triangle $A_3B_3C_3$.

(ii) Write down the matrix that represents this transformation. [4]

9 **Answer the whole of this question on a sheet of graph paper.**

The table below shows the grades obtained by candidates in a Math
examination.

Grade	A	B	C	D	E	U
Frequency	10	25	40	24	21	30

(a) Calculate the number of candidates who wrote the examinati

(b) State the modal grade.

(c) Using a scale of 2 cm to represent 5 candidates, draw a bar gr
the information.

(d) Given that the passing grades are A, B and C, find the probab
two candidates chosen at random passed the examination.

(e) If a pie-chart is drawn for this information, calculate the angle
sector that represents grade C.

(a) The length, l, of a rectangle of constant area varies inversely as b, the width of the rectangle.

(i) State the relationship between l, b and a constant k.

(ii) Given that $l = 8,5$ cm when $b = 6$ cm, find b when $l = 10,2$ cm. [4]

(b) **Answer this part of the question on a sheet of graph paper.**

Using a scale of 1 cm to represent 1 unit on the x – axis and 2 cm to represent 1 unit on the y-axis draw the x and y axes for $0 \leq x \leq 14$ and $-3 \leq y \leq 5$.

(i) Show by shading the **unwanted** regions, the region which is

defined by $x \geq 3$,

$y \geq -2$,

and $x + 2y \leq 8$.

(ii) From the region defined, find the coordinates of a point that gives a maximum value of $3x - 2y$.

(iii) State the maximum value of $3x - 2y$.

[8]

11 (a) The pattern below refers to the number of elements in a set and the number of subsets of that set. Study the pattern and answer the que[illegible] that follow.

Number of elements in a set	Number of subsets
1	2
2	4
3	8
4	16
5	p
.	.
.	.
.	.
q	128
.	.
.	.
.	.
n	r

(i) Find the value of p and the value of q.

(ii) Express r in terms of n.

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

Date	Details	Debit \$	Credit \$	B[illegible] \$
1-09-06				6 [illegible]
30-09-06	Interest	80		6 [illegible]
30-09-06	Repayment		120	5 [illegible]
30-10-06	Interest	79,47		6 [illegible]
30-10-06	Repayment		120	5 [illegible]
30-11-06	Interest	78,93		5 [illegible]
30-11-06	Repayment		120	5 [illegible]
30-12-06	Interest	w		x
30-12-06	Repayment		y	z

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

(ii) Calculate the values of

(a) w,

(b) x,

(c) y,

(d) z.

[8]

Answer the whole of the question on a sheet of graph paper.

The velocity of a particle moving along a straight line is given by $v = 15 + 7t - 2t^2$.

The table below shows corresponding values of v and t.

Time (t) s	0	1	2	3	4	5	6
Velocity (v)m/s	15	p	21	18	q	0	−15

(a) Find the value of p and the value of q. [2]

(b) Using a scale of 2 cm to represent 5 m/s on the v-axis and 2 cm to represent 1 second on the t-axis, draw a graph of $v = 15 + 7t - 2t^2$ from $t = 0$ to $t = 6$. [4]

(c) Use your graph to estimate

(i) the maximum value of **v**,

(ii) the acceleration of the particle when $t = 3$ seconds,

(iii) the distance travelled by the particle from $t = 0$ to $t = 5$. [6]

EMATICS
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$$\left(\frac{7}{2} - \frac{8}{5}\right) \div \frac{5}{3}$$

$$= \left(\frac{35-16}{10}\right) \div \frac{5}{3}$$

$$= \frac{19}{10} \div \frac{5}{3}$$

$$= \frac{19}{10} \times \frac{3}{5}$$

$$= \underline{1\tfrac{7}{50}}$$

$\frac{...}{100} \times \frac{17}{100} = \underline{1,7051}$

$\frac{...}{10} \times \frac{1\,000}{18} = \underline{400}$

Ratio $= 3 + 4 + 5$
$= 12$
$= \underline{50ha}$

$= 3 \times 3 \times 3 \times x \times x \times xy\, xz$
$= 2 \times 2 \times 2 \times 3 \times 3 \times x \times x \times y \times y \;\; x\, y \times z \times z$
$= 2 \times 2 \times 3 \times 3 \times 3 \times x \times x \times y \times z \;\; x\, z \times z$
$= 3 \times 3 \times x \times x \times y \times z$
$= \underline{9xyz}$

$r = 2(3p + 2) - 5$
$r = 6p + 4 - 5$
$r = 6p - 1$

$r = 6(-3) - 1$
$r = -18 - 1$
$\underline{r = -19}$

b(i) $\frac{x}{3} + \frac{x-4}{5}$

$\frac{5x + 3(x-4)}{15}$

$\frac{5x + 3x - 12}{15}$

$\frac{8x - 12}{15}$

(ii) $\frac{8x - 12}{15} = 4$

$8x - 12 = 60$

$8x = 60 + 12$

$8x = 72$

$\frac{8x}{8} \quad \frac{72}{8}$ $\qquad \underline{x = 9}$

(c) 3kg = 3 000g

$\frac{150 \times 100}{3\ 000} = \underline{5\%}$

3(a)(i) $ABD = 33^\circ$

(ii) $CBD = 87 - 33^\circ$

$= \underline{54^\circ}$

(iii) $BAC = \underline{54^\circ}$

(iv) $ADB = \underline{39^\circ}$

(v) $CFD = 180 - (33 + 54)$

$\underline{93^\circ}$

3(b) (i) $\sin 37 = \frac{PT}{8}$

$PT = 8 \times \sin 37$

$= \underline{4{,}81\text{cm}}$

(ii) Area $= \frac{37}{360} \times \pi r^2$

$= \frac{37 \times 3{,}142 \times 8^2}{360}$

$= \underline{20{,}7\text{cm}^2}$

(iii) Area $= \frac{1}{2}\, 8 \times 8 \sin 37$

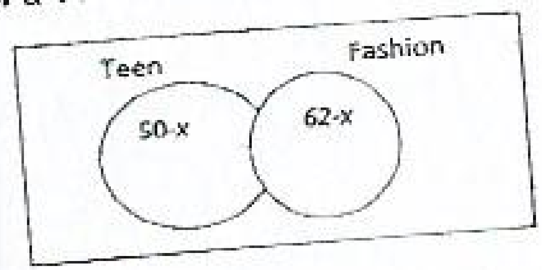
$= 32 \sin 37 \qquad = \underline{19{,}3\text{cm}^2}$

Area = Sector – Triangle
= 20,7 – 19,3
= **1,4cm²**

$3np - 6nq + ap - 2aq$
$3n(p-2q) + a(p-2q)$
$\underline{(p-2q)(3n+a)}$

$12 - 4g - g^2$
$12 + 2g - 6g - g^2$
$2(6+g) - g(6+g)$
$\underline{(6+g)(2-g)}$

Draw a Venn Diagram



$50 - x + x + 62 - x = 72$
$112 - x = 72$
$x = 40$
$x = 40$
watched both

$62 - 40 = \underline{22}$

First convert to base 10

$3^2 \quad 3^1 \quad 3^0$
$1 \quad 1 \quad 2_3$
$(3^2 \times 1) + (3^1 \times 1) + (3^0 \times 2)$
$9 + 3 + 2$
14

Then to base 5

5	14
5	2 r 4
	0 r 2

$112_3 = \underline{24_5}$

(ii)
$$
\begin{array}{r}
1101_2 \\
+\ 1011_2 \\
\hline
\mathbf{11\,000}
\end{array}
$$

---

b(i)

$$2 \log_5 (3x + 2) - \log_5 2 = 1$$
$$\log_5 (3x + 2)^2 - \log_5 2 = 1$$

$$\log_5 \left[\frac{(3x + 2)^2}{2}\right] = 1$$

$$\rightarrow \frac{(3x + 2)^2}{2} = 5^1$$

$$(3x + 2)^2 = 5 \times 2$$
$$(3x + 2)^2 = 10$$

$(3x + 2)(3x + 2) = 10$
$9x^2 + 6x + 6x + 4 = 10$
$9x^2 + 12x - 6 = 0$
$3(3x^2 + 4x - 2) = 0$
Divide by 3 both sides shown
$\underline{3x^2 + 4x - 2 = 0}$

(ii) Apply Quadratic Formular

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-4 + \sqrt{4^2 - 4(3 \times -2)}}{2(3)}$$

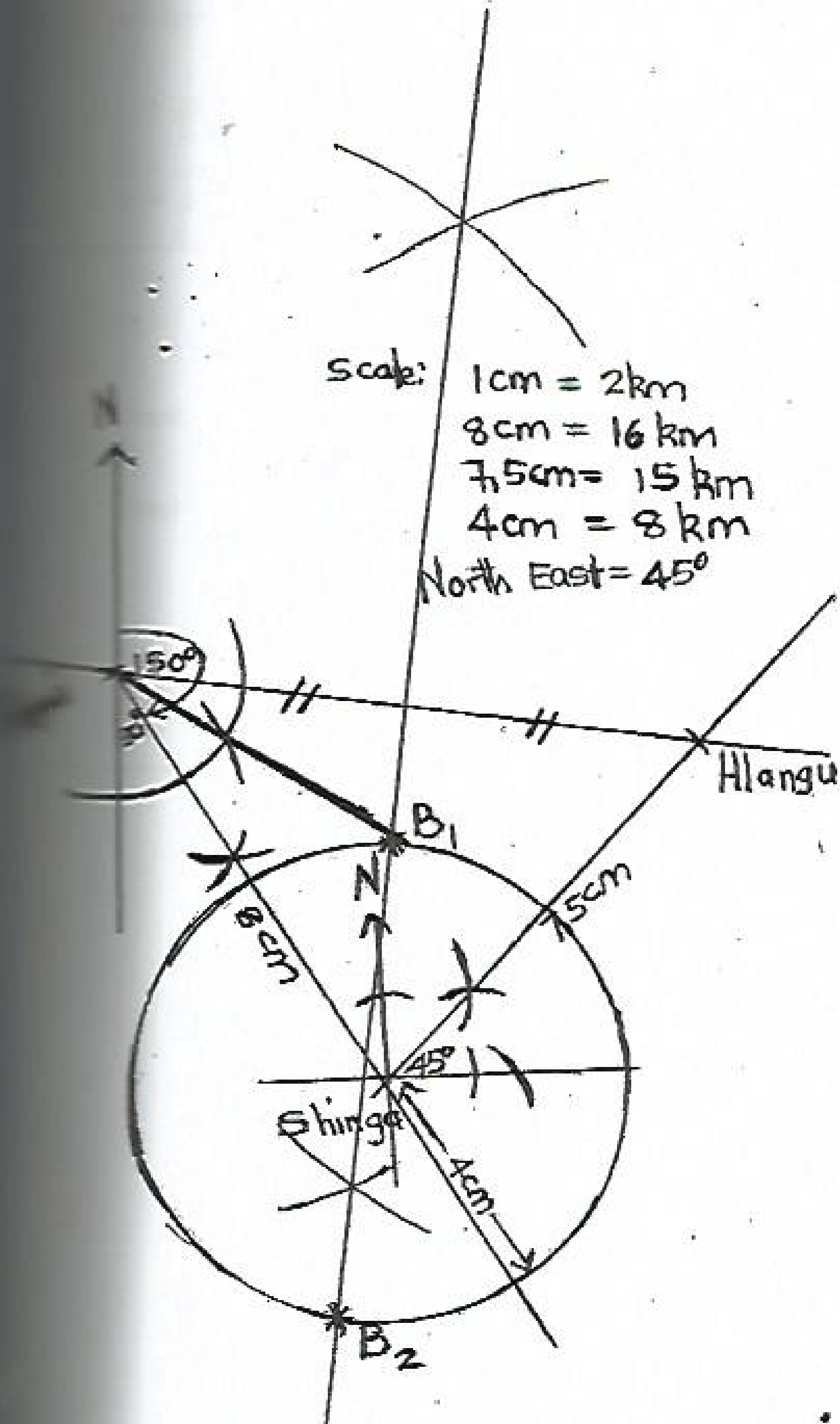
$$= \frac{-4 + \sqrt{40}}{6}$$

$$x = \frac{-4 + \sqrt{40}}{6} \text{ or } \frac{-4 - \sqrt{40}}{6}$$
$\underline{= 0{,}39 \text{ or } -1{,}72}$

---

6 Graph Paper

JUNE 2011 Q6.



(c) The shorter distance is 10km.

(Tugwi to B_1 = 5cm)

7(a) (i) A^{-1}

Determinant $= (3x\,{-2}) - (1 \times -4)$

$= -6 - (-4)$

$= 6 + 4$

$= \underline{-2}$

Inverse $= -\frac{1}{2}\begin{pmatrix} -2 & 4 \\ -1 & 3 \end{pmatrix}$

ii $\begin{pmatrix} 3 & -4 \\ 1 & -2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$

$-\frac{1}{2}\begin{pmatrix} -2 & 4 \\ -1 & 3 \end{pmatrix}\begin{pmatrix} 3 & -4 \\ 1 & -2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = -\frac{1}{2}\begin{pmatrix} -2 & 4 \\ -1 & 3 \end{pmatrix}\begin{pmatrix} -3 \\ -2 \end{pmatrix}$

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = -\frac{1}{2}\begin{pmatrix} -2 \\ -3 \end{pmatrix}$

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ \frac{3}{2} \end{pmatrix}$

$\underline{x = 1 \text{ and } y = 1\frac{1}{2}}$

(b)(i) (a) $\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC}$

$= \underline{-x + y}$

(b) $\overrightarrow{AD} = \frac{3}{5}\overrightarrow{AC} = \underline{\frac{3}{5}(-x + y)}$

(ii) $\overrightarrow{AB} = K\,\overrightarrow{OC}$

$\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$

$= x + K\,\overrightarrow{OC}$

$\underline{= x + ky}$

(iii) $\overrightarrow{OB} = L\overrightarrow{OD}$

$\overrightarrow{OB} = L\,[\,OA + AD]$

$\overrightarrow{OB} = L\begin{bmatrix} x - \frac{3x}{5} + \frac{3y}{5} \end{bmatrix} = L\begin{bmatrix} \frac{2x}{5} + \frac{3y}{5} \end{bmatrix}$

$= \underline{\frac{2hx}{5}} + \underline{\frac{3hy}{5}}$

$$x + ky = \frac{2hx}{5} + \frac{3}{5}hy$$

$$1 = \frac{2h}{5}$$

$$5 = 2h$$

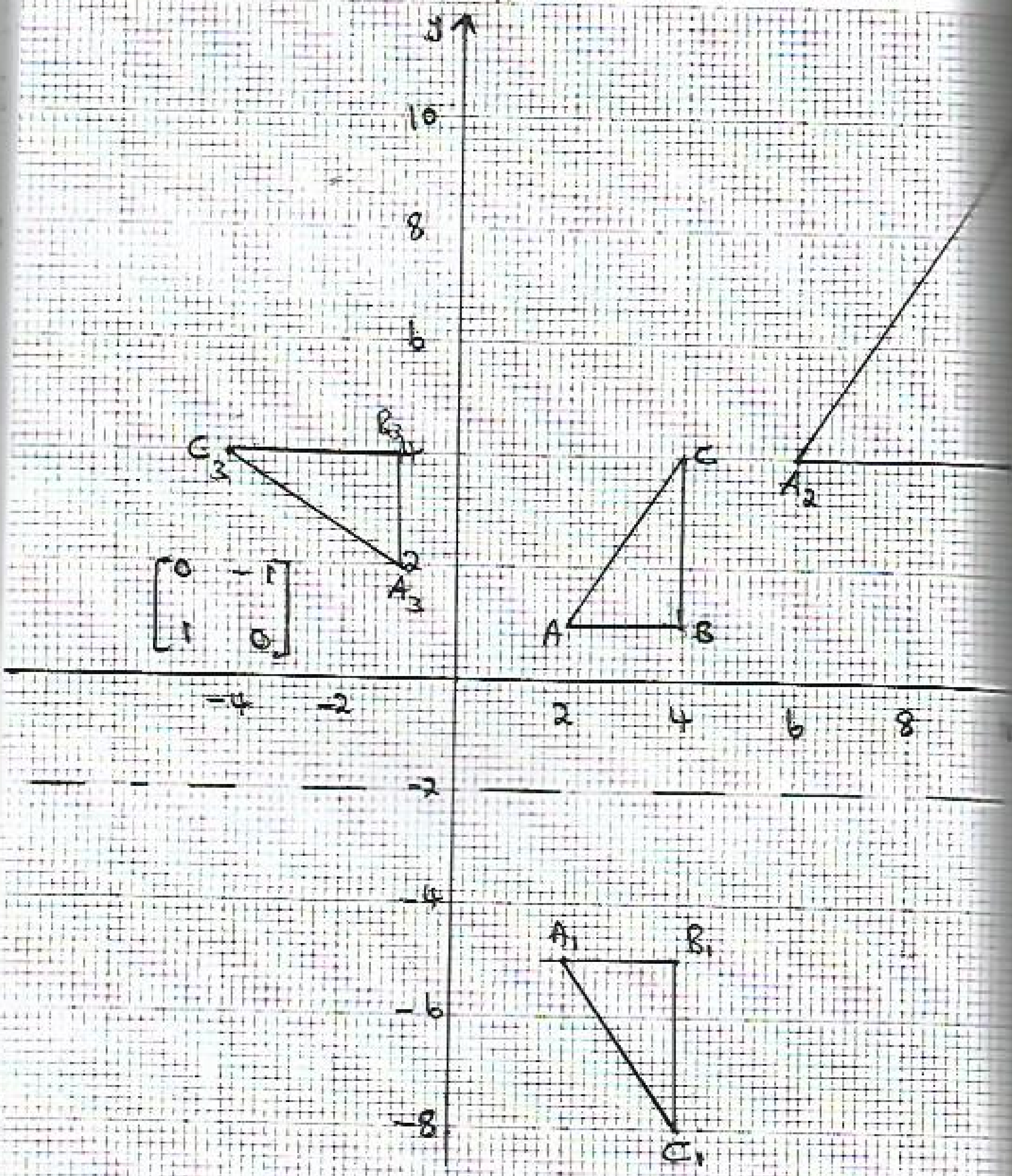
$$h = \frac{5}{2}$$

$\times \, ^{5}/_{2}$

Graph paper

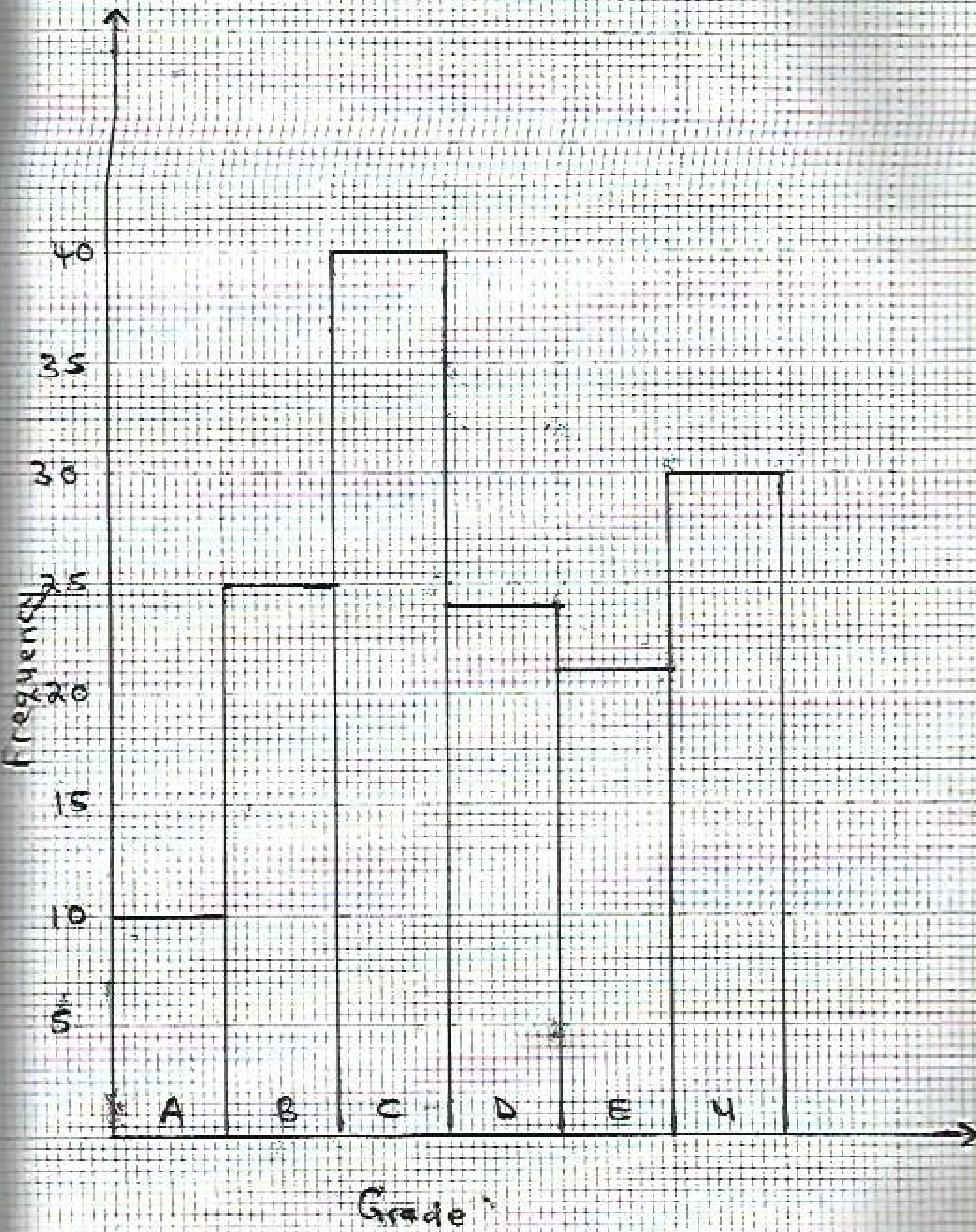
Graph paper

QUESTION 8 J. 2011



Enlargement Centre (-2; -2) Scale factor =

ESTION 9 J. 2011



10(a) $L \propto \frac{1}{B}$

$\underline{L = \frac{k}{B}}$

(ii) $8{,}5 = \frac{k}{6}$

$\underline{k = 51}$

$L = \frac{51}{B}$

$10{,}2 = \frac{51}{B}$

$10{,}2b = 51$ $\qquad b = \frac{51}{10{,}2}$

$\underline{b = 5}$

(b) Graph Paper

(a) $16 \times 2 = u$

$\underline{p = 32}$

$\underline{q = 7}$

(ii) $\underline{r = 2^n}$

$I = \frac{P \times R \times T}{100}$

$R = \frac{100\,I}{PT}$

$R = \frac{100 \times 80}{6\,000 \times (1/12)}$

$= \frac{8\,000}{500}$

$\underline{= 16\%}$

(ii)(a) $W = \dfrac{\underline{5878,4 \times 16 \times (^1/_{12})}}{100}$

$\underline{W = 78,38}$

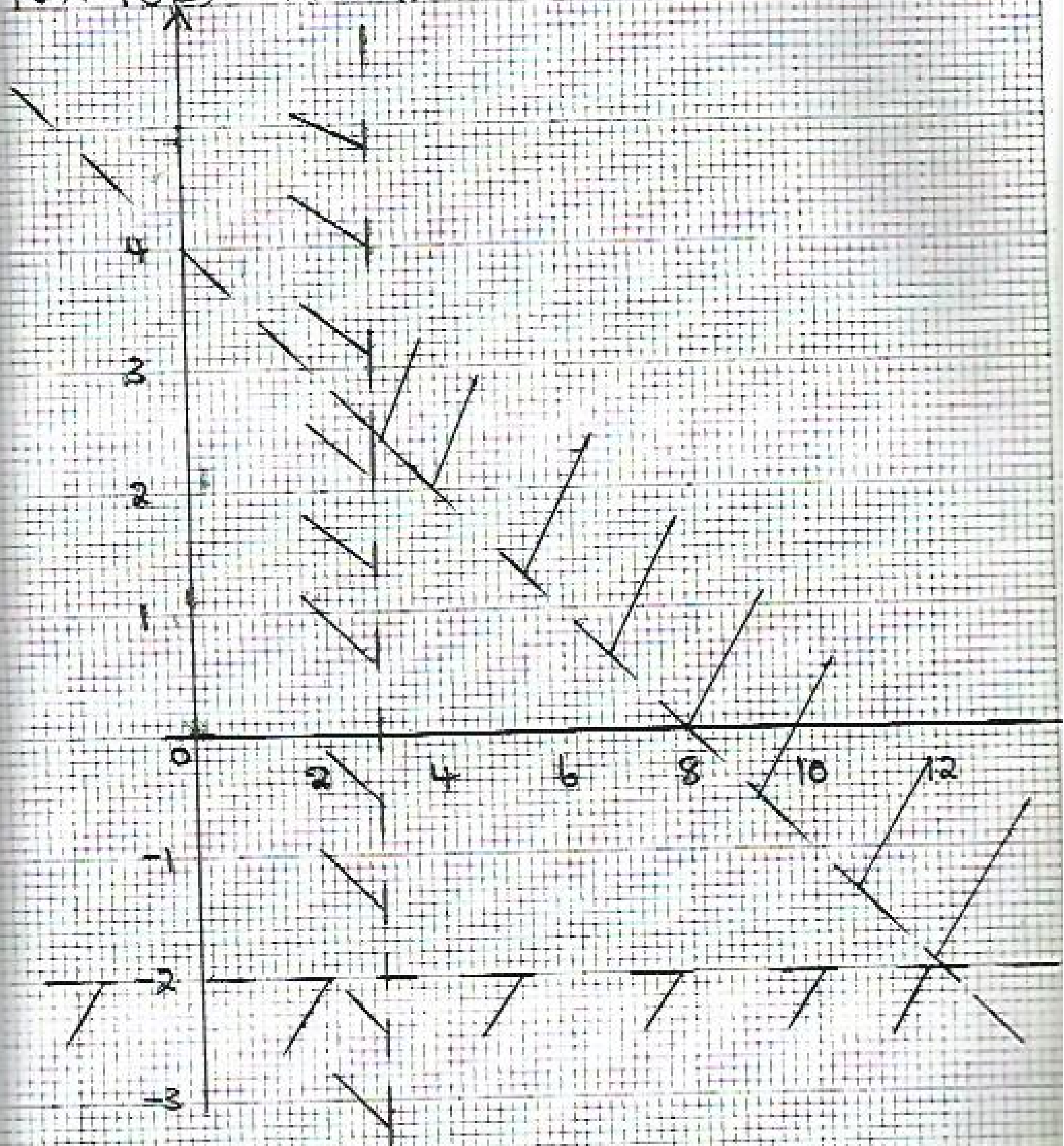
(b) $x = 5878,4 + 78,38$
$= \underline{5\,956,78}$

(c) $y = \underline{\$120}$

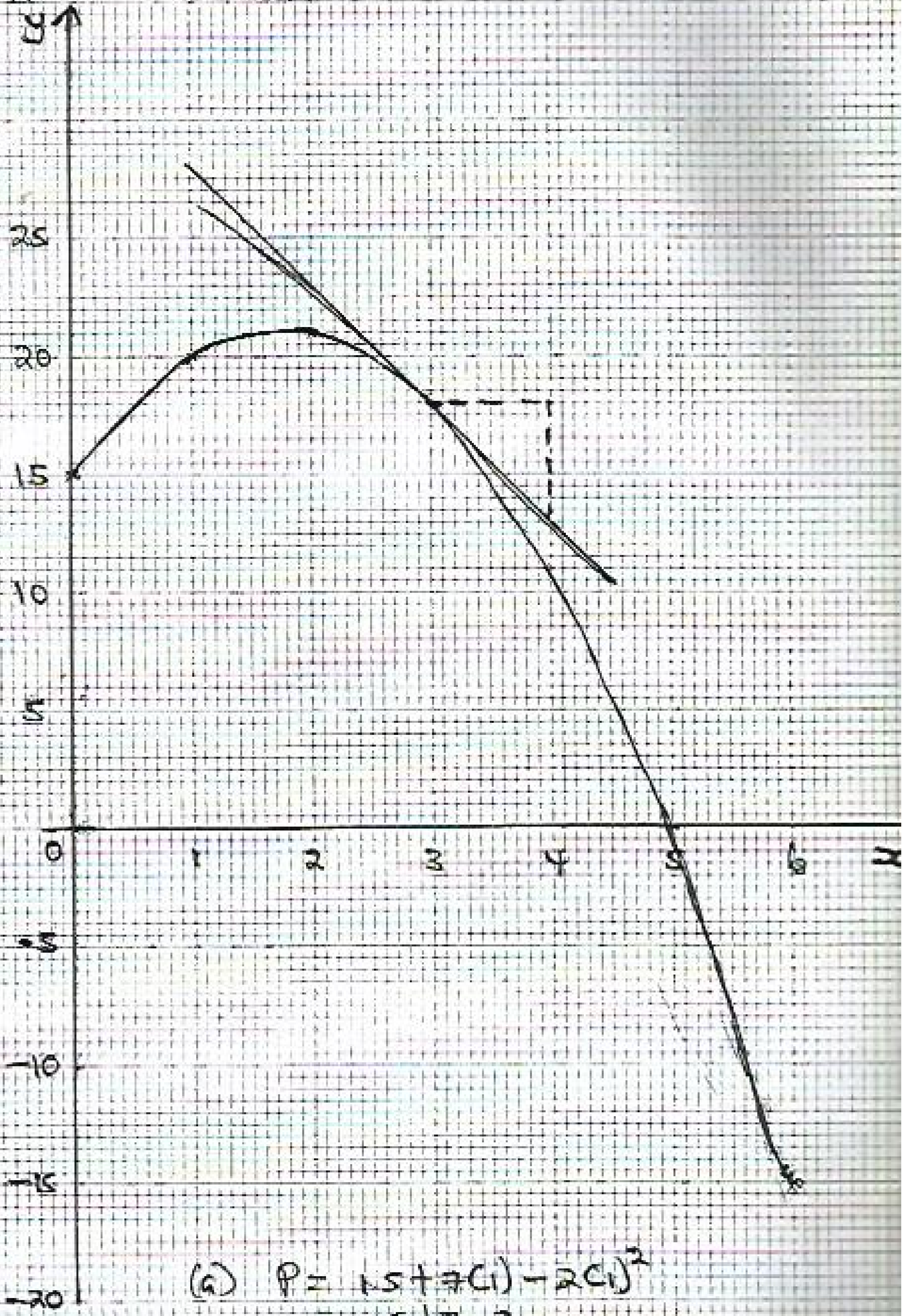
(d) $Z = 5956,78 - 120$
$= \underline{\$5836,78}$

12. Graph Paper

~~ESTION~~ 10(b) J. 2011



ESTION 12 J. 2011



(a) $P = 15 + 7(1) - 2(1)^2$

$= 15 + 7 - 2$

$= \underline{20}$

$q = 15 + 7(4) - 2(4)^2$

$= \underline{11}$

(c) (i) 21 m/s

(ii) -5 m/s

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS

4028/2

PAPER 2

NOVEMBER 2011 SESSION 2 hours 30 minutes

dditional materials:
Answer paper
eometrical instruments
raph paper (3 sheets)
Mathematical tables
lain paper (1 sheet)

2 hours 30 minutes

RUCTIONS TO CANDIDATES

ur name, Centre number and candidate number in the spaces provided on the paper/answer booklet.

all questions in Section **A** and any **three** questions from Section **B**.

ur answers on the separate answer paper provided.
e more than one sheet of paper, fasten the sheets together.

ing must be clearly shown. It should be done on the same sheet as the rest of the

of essential working will result in loss of marks.
ree of accuracy is not specified in the question and if the answer is not exact, the hould be given to three significant figures. Answers in degrees should be given imal place.

MATION FOR CANDIDATES

er of marks is given in brackets [ ] at the end of each question or part Mathematical tables or electronic calculators may be used to evaluate umerical expressions.

This question paper consists of 12 printed pages.

[Turn over

Section A [64 marks]

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

1 (a) Simplify $5\frac{1}{6} - 3\frac{2}{3} + 1\frac{1}{4}$.

(b) The virus that causes the common cold is 5×10^{-7} m long. Giving the answer in standard form, find the total length of 12 000 such viruses.

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

(d) Calculate the Principal that earns \$300 Simple Interest at 5% per annum for 6 years.

---

2 (a) Solve the inequality $15 - 3x < 2(x - 5)$.

(b) Factorise completely

(i) $2xy - x - z + 2yz$,

(ii) $2p^2q + pq^2$.

(c) Assuming there is an equal chance of being born a boy or a girl, find the probability that

(i) a child is born a boy,

(ii) in a family of three children, there are two boys and one girl.

(d) An office is 4,35 m long and 3,62 m wide.

Its floor is to be carpeted at a cost of \$15,99 per square metre. Calcul

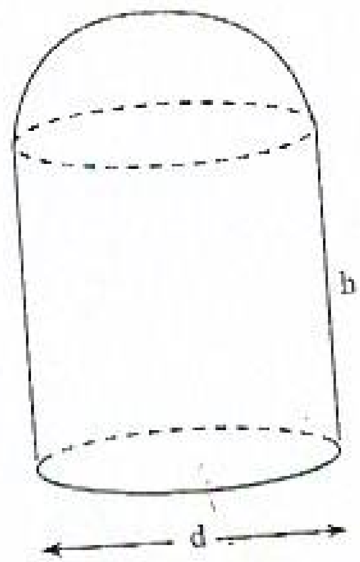
(i) the area of the floor,

(ii) the cost of carpeting the floor.

(a) Solve the equation $x(x+1)+2x(x-1)=3(x^2-1)$. [3]

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

(c) A salt shaker is made up of a cylinder of height h and a hemisphere of internal diameter d as shown below.



(i) Write down an expression for the volume of the salt shaker in terms of π, d and h.

(ii) Find the internal volume of the salt shaker if $h = 11$ cm and $d = 3{,}5$ cm, leaving the answer in terms of π.

$$\left[\text{Volume of sphere} = \frac{4\pi r^3}{3}\right]$$ [5]

4 (a) A compound is made up of potassium nitrate, sulphur and charcoal mixed in the ratio 33: 5: 7 respectively.

(i) Calculate the percentage of sulphur in the compound.

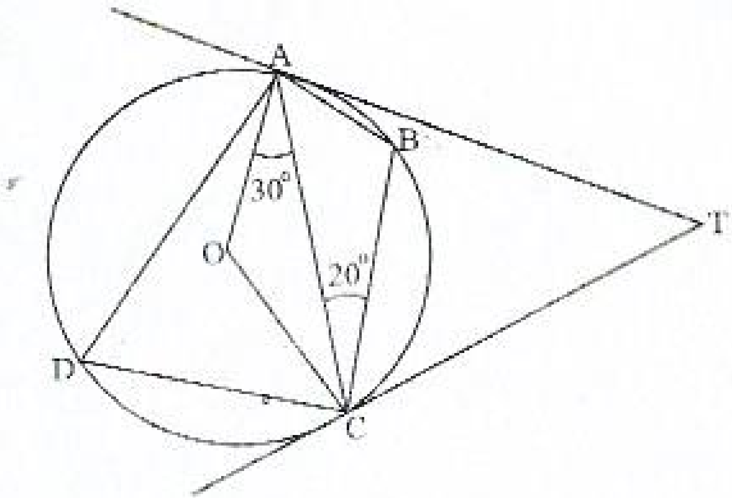
(ii) Find the mass of charcoal needed to make 900 kg of the compound.

(iii) Given that 10 kg of sulphur and 14 kg of charcoal are mixed, find the mass of potassium nitrate needed to make up the compound.

(b) Solve the equation $2x^2 - 3x - 7 = 0$, giving your answers correct to 2 decimal places.

(c) Given that M is directly proportional to t, and that $M = 27{,}5$ when $t = 55$, find the value of t when $m = 43$.

(a)



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

Find

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

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

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

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

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

(b) Given that $\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 3 & 1 \\ 2 & 0 \end{pmatrix}$, find

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

(ii) $\mathbf{BA}$,

(iii) $\mathbf{B}^{-1}$ [6]

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

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

(a) *On a single diagram, construct*

(i) *quadrilateral ABCD in which AB = 9 cm, BC = 6 cm, AD = 7.5 cm,* $DC = 5.5$ *and* $B\hat{A}D = 45°$,

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

(iii) the locus of points 5.7 cm from B.

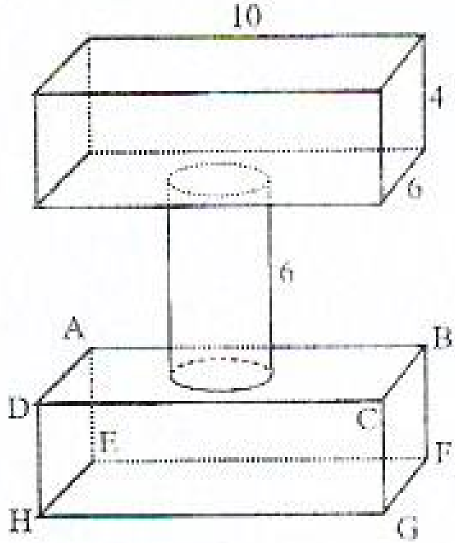
(b) Measure and write down the size of $A\hat{D}C$.

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

Section B [36 marks]

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

Each question carries 12 marks.



Take π to be $\frac{22}{7}$

The diagram shows a metal object made up of two identical cuboids and a cylinder riveted together. The cuboids have dimensions 10 cm by 6 cm by 4 cm. The cylinder has a height of 6 cm and a diameter of 4 cm.

(a) Calculate

(i) the exposed area of ABCD,

(ii) the surface area of cuboid ABCDEFGH,

(iii) the curved surface area of the cylinder,

(iv) the total surface area of the object. [9]

(b) Given that the volume of the metal used is 555.4 cm^3 and that the density of the metal is 9 000 kg/m^3, calculate, giving your answer correct to the nearest kg, the mass of the object. [3]

[Turn over

8 **Answer the whole of this question on a sheet of graph paper.**

The table shows values for the graph of $y = x^3$.

x	−3	−2	−1	0	1	2	3
y	−27	−8	−1	0	1	8	27

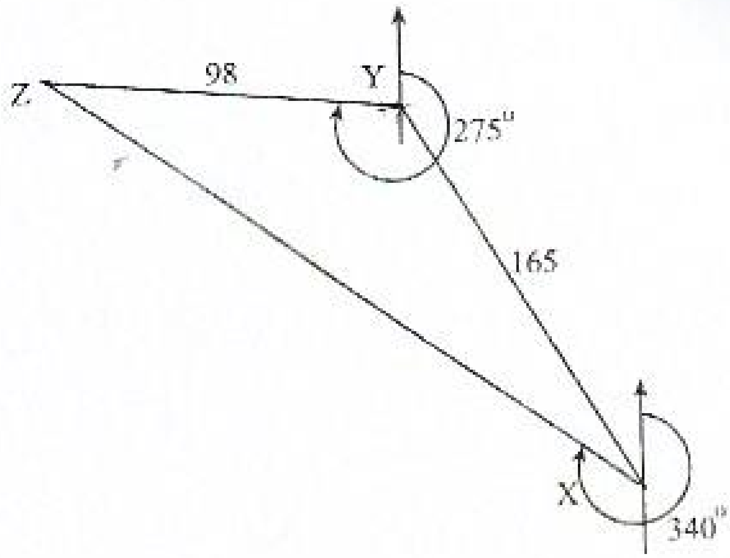
(a) Using a scale of 2 cm to represent one unit on the x-axis and 2 cm to represent 5 units on the y-axis, draw the graph of $y = x^3$ for $-3 \leq x \leq 3$.

(b) Use your graph to find

(i) the gradient of the curve at $x = 1$,

(ii) the area enclosed between the graph and the line $y = 2x$ and the lines $x = 0$ and $x = 1{,}5$.

(c) By drawing a suitable straight line, solve the equation $x^3 = 3x$.



In the diagram, Y is 165 km from X on a bearing 340° and Z is 98 km from Y on a bearing of 275°.

(a) Calculate the distance between X and Z. [5]

(b) A helicopter took $1\frac{1}{2}$ hours to fly from X to Y direct. Find the speed of the helicopter. [2]

(c) (i) Find $Y\hat{X}Z$.

(ii) State the bearing of Z from X. [5]

10 **Answer the whole of this question on a sheet of graph paper.**

The table shows the heights of 32 pupils measured to the nearest cm.

Height (h)	$120 \le h < 130$	$130 \le h < 140$	$140 \le h < 150$	$150 \le h < 160$	$160 \le h < 170$	$170 \le h$ [illegible]
frequency	1	3	6	10	7	4

Below is the cumulative frequency table for the information above.

upper class boundary	$h < 130$	$h < 140$	$h < 150$	$h < 160$	$h < 170$	$h < 180$	$h <$ [illegible]
cumulative frequency	1	4	10	20	27	31	32

(a) Using a scale of 2 cm to represent 5 pupils on the vertical axis and 2 cm to represent 10 cm on the horizontal axis, draw the Cumulative frequency curve to illustrate this information.

(b) Use your graph to find the median height of the pupils.

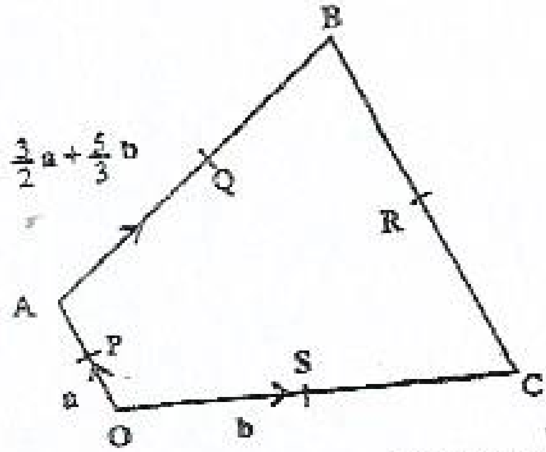
(c) To get into a game park at half price, pupils have to be under 150 cm tall.

Find the number of pupils who can get in at half price.

(d) If two pupils are chosen at random from the class, find the probability that the height of the first is less than 150 cm and that of the second is at least 160 cm.

(e) Calculate an estimate of the mean height of the pupils.

(a)



In the diagram, OABC is a quadrilateral and P, Q, R and S are the midpoints of OA, AB, BC and OC respectively. $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{b}$ and $\overrightarrow{AB} = \frac{3}{2}\mathbf{a} + \frac{5}{3}\mathbf{b}$.

Find in terms of a and/or b

(i) $\overrightarrow{PS}$,

(ii) $\overrightarrow{PQ}$,

(iii) $\overrightarrow{BC}$,

(iv) $\overrightarrow{SR}$.

(v) Using the information in (ii) and (iv) above or otherwise, state the special name given to quadrilateral PQRS. [8]

(b) A gardener has a rectangular lawn 20 m long and 8 m wide. He wants to put fertiliser on his lawn. He was advised to put 50 g/m^2.

(i) Calculate the amount of fertiliser that he should buy.

(ii) He manages to get only 5 kg of the fertiliser and spreads it on the lawn.

Find the average mass of fertiliser on each m^2. [4]

12 **Answer the whole of this question on a sheet of graph paper.**

Quadrilateral Q has vertices $(-2; 0)$, $(-3; 0)$, $\left(-3; 1\frac{1}{2}\right)$ and $(-2; 1)$.

Using a scale of 2 cm to represent one unit on both axes, draw the x and
for $-6 \le x \le 2$ and $-3 \le y \le 5$.

(a) Draw and label quadrilateral Q.

(b) Quadrilateral Q is mapped onto Q_1 by a reflection in the line $y =$

(i) Draw the line $y = 1 - x$.

(ii) Draw and label quadrilateral Q_1.

(c) Quadrilateral Q is mapped onto quadrilateral Q_2 with vertices $(-1;$
$(-1; -2)$, $\left(-2\frac{1}{2}; -2\right)$ and $(-2; -1)$.

(i) Draw and label quadrilateral Q_2.

(ii) Describe completely, the **single** transformation which maps
quadrilateral Q_1 onto Q_2.

(d) Quadrilateral Q_3 is the image of Q under a transformation represented
by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}$.

Draw and label quadrilateral Q_3.

ATHEMATICS
OVEMBER 2011
NSWERS

(a) $5\,^{1}/_{6} = 3\,^{2}/_{3} \div 1\,^{1}/_{4}$

$\frac{31}{6} - \frac{11}{3} \div \frac{5}{4}$

$\frac{31}{6} - \frac{11}{3} \div \frac{4}{5}$

$\frac{31}{6} - \frac{44}{15}$

$\frac{5(31 - 44(2)}{30}$

$\frac{155 - 88}{30}$

$\frac{67}{30}$

$2\,^{7}/_{30}$

(b)
Total length $= 12\,000 \times 5 \times 10^{-7}$
Total length $= 1{,}2 \times 10^{4} \times 5 \times 10^{-7}$
Total Length $= 1{,}2 \times 5 \times 10^{-7+4}$
$= 6 \times 10^{-3}$ m

(c)
$\frac{3}{x^2 - x} - \frac{5}{x^2 - 1}$

$\frac{3}{x(x-1)} - \frac{5}{(x-1)(x+1)}$

$\frac{3(x+1) - 5(x)}{x(x-1)-(x+1)}$

$\frac{3x + 3 - 5x}{x(x^2 - 1)}$

$\frac{3 - 2x}{x(x^2 - 1)}$

(d)
$I = \frac{P \times R \times T}{100}$

$300 = \frac{P \times 5 \times 6}{100}$

$\frac{300 \times 100}{30} = \frac{P \times 30}{30}$

Principal $= \$1\,000$

2(a) $15-3x < 2(x-5)$

$15 - 3x < 2x - 10$

$-3x - 2x < -10 - 15$

$\frac{-5x}{-5} < \frac{-25}{-5}$

$x > 5$

(b)(i) $2xy - x - z + 2yz$

$x(2y-1) + z(-1+2y)$

$x(2y-1) + z(2y-1)$

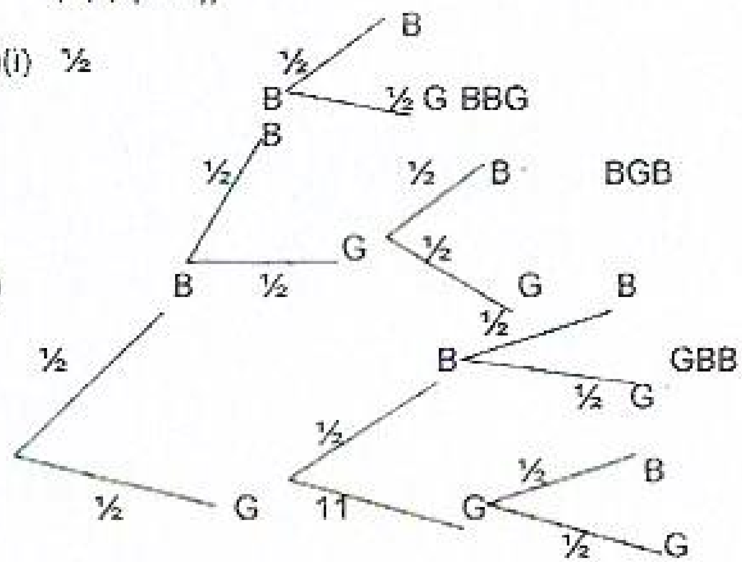
$(2y-1)(x+z)$

(ii) $2p^2q + pq^2$

$pq(2p+q)$

(c)(i) ½

(ii)



P(two boys and one girl) $= 3x(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2})$

$= \frac{3}{8}$

d) (i) Area of the floor = Length x Width

$= (4{,}35 \times 3{,}63)m^2$

$= 15{,}747m^2$

(ii) Cost of carpeting the floor = $15{,}747m^2 \times \$15{,}99$

= \$259.79453

= \$251,79

3(a) $x(x+1) + 2x(x-1) = 3(x^2-1)$

$x^2 + x + 2x^2 - 2x = 3x^2 - 3$

$3x^2 - 3x^2 - x = -3$

$\frac{-x}{-1} = \frac{-3}{-1}$ $\qquad x - 3$

$b = ½\sqrt{a^2 - x^2}$

$2b = \sqrt{a^2 - x^2}$

$(2b)^2 \sqrt{a^2 - x^2}$

$x = a^2 - 4b^2$

$x = \sqrt{a^2 - 4b^2}$

Volume = Volume of Cylinder + Volume of the hemisphere

$\pi\left(\frac{d}{2}\right)^2 h + ½\left(\frac{4\pi r^3}{3}\right)$

$\frac{\pi d^2 h}{2} + \frac{4\pi\left(\frac{d}{2}\right)^3}{6}$

$\frac{\pi d^2 h}{2} + \frac{4\pi\left(\frac{d}{2}\right)^3}{6}$

$\frac{\pi d^2 h}{2} + \frac{4\pi\left(\frac{d^3}{8}\right)}{6}$

$\frac{\pi d^2 h}{2} + \frac{\pi d^3}{12}$

$\frac{1\pi d^2}{12} \quad (6h + d)$

$= \frac{(3,5)^2 \pi}{12} \quad (6\,(11) + 3,5)$

$= \frac{49\pi}{48} \left(\frac{139}{2}\right)$

$= \frac{6811\pi}{96} \quad cm^3$

$= 70,9\pi \ cm^3$

4(a)(i) $\dfrac{5}{33+5+7} \times 100\%$

Percentage of sulphur $= \dfrac{5}{14} \times 100\%$

$= 11{,}1\ \%$

(ii) Mass of charcoal $= 7 \times 900\text{kg}$

$= 140\text{kg}$

(iii) 10kg____________Sulphur
14kg____________Charcoal
20kg____________Potassium nitrate

10kg____________5
More____________45

Total mass $= \dfrac{45}{5} \times 10\text{kg}$

$= 90\text{kg}$

Mass of potassium Nitrate = 90kg - (10kg + 14kg)
= 90kg – 24kg
= 66kg

(b) $2x^2 - 3x - 7 = 0$

$x = \dfrac{-b + \sqrt{b^2 - 4ac}}{2a}$

$x = \dfrac{3 + \sqrt{(-3)^2 - 4\,(2 \times (-7))}}{2(2)}$

$x = \dfrac{3 + \sqrt{9 + 56}}{4}$

$x = \dfrac{3 + \sqrt{65}}{4}$

$x = \dfrac{3 + \sqrt{65}}{4}$ or $\dfrac{3 - \sqrt{65}}{4}$

$x = 5{,}53$ or $-2{,}53$

C) $M \quad t$

$M = kt$

$\dfrac{27{,}5}{55} = \dfrac{55k}{55}$

$K \ 0{,}5$ $\qquad M = 0{,}5t$

$\dfrac{43}{0{,}5} = \dfrac{0{,}5t}{0{,}5}$ $\qquad$ **t = 86**

$A\,O\,C = 180^\circ - (30^\circ + 30^\circ)$
$A\,O\,C = 180^\circ - 60^\circ$
$A\,O\,C = 120^\circ$

$A\,D\,C = \frac{1}{2} A\,O\,C$
$A\,D\,C = \frac{1}{2}(120^\circ)$
$A\,D\,C = 60^\circ$

$B\,C\,T = 90^\circ - (30^\circ + 20^\circ)$
$B\,C\,T = 90^\circ - 50^\circ$
$B\,C\,T = 40^\circ$

$C\,A\,B = 40^\circ$
$A\,T\,C = 180^\circ - (60 + 60)$
$A\,T\,C = 180^\circ - 120^\circ$
$A\,T\,C = 60^\circ$

$$A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}; \quad B = \begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix}$$

$$2\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 4 \\ 0 & 2 \end{bmatrix} + \begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 5 \\ 2 & 2 \end{bmatrix}$$

(ii)

$$BA = \begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$

$$BA = \begin{bmatrix} 3 + 0 & 6 + 1 \\ 2 + 0 & 4 + 0 \end{bmatrix}$$

$$BA = \begin{bmatrix} 3 & 7 \\ 2 & 4 \end{bmatrix}$$

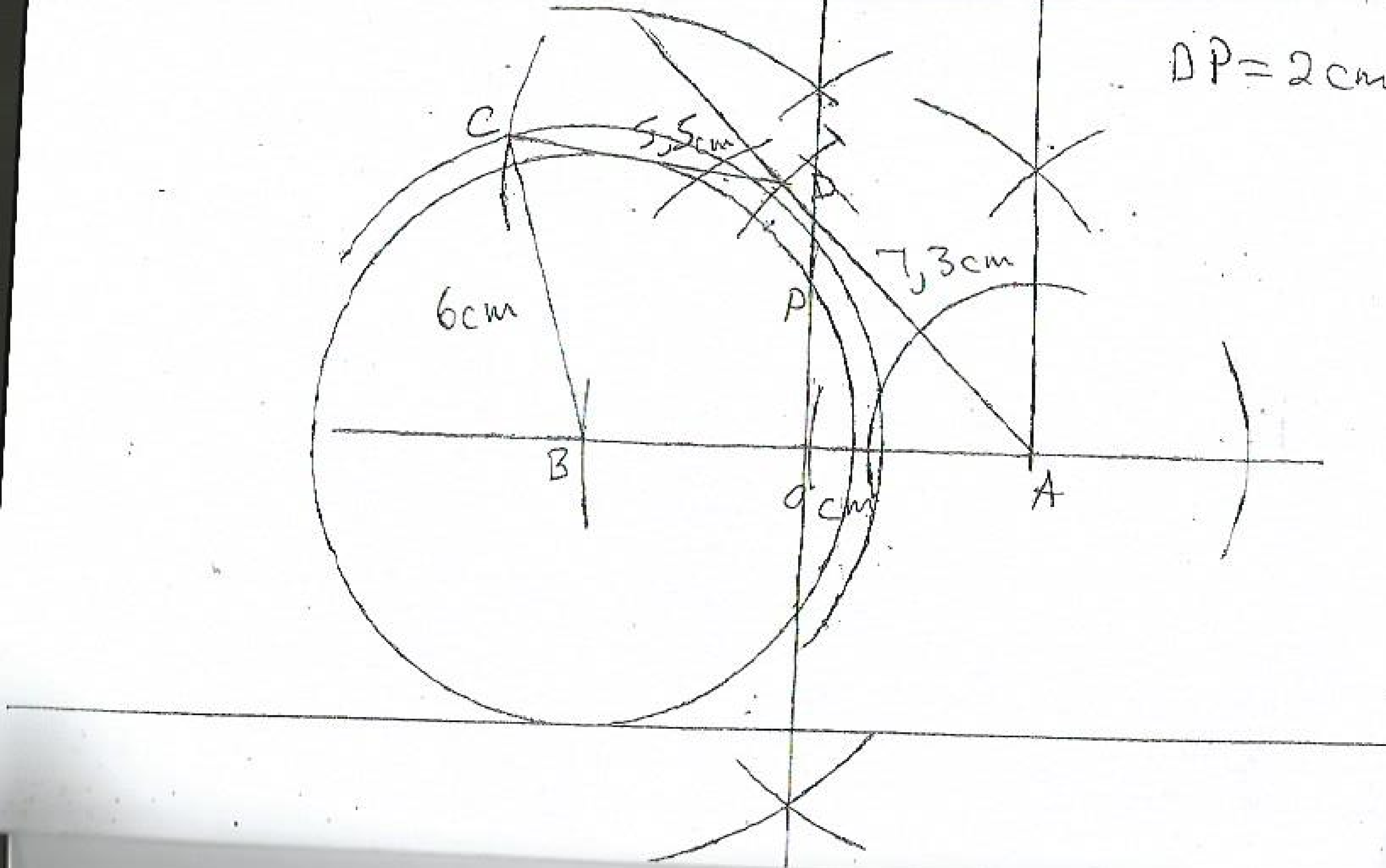
(iii) B

$$|B| = (3 \times 0) - (2 \times 1)$$

$$|B| = 0 - 2$$

$$|B| = -2 \qquad B^{-1} = -\tfrac{1}{2}\begin{bmatrix} 0 & -1 \\ -2 & 3 \end{bmatrix}$$

DP = 2cm



SECTION B

Exposed arm of ABCD $= 10cm \times 6cm$
$= 60cm^2$

Surface areas (ABCDEFGH)
$= 2(10 \times 6) + 2(6 \times 4) + 2\,(10 \times 4)$
$= 120cm^2 + 48cm^3 + 80cm^2$
$= 248cm^2$

Curved surface area $= \pi dh$
$= \frac{22}{7} \times 4 \times 6$
$= 75{,}43cm^2$

Total Surface Area
$= 2\,(248)\,cm^2 + 75{,}43cm^2$
$= 496cm^2 + 75{,}43cm^2$

$= \quad 571{,}43cm^2$

Base Area of the cylinder $= \left[\frac{22}{7} \times 2\right]^2 \quad \times 2$

$= 25{,}14$

Total Surface Area $= 571{,}43cm^2 - 25{,}14cm^2$

$= 546{,}29cm^2$

(b) Density $= \frac{\text{Mass}}{\text{Volume}}$

Mass $=$ Density x Volume

Mass $= 9\,000\ kg/m^3 \times 555{,}5cm^3$

$= \frac{9000\ kg/m^3 \times 555{,}4m^3}{1\,000\,000}$

$= 4{,}9986$

$= 5{,}0kg$

9(a) $XYZ = 275° - (180 - 20)$

$XYZ = 275° - 160°$

$XYZ = 115°$

$(XZ)^2 = 98^2 + 165^2 - 2 \times 98 \times 165 \text{ Cos } 115°$

$(XZ)^2 = 9604 + 27\,225 - 323\,40 \times 165 \text{ Cos } 115°$

$(XZ)^2 = 36829 - 32340 \text{ Cos } 115°$

$(XZ)^2 = 50\,496{,}47$

$XZ = \sqrt{50\,496{,}47}$

$\mathbf{XZ = 224{,}7km}$

(b) Speed $= \frac{\text{Distance}}{\text{Time}}$

Speed $= \frac{165\ km}{1{,}5hrs}$

Speed $= 110\ km / hr$

(c) (i) $YXZ \longrightarrow$

$\frac{\text{Sin } YXZ}{98} = \frac{\text{Sin } 115}{224{,}7}$

$\text{Sin } YXZ = 0{,}39527$

$YXZ = \text{Sin}^{-1}(0{,}39527)$

$YXZ = 23{,}28°$

$YXZ = 23{,}3°$

(ii) Bearing of Z from X $= 360° - (20 + 23{,}28)$

$= 360° - 43{,}28$

$= 316{,}7°$

Nov 2011 Q 8

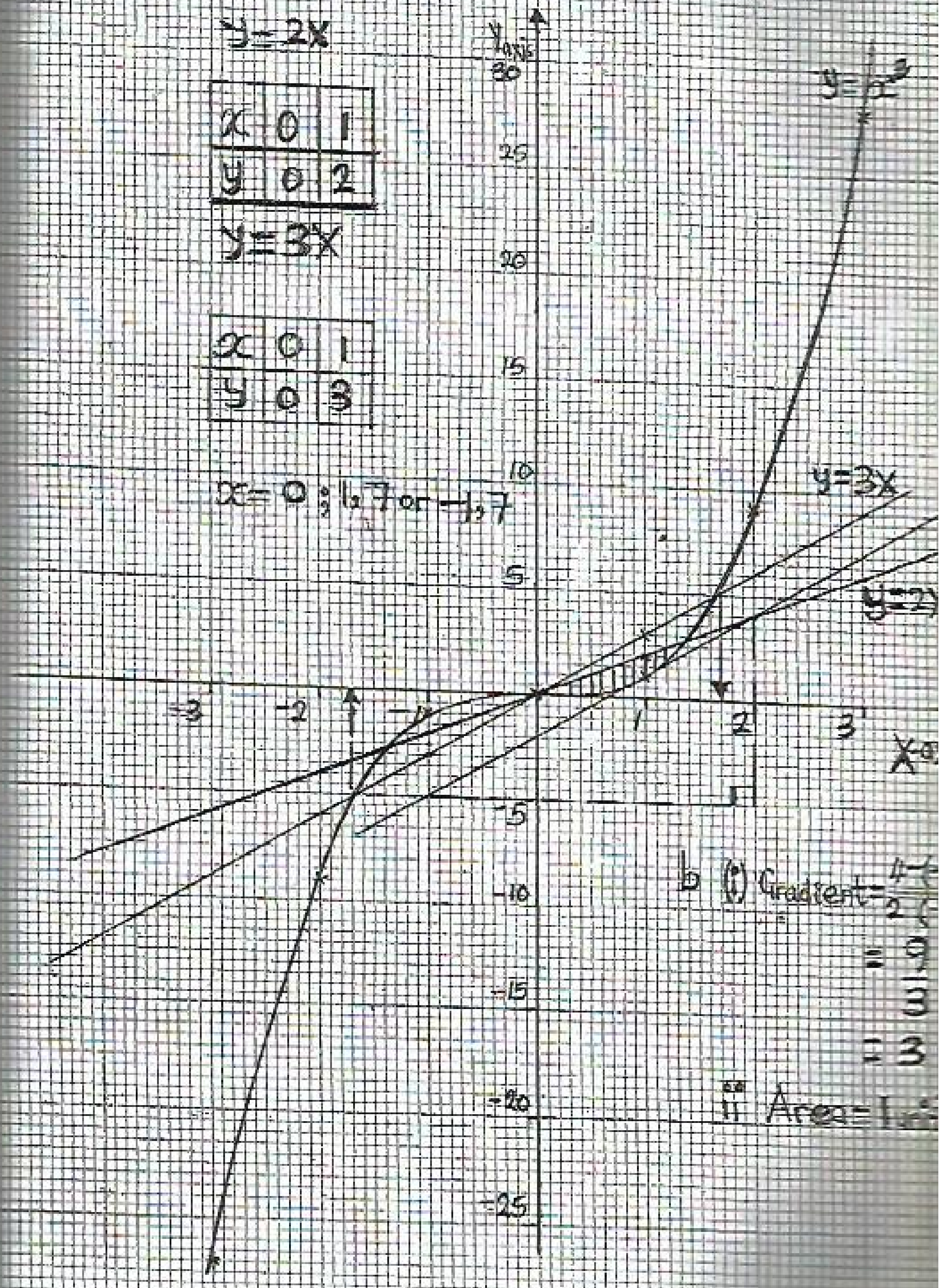
$y = 2x$

x	0	1
y	0	2

$y = 3x$

x	0	1
y	0	3

$x = 0$; $1{,}7$ or $-1{,}7$



b (i) Gradient $= \frac{4-(}{2-(}$

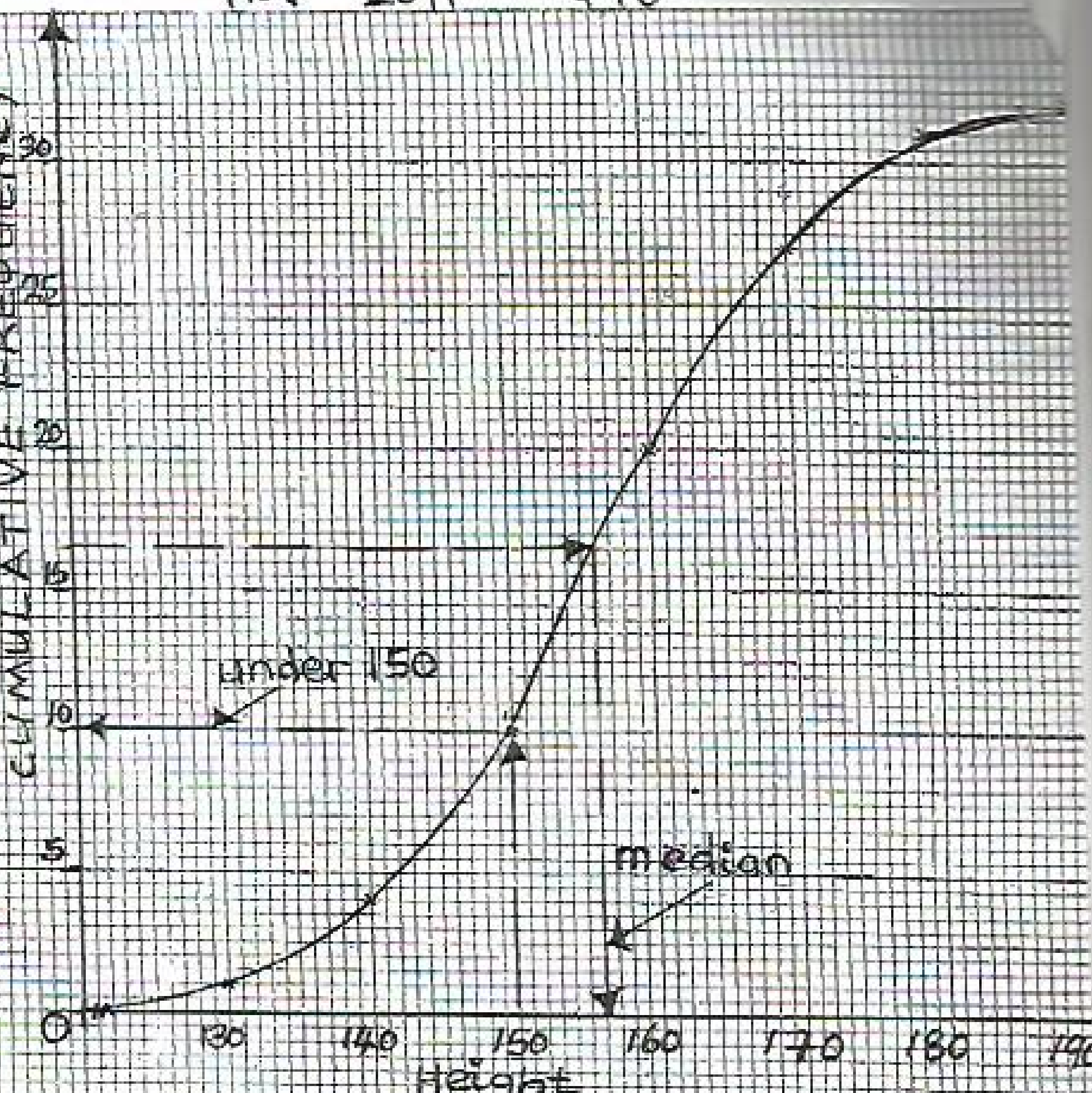
$= \frac{9}{3}$

$= 3$

ii Area $= 1{,}$

Nov 2011 Q10

(a)



(b) median $= \frac{1}{2}(32+1)^{th}$

$= 16{,}5^{th}$

$\therefore$ median $= 156$ cm

(c) 10 pupils

(d) $\frac{10}{32} \times \frac{12}{31} = \frac{15}{124} = 0{,}12097$

(e) $\frac{124{,}5 + 134{,}5 \times 3 + 144{,}5 \times 6 + 154{,}5 \times 10 + 164{,}5 \times 7 \ldots 184{,}5}{32}$

$= \frac{4974}{32}$

$= 155{,}4$ cm

11(a)

(i) $\overline{PS} = -\frac{1}{2}a + \frac{1}{2}b$

(ii) $\overline{PQ} \quad -\overline{PA} + \overline{AQ}$

$\overline{PQ} = \frac{1}{2}a + \frac{1}{2}\ \frac{3a}{2} + \frac{5}{3}b$

$\overline{PQ} = \frac{1}{2}a + \frac{3}{4}a + \frac{5}{6}b$

$\overline{PQ} = \frac{5}{4}a + \frac{5}{6}b$

(iii) $\overline{BC} = \overline{BA} + \overline{AO} + \overline{OC}$

$\overline{BC} = \left[\frac{-3}{2}a + \frac{5}{3}b\right] -a + b$

$\overline{BC} = \frac{-3}{2}a - \frac{5}{3}b - a + b$

(i) $\overline{SR} = \overline{SC} + \overline{CR}$

$\overline{SR} = \frac{1}{2}b - \frac{1}{2}\left[\frac{-5a}{2} - \frac{2}{3}b\right]$

$\overline{SR} = \frac{1}{2}b + \frac{5}{4}a + \frac{1}{3}b$

$\overline{SR} = \frac{5b}{6} + \frac{5a}{4}$

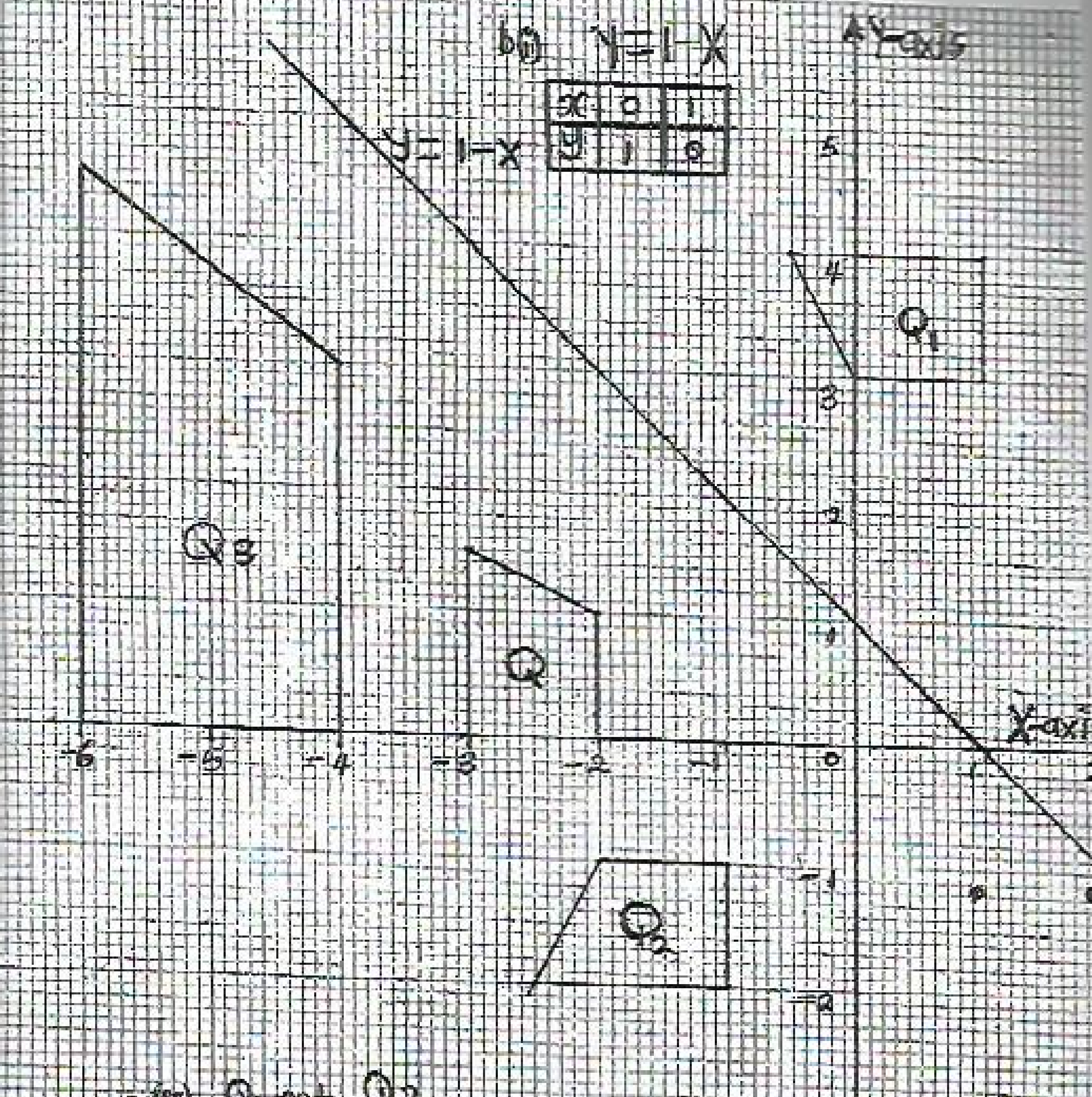
V) Since $\overline{PQ}$ and $\overline{SR}$ are equal and parallel it also means that $\overline{PS}$ and QR are equal and parallel.
Therefore PQRS is a Parallelogram

b(i) Area of the garden $= 20m \times 8m$
$= 160m^2$

Amount of fertilizer $= 50g / m^2 \times 160m^2$
$= 8\,000g$
$= 8kg$

(ii) Average mass of fertilizer / $m^2 = \frac{5kg}{160m^2}$
$= 0,3124KG/m^2$
$= 31,25g/m^2$

NOV 2011 Q 12



c(ii) Q_1 onto Q_2
- Shear
- factors $-3/2$ and $-1/3$

$$\text{(d)}\quad \begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix} \overset{Q}{\begin{pmatrix} -2 & -3 & -2 & -3 \\ 0 & 0 & 1 & 1.5 \end{pmatrix}} = \overset{Q_3}{\begin{pmatrix} -4 & -6 & -4 & -6 \\ 0 & 0 & 3 & 4.5 \end{pmatrix}}$$

MBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

ATHEMATICS **4028/2**

PER 2

JUNE 2012 SESSION 2 hours 30 minutes

...itional materials:
- ...swer paper
- ...eometrical instruments
- ...raph paper (3 sheets)
- ...athematical tables
- ...ain paper (1 sheet)

... 2 hours 30 minutes

...UCTIONS TO CANDIDATES

... your name, Centre number and candidate number in the spaces provided on the ... paper/answer booklet.

... all questions in Section A and any **three** questions from Section B.

... your answers on the separate answer paper provided.
... use more than one sheet of paper, fasten the sheets together.

... working must be clearly shown. It should be done on the same sheet as the rest of the ...

...ion of essential working will result in loss of marks.
... degree of accuracy is not specified in the question and if the answer is not exact, the ... should be given to three significant figures. Answers in degrees should be given ... decimal place.

...ORMATION FOR CANDIDATES

... number of marks is given in brackets [ ] at the end of each question or part question.
...matical tables or electronic calculators may be used to evaluate explicit ...rical expressions.

This question paper consists of 11 printed pages and 1 blank page.

Section A [64 marks]

Answer all the questions in this section.

1 (a) Express as a single fraction in its simplest form

(i) $3\frac{3}{4}-2\frac{1}{2}$,

(ii) $\frac{2a-5}{a-4}-\frac{1}{2}$. [5]

(b) Find the numerical value of $d\left(n-d^2\right)$ when $n=4$ and $d=\frac{1}{2}$. [2]

(c) By selling an article for \$11, 40, a shop owner made a loss of 5%.

Calculate the cost price of the article. [3]

2 (a) Factorise completely

(i) $2k^2-7k-15$,

(ii) $2am^2-2an^2-bm^2+bn^2$. [5]

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

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

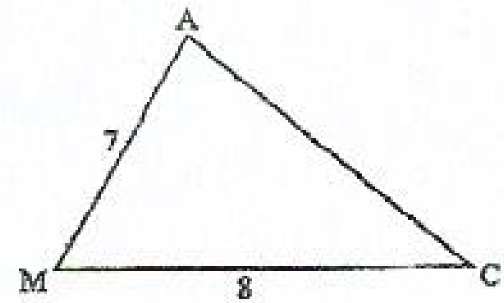
(ii) Given that Mary has \$12 and Diana has \$8, find the value of x and the value of y. [6]

3 (a) Given that $T=\frac{11v}{6}+20$,

(i) make v the subject of the formula,

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

(b)



In the diagram, AM = 7 cm and MC = 8 cm. If the area of Δ AMC = 25 cm^2, calculate $A\hat{M}C$. [3]

(c) It is given that $\mathbf{P} = \begin{pmatrix} 4 & -3 \\ 5 & 2 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 7 & 3 \\ 4 & 6 \end{pmatrix}$.

Find (i) the inverse of **Q**,

(ii) the matrix **R** such that **P** + **R** = **Q**. [4]

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

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

(a) On a single diagram, construct

(i) trapezium ABCD in which AB = 8,5 cm, $A\hat{B}C = 120°$, BC = 6 cm, CD = 12 cm and AB is parallel to DC,

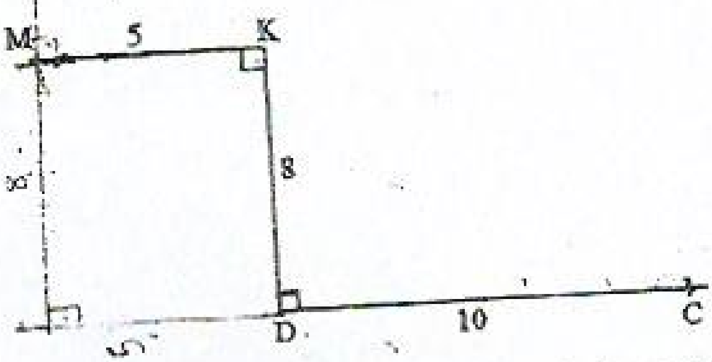
(ii) the locus of points which are equidistant from C and D,

(iii) the circle of which CD is the diameter. [7]

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

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

5 (a)



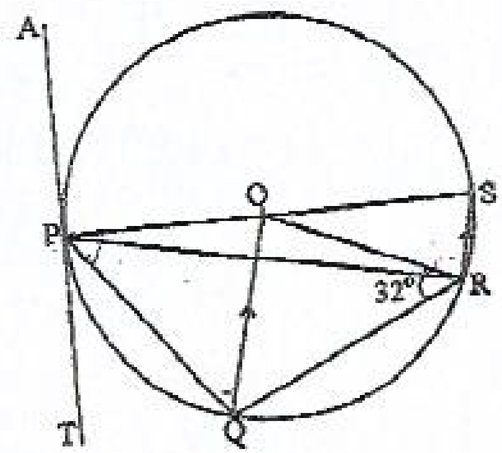
In the diagram, K is 5 km due east of M, D is 8 km due south of K and C is 10 km due east of D.

Calculate

(i) the length of straight line MC,

(ii) the bearing of C from M correct to the nearest degree. [5]

(b)



In the diagram, P, Q, R and S are points on the circle centre O. AT is a tangent to the circle at P and QO is parallel to RS.

Given that $P\hat{R}Q = 32°$, calculate

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

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

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

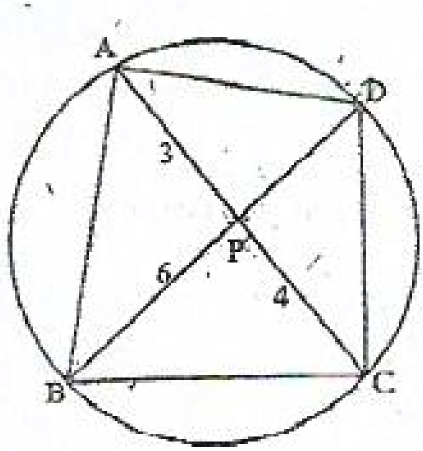
(iv) $P\hat{R}O$. [6]

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

(b) Solve the equation

$$\frac{3}{2x-5}-\frac{4}{x-3}=0.$$ [3]

(c)



In the diagram, ABCD is a cyclic quadrilateral in which AC and BD intersect at P. AP = 3 cm, PC = 4 cm and BP = 6 cm.

(i) Name in correct order, the triangle that is similar to triangle APD.

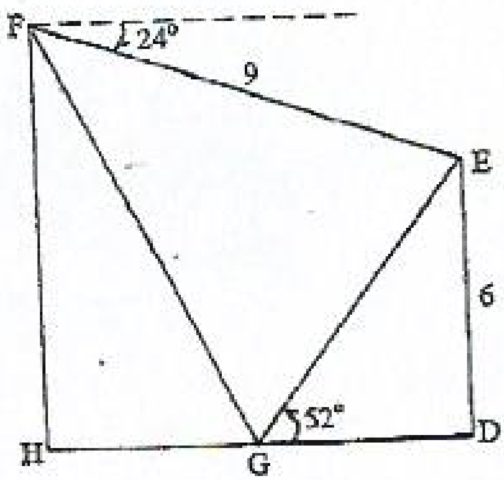
(ii) Find the ratio of $\frac{\text{area of } \Delta APD}{\text{area of } \Delta CPD}$.

(iii) Given that the area of $\Delta CPD = 8\ \text{cm}^2$, calculate the area of the quadrilateral ABCD. [5]

Section B [36 marks]

Answer any three questions in this section

7



In the diagram, the points H, G and D are in a straight line on level ground. DE is a tree 6 m high and the angle of elevation of E from G is 52°. The angle of depression of E from the top of a tower HF, is 24°.

Given that EF = 9 m, calculate

(a) $G\hat{E}F$, [2]

(b) the length of

(i) GE,

(ii) FG. [6]

(c) the angle of depression of G from F. [4]

8 **Answer the whole of this question on a sheet of graph paper.**

Using a scale of 2 cm to represent 2 units on both axes, draw the x and y axes for $-6 \leq x \leq 10$ and $-10 \leq y \leq 8$.

(a) Triangle A has vertices at (3; 1), (1; 2) and (2; 4). Draw and label clearly the triangle. [1]

(b) Triangle B is the image of triangle A under an anticlockwise rotation of 90° about $(-2; 2)$.

Draw and label clearly the triangle B. [2]

(c) A single transformation P maps triangle A onto triangle C with vertices at (9; 1), (3; 2) and (6; 4).

(i) Draw and label clearly triangle C.

(ii) Find and write down, the matrix which represents the transformation P.

(iii) Describe fully the single transformation P. [6]

(d) Triangle A is mapped onto triangle D by an enlargement of scale factor -2 with the origin as the centre.

Draw and label clearly triangle D. [3]

(a) The resistance, R newtons, to a train travelling at v km/h, is given by the formula $R = c + dv^2$ where c and d are constants.

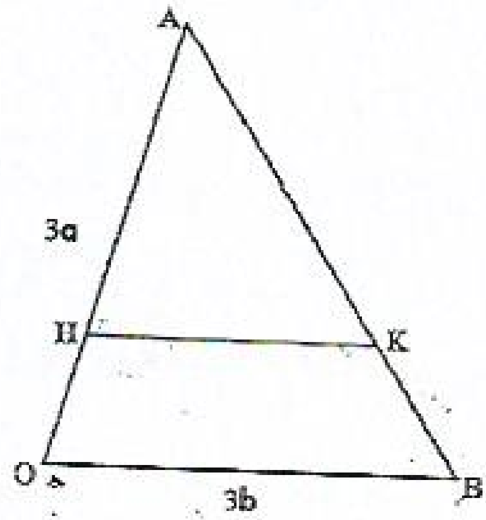
Given that $R = 4$ when $v = 20$ and that $R = 10$ when $v = 40$,

find

(i) the value of c and the value of d,

(ii) v when $R = 3$. [5]

(b)



In the diagram, OAB is a triangle in which H and K are points on OA and BA respectively such that the ratio OH : HA = 1 : 2 and the ratio BK : KA = 1 : 2, $\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$.

Express in terms of **a** and/ or **b**

(i) 1. $\overrightarrow{OH}$,

2. $\overrightarrow{BA}$,

3. $\overrightarrow{BK}$,

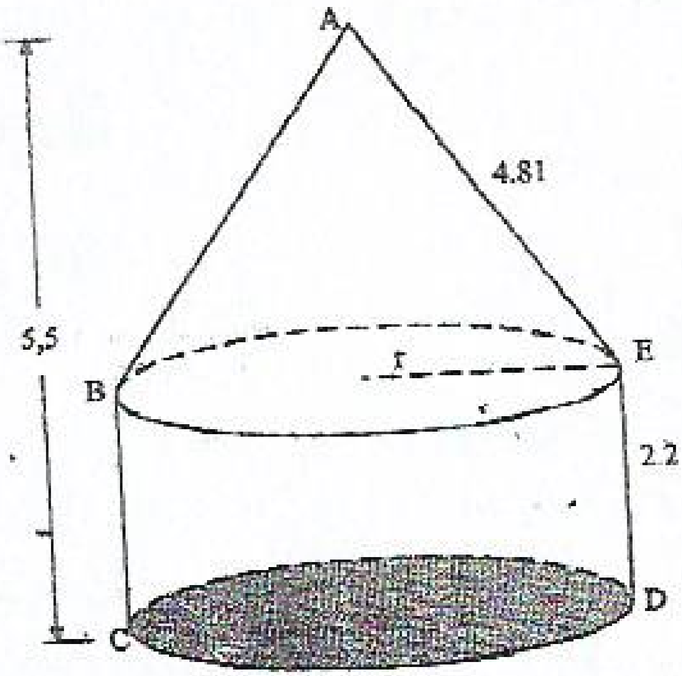
4. $\overrightarrow{KA}$,

5. $\overrightarrow{HK}$.

(ii) Write down the ratio $\dfrac{HK}{OB}$. [7]

10 (a) Solve the equation $3q^2 - 5q - 5 = 0$ giving your answers correct to two decimal places. [5]

(b)



use $\pi = \frac{22}{7}$

In the diagram, ABCDE is a composite solid which is made up of a cylinder and a cone with a common radius r metres. AE = 4, 81 m and DE = 2,2 m.

Calculate

(i) the common radius of the solid,

[7] (ii) the surface area of the solid excluding the shaded base,

(iii) the volume of the solid. [7]

[Curved surface area of a cone = πrl, volume of a cone = $\frac{1}{3}\pi r^2 h$]

[5]

11 Answer the whole of this question on a sheet of graph paper.

Below is an incomplete table of values for $y = x^3 - 5x + 3$.

x	-3	-2	-1	0	1	2	3
y	-9	m	7	3	-1	1	n

(a) Find the value of m and the value of n. [2]

(b) Using scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 5 units on the y-axis, draw the graph of $y = x^3 - 5x + 3$. [4]

(c) On the same axis, draw the line $y = x + 3$. [1]

(d) Write down the roots of the equation $x^3 - 5x + 3 = x + 3$. [3]

(e) Use your graph to estimate the gradient of the curve $y = x^3 - 5x + 3$ at the point where $x = -2$. [2]

12 Answer the whole of this question on a sheet of graph paper.

The table below shows the heights, h of 100 grade seven pupils correct to the nearest centimetre.

Height (hcm)	$110<h\leq115$	$115<h\leq120$	$120<h\leq125$	$125<h\leq130$	$130<h\leq135$	$135<h\leq140$	$140<h\leq145$	$145<h\leq150$
Frequency	2	14	24	30	16	10	3	1

The table below is the cumulative frequency table for the information above.

Height (hcm)	$h\leq115$	$h\leq120$	$h\leq125$	$h\leq130$	$h\leq135$	$h\leq140$	$h\leq145$	$h\leq150$
Cumulative Frequency	2	16	p	70	q	r	99	100

(a) Find the values of p, q and r. [2]

(b) Using a scale of 2 cm to represent 10 pupils on the vertical axis and 2 cm to represent a height of 5 cm on the horizontal axis, draw the cumulative frequency curve for the height distribution. [4]

(c) Use your graph to estimate the median height of these pupils. [1]

(d) Calculate the approximate mean height of these pupils correct to the nearest centimetre. [3]

(e) Two pupils are chosen at random from this group. Find the probability that both of them have a height of more than 125 cm but not more than 135 cm. [2]

ATHEMATICS
JUNE 2012
ANSWERS

(a) (i) $3\frac{3}{4} - 2\frac{1}{2} = \frac{15}{4} - \frac{5}{2} = \frac{15-10}{4} = \frac{5}{4}$

Answer $1\frac{1}{4}$

(ii) $\frac{2a-5}{a-4} - \frac{1}{2}$

$\frac{2(2a-5)-(a-4)}{2(a-4)}$

$\frac{4a-10-a+4}{2(a-4)}$

$\frac{3a-6}{2(a-4)}$

Answer $\frac{3a-6}{2a-8}$ or $\frac{3(a-2)}{2(a-4)}$

(b) $d(n - d^2)$

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

$\frac{1}{2}(4 - \frac{1}{4})$

$\frac{1}{2}\frac{(16-1)}{4}$

$\frac{1}{2}\left[\frac{15}{4}\right] = \frac{15}{8}$

Answer $1\frac{7}{8}$

(c) $11,40 — 95%
$x — 100%

Cost Price = $\frac{100}{95}$ x $11,40

= $12,00

2(a) $2k^2 - 7k - 15$

$2k^2 - 10k + 3k - 15$

$2k(k-5) + 3(k-5)$

$(2k+3)(k-5)$

(ii) $2am^2 - 2an^2 - bm^2 + bn^2$

$2a(m^2 - n^2) - b(m^2 - n^2)$

$(m^2 - n^2)(2a - b)$

$(m - n)(m + n)(2a - 6)$

(b) Mary $= \$(3x - 4y)$

Diana $= \$(2y - x)$

(i) $3x - 4y - (2y - x)$

$3x - 4y - 2y + x$

$4x - 6y$

(ii) $3x - 4y = 12$ (i)

$-x + 2y = 8$ (ii)

(i) x 1 $3x - 4y = 12$

(ii) x 2 $-2x + 4y = 16$

$x = 28$

$3x - 4y = 12$

$3(28) - 4y = 12$

$\frac{-4y}{-4} = \frac{-72}{-4}$

$y = 18$

3(a) $T = \frac{11v}{6} + 20$

$6 \times T = \frac{11v\,(6)}{6} + 6(20)$

$6T = 11v + 120$

$\frac{11v}{11} = \frac{6T - 120}{11}$

$V = \frac{6T - 120}{11}$

$V = \frac{6T - 120}{11}$

When $T = v$; then;

$V = \frac{6v - 120}{11}$

$11v = 6v - 120$

$11v - 6v = -120$

$\frac{5v}{5} = \frac{-120}{5}$

Answer $v = -24$

Area of a $\triangle$ = $\frac{1}{2} ab \sin\theta$

$\frac{1}{2}(8 \times 7) \sin AMC = 25$

$28 \sin AMC = 25$

$\sin AMC = \frac{25}{28}$

$AMC = \sin^{-1}\left(\frac{25}{28}\right)$

AMC = 63,2°

$p = \begin{pmatrix} 4 & -3 \\ 5 & 2 \end{pmatrix}$ and $Q = \begin{pmatrix} 7 & 3 \\ 4 & 6 \end{pmatrix}$

Inverse of Q

$1 Q 1 = (7 \times 6) - (4 \ 3)$

$1 Q 1 = 42-12$

$1 Q 1 = 30$

$Q^{1} = \frac{1}{30} \begin{pmatrix} 6 & -3 \\ -4 & 7 \end{pmatrix}$

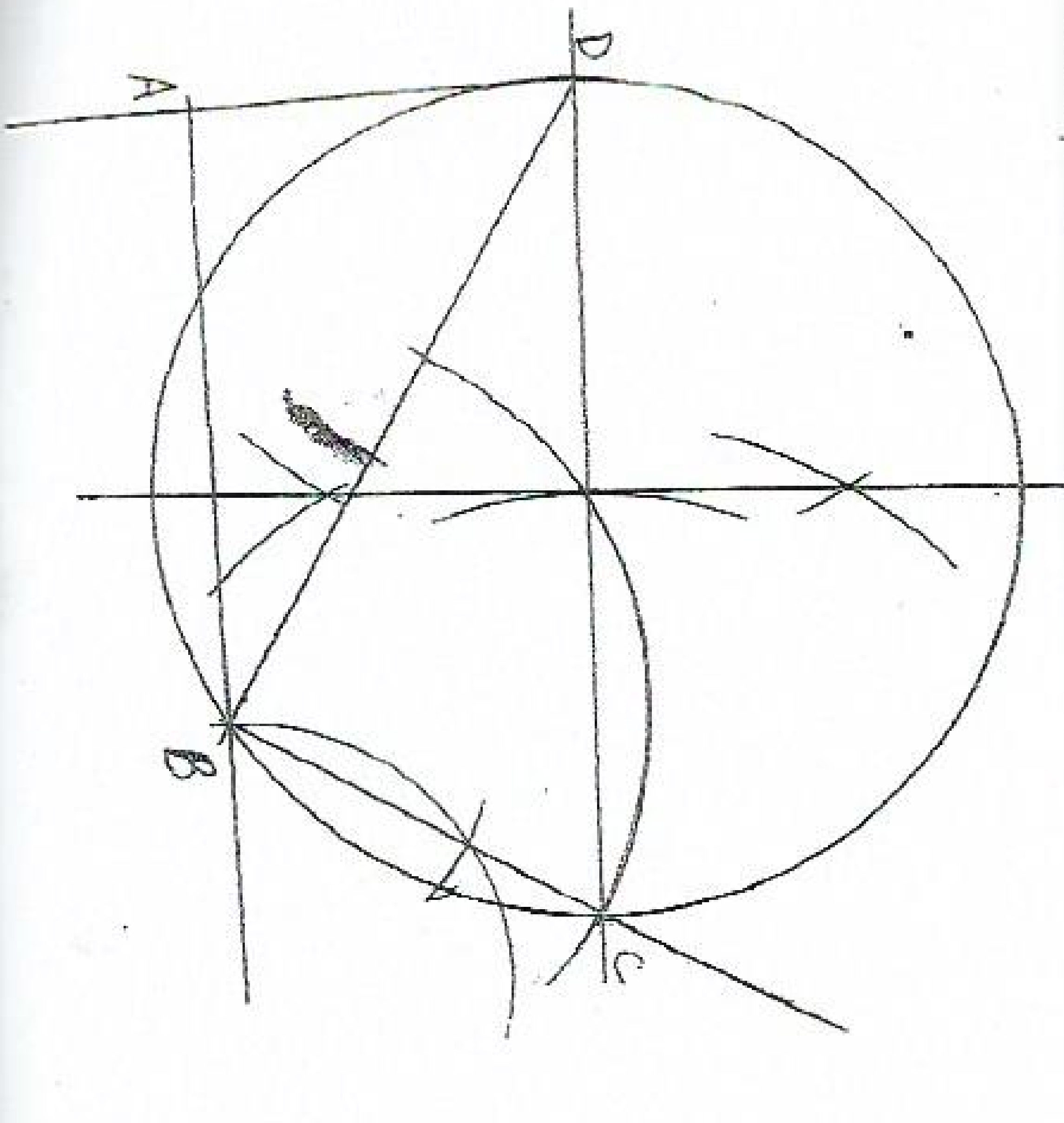
$P + R = Q$

$\begin{pmatrix} 4 & -3 \\ 5 & 2 \end{pmatrix} = R = \begin{pmatrix} 7 & 3 \\ 4 & 6 \end{pmatrix}$

$R = \begin{pmatrix} 7 & 3 \\ 4 & 6 \end{pmatrix} - \begin{pmatrix} 4 & -3 \\ 5 & 2 \end{pmatrix}$ **$R = \begin{pmatrix} 3 & 6 \\ -1 & 4 \end{pmatrix}$**

Diagram

JUNE 2012 - QUESTION 4.



c) the locus of points equidistant from the line AB

$MC^2 = 8^2 + (10 + 5)^2$

$MC^2 = 64 + 225$

$MC^2 = 289$

$MC = \sqrt{289}$

$MC = 17$

Bearing of C from M = $90^\circ + \tan^{-1}\left(\frac{8}{15}\right)$

$= 90^\circ + 28.1$

$= 118^\circ$

QPT $= 32^\circ$

QPS $= 90^\circ - 32^\circ$

QPS $= 58^\circ$

PSR $= 2 \times 32^\circ$

PSR $= 64^\circ$

PRO $= 90^\circ - 64^\circ$

PRO $= 26^\circ$

P (3 ; -4) and Q (-1 ; 2)

$M = \frac{2-(-4)}{-1-3}$

$M = \frac{6}{-4}$

$M = \frac{-3}{2}$

$\frac{-3}{2} = \frac{y+4}{x-3}$

$-3(x-3) = 2(y+4)$

$-3x + 9 = 2y + 8$

$2y + 3x = 9 - 8$

$2y + 3x = 1$

$\frac{3}{2x-5} - \frac{4}{x-3} = 0$

$\frac{3}{2x-5} = \frac{4}{x-3}$

$3(x-3) = 4(2x-5)$

$3x - 9 = 8x - 20$

$3x - 8x = -20 + 9$

$\frac{-5x}{-5} = \frac{-11}{-5}$ Answer $x = 2\,{}^1/_5$

(c)(i) APD is similar to BPC

(ii) $\frac{\text{Area of } \triangle APD}{\text{Area of } \triangle CPD} = \frac{3}{4}$

(iii) Area of $\triangle$ CPD = $8cm^2$

Area of APD = ¾ x $8cm^2$

= $6cm^2$

APD = BPC

$\frac{AP}{BP} = \frac{PD}{PC} = \frac{AD}{BC} = \frac{3}{6} = \frac{1}{2}$

$\frac{\text{Area} \triangle APD}{\text{Area} \triangle BPC} = (½)^2$

Area$\triangle$ BPC = $\frac{4}{1}$ x $6cm^2$

= $24cm^2$

$\frac{\text{Area of } \triangle BPA}{\text{Area of } \triangle BPC} = \frac{3}{4}$

Area of $\triangle$ BPA = ¾ x $24cm^2$

=$18cm^2$

Area of quadnlateral ABCD =

= $8cm^2$ + $6cm^2$ + $24cm^2$ + $18cm^2$

= $56cm^2$

SECTION B

7(a) GEF = $24^0 + 52^0$

GEF = 76^0

(b)(i) $\frac{6}{GE}$ = Sin 52^0

6 = GE Sin 52^0

GE = $\frac{6}{\text{Sin } 52}$

GE = 7,6

(ii) $(FG)^2 = 7{,}6^2 + 9^2 - 2 \times 7{,}6 \times 9 \text{ Cos } 76$

$(FG)^2 = 57{,}97 + 81 - 136{,}8 \text{ Cos } 76$

$FG^2 = 138{,}97 - 136{,}8 \text{ Cos } 76$

$FG^2 = 105{,}88$

FG = $\sqrt{105{,}88}$ FG = 10,29

$= 10,3m$

$$\frac{\sin GFE}{7,6} = \frac{\sin 76}{10,29}$$

$$\sin GFE = \frac{7,6 \sin 76}{10,29}$$

$\sin GFE = 0,71667$

$EFE = \sin^{-1}(0,71667)$

$EFE = 45,78^\circ$

Depression of G from F

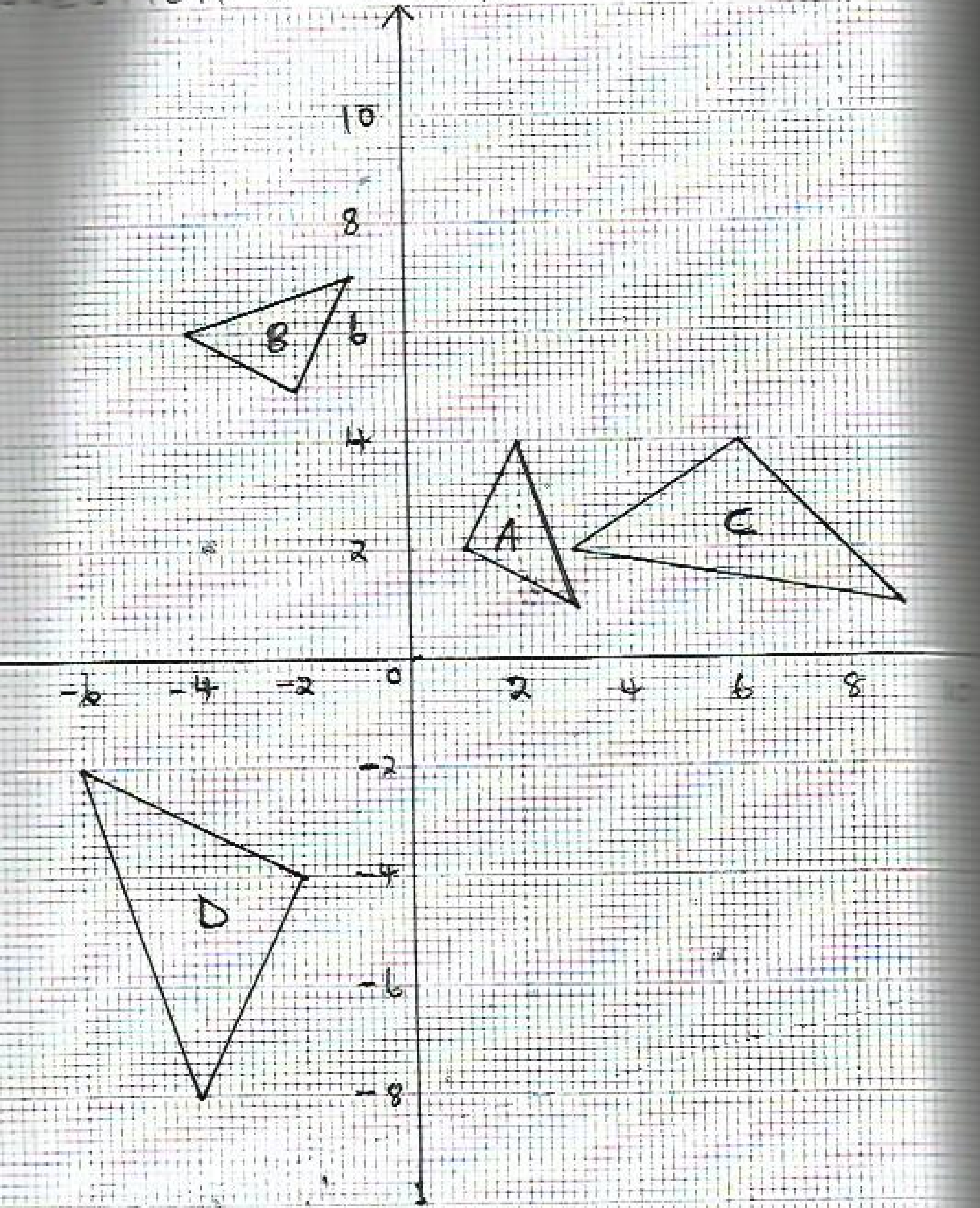
$= 45,78^\circ + 24$

$= 69,78^\circ$

$= 69,8^\circ$

Diagram

QUESTION 8 J. 2012



Use a set – square to find the co-ordinates of $\triangle B$

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 3 & 1 & 2 \\ 1 & 2 & 4 \end{pmatrix} = \begin{pmatrix} 9 & 3 & 6 \\ 1 & 2 & 4 \end{pmatrix}$$

$3a + b = 9$ - - (i)

$a = 2b = 3$ - - - (ii)

$3a + b = 9$

(11) x 3 $\quad \underline{3a + 6b = 9}$

$-5b = 0$

$b = 0$

$3a + 0 = 9$

$\frac{3a}{3} = \frac{9}{3}$

$a = 3$

$3c + d = 1$ - - - - (iii)

$c + 2d = 2$ - - - (iv)

$\underline{3c + d = 1}$

$\frac{5d}{5} = \frac{-5}{-5}$

$d = 1$

$3c + 1 = 1$

$c = 0$

$P = \begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$

Matrix Operator $= \begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$

(iii) The transformation is a one-way stretch X – axis being invariant

d) $\begin{pmatrix} -2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 3 & 1 & 2 \\ 1 & 2 & 4 \end{pmatrix} = \begin{pmatrix} -6 & -2 & -4 \\ -2 & -4 & -8 \end{pmatrix}$

$\triangle C$ has vertices $(-6; -2)$; $(-2; -4)$ And $(-4; -8)$

9) $R = c + dv^2$

$4 = c + d(20)^2$

$4 = c + 400d$ - - - (i)

$10 = c + d(40)$

$10 = c + 1600d$ - - - (ii)

$c + 400d = 4$

$\underline{c + 1600d = 10}$

$-1200 = \underline{-6}$

$-1200 \quad -1200$

$d = 0{,}005$

$c + 400\,(0{,}005) = 4$

$c = 4 - 2$

$c = 2$

$R = 2 + 0{,}005\,x^2$

(ii) $R = 2 + 0{,}005x^2$

When $R = 3$

$3 = 2 + 0{,}005\,x^2$

$0{,}005v^2 = 1$

$v^2 = \dfrac{1}{0{,}005}$

$v^2 = 200$

$v = \sqrt{200}$

$v = \sqrt{100 \times 2}$

$v = 10\sqrt{2}$

OR $v = 14{,}1$

$\overline{OH} = 1/3\ \overline{OA}$

$\overline{OH} = 1/3\ (3a)$

$OH = a$

2. $\overline{BA} = \overline{BO} + OA$

$\overline{BA} = 3b + 3a$

3. $\overline{BK} = \frac{1}{3}\ \overline{BA}$

$\overline{BK} = \frac{1}{3}(-3b + 3a)$

$\overline{BK} = a - b$

4. $\overline{KA} = \frac{2}{3}\overline{BA}$

$\overline{KA} = \frac{2}{3}(3a - 3b)$

$\overline{KA} = 2a - 2b$

5. $\overline{HK} = \overline{HA} + \overline{AK}$

$HK = 2a + (-2a + 2b)$

$\overline{HK} = 2b$

(ii) **HK = 2**

(iii) $\frac{HK}{OB} = \frac{3}{2}$

(c) $3q^2 - 5a - 5 - a$

$$q = \frac{-b \pm \sqrt{b2 - 4ac}}{2a}$$

$$q = \frac{5 \pm \sqrt{(-5)^2 - 4(3 \times -5)}}{2(3)}$$

$$q = \frac{5 \pm \sqrt{25 + 60}}{6}$$

$$q = \frac{5 \pm \sqrt{85}}{6}$$

$$q = \frac{5 + \sqrt{85}}{6} \text{ or } \frac{5 - \sqrt{85}}{6}$$

$q = 2{,}37$ or $0{,}70$

b(i) Height of cone $= 5{,}5 - 2{,}2$

$= 3{,}3m$

$r^2 + 3{,}3^2 = 4{,}81^2$

$r^2 + 10{,}89 = 23{,}1361$

$r^2 + 23{,}1361 - 10{,}89$

$r^2 + 12{,}2461$

$r = \sqrt{12{,}2461}$

$r = 3{,}499$

$r = 3{,}50m$

(ii) Curved Surface Area of Cone $= \pi r C$

$= \frac{22}{7} \times 3{,}5 \times 4{,}81$

$= 52{,}90m^2$

Curved Surface area of Cylinder $= 2\pi r h$

$= \quad 2 \times \frac{22}{7} \times 3{,}5 \times 2$

$= \quad 48{,}39 \text{ m}^2$

Total Surface Area $= 52{,}9\text{m}^2 + 48{,}39\text{m}^2$

$101{,}3\text{m}^2$

Volume of cylinder $= \quad \pi r^2$

$= \quad \frac{22}{7} \times (3{,}5)^2 \times 2{,}2$

$= \quad 84{,}65\text{m}^3$

Volume of $= \quad {}^1/_3\, \pi r^2$

$= \quad \frac{1}{3} \times \frac{22}{7} \times 3{,}5^2 \times 3{,}3$

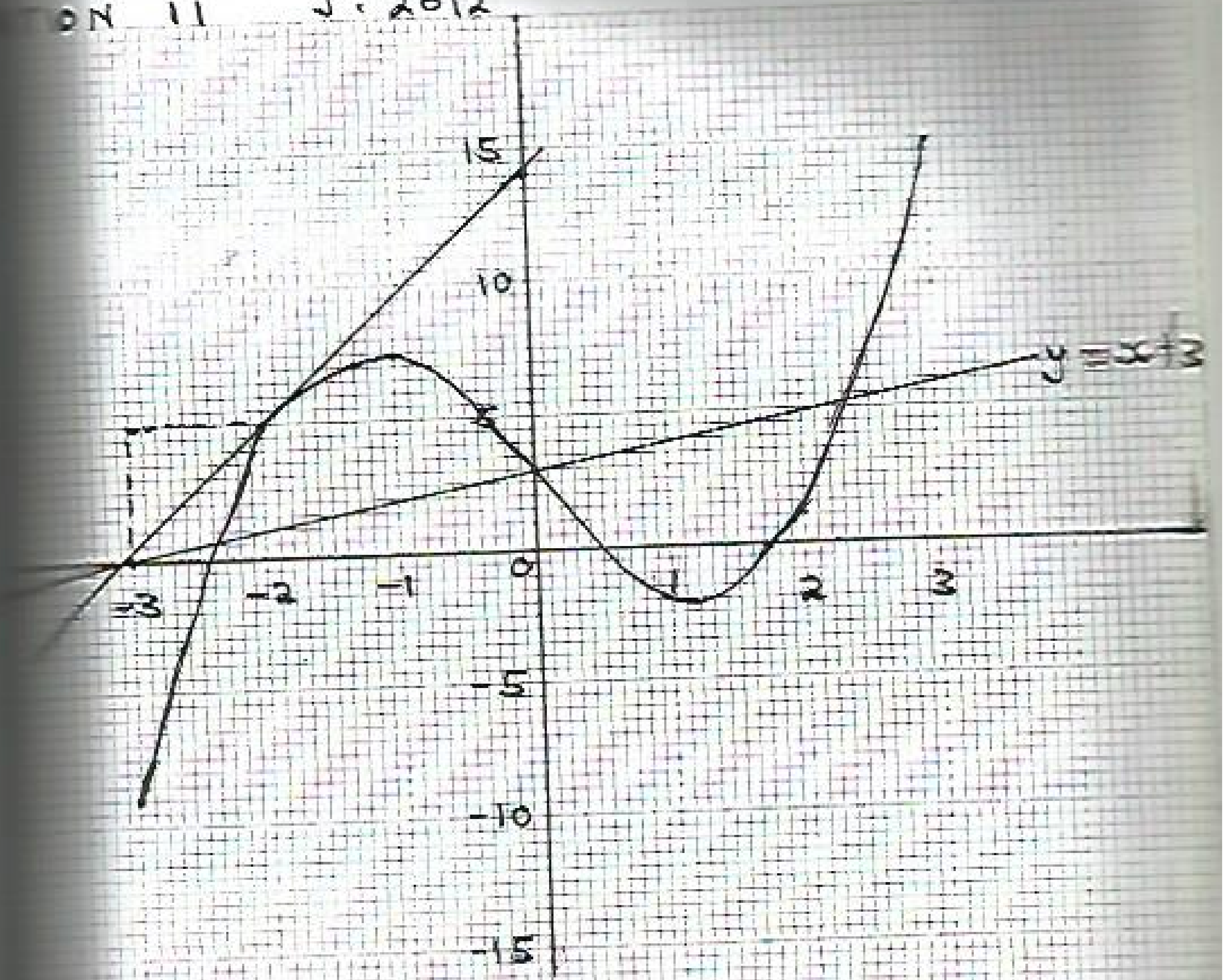
$= \quad 42{,}33\text{m}^3$

Total Volume $= 84{,}65 \text{ m}^2 + 42{,}33\text{m}^3$

$= \quad 126{,}98\text{m}^3$

<u>Diagram</u>

ON 11 J. 2012



n = (-2)³ − 5(−2) + 3
= −8 + 10 + 3
= 5

n = 3³ − 5(3) + 3
= 27 − 15 + 3
= 15

(d) Roots are
−2,45 or 2,45

(e) Gradient = $\frac{0-5}{-3-(-2)}$
= 5

y = x + 3

x	0	−3
y	3	0

12 $p = 16 + 24$

$\underline{p = 40}$

$q = 70 + 16$

$\underline{q = 86}$

$r = 86 + 10$

$\underline{r = 96}$

Median $= \frac{1}{2}(n+1)^{th}$

$= \frac{1}{2}(100+1)^{th}$

$= 55{,}5^{th}$

Median height = 127,5cm

Height	Frequency	Class Centre	F x h
$110 < h \le 115$	2	113	226
$115 < h \le 120$	14	118	1652
$120 < h \le 125$	24	123	2952
$130 < h \le 135$	16	133	2128
$135 < h \le 140$	16	138	1380
$140 < h \le 145$	3	143	429
$145 < h \le 150$	1	148	148
TOTAL	100	TOTAL	12 755

Mean height $= \frac{\sum m \times f}{\sum f}$

$= \frac{12755}{100}$

$= 127{,}55$

Number of pupils with a height in the range $(125 \le h \le 135) = 86 - 40$

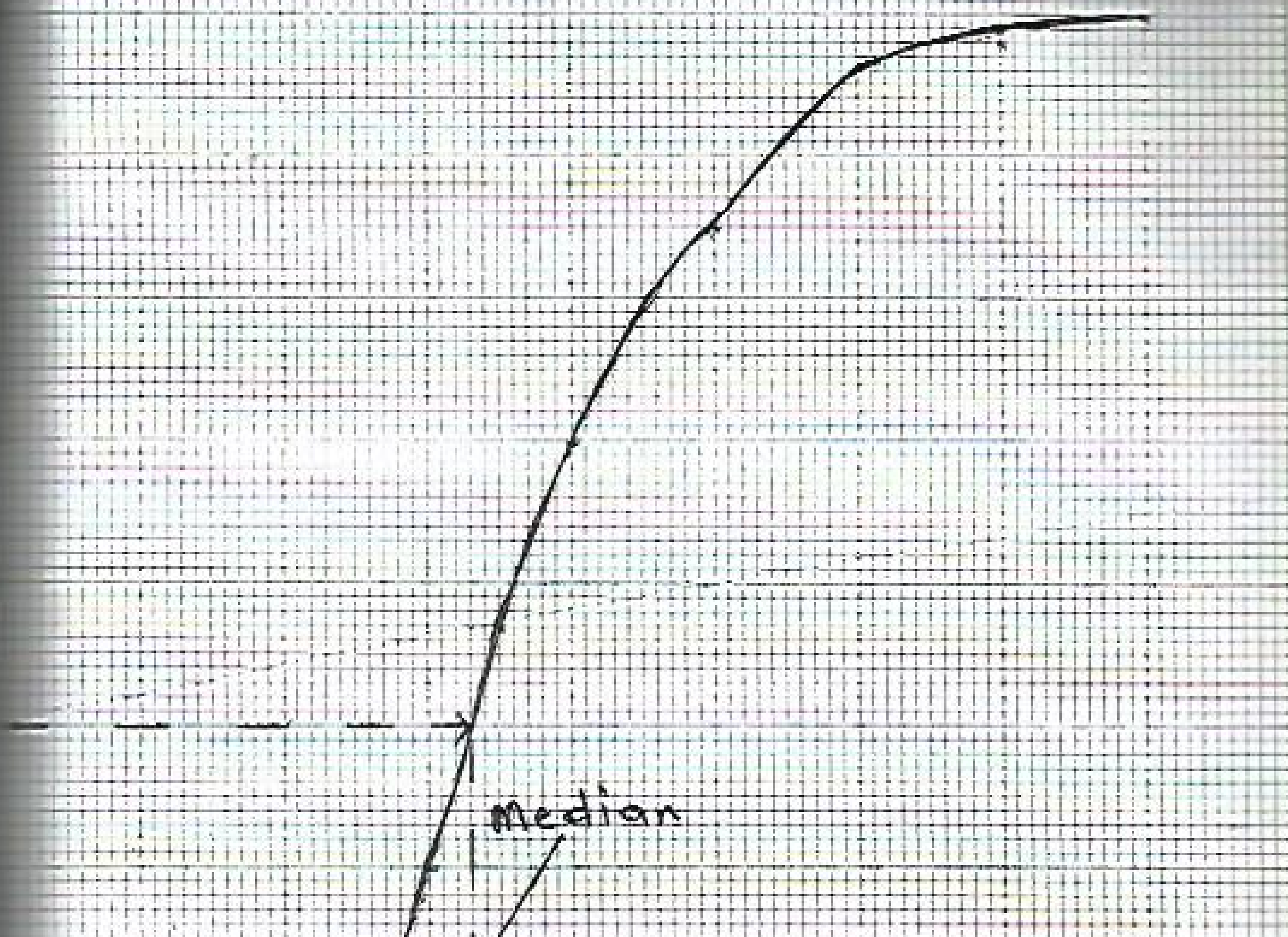
$= 46$

Probability $= \frac{46}{100} \times \frac{45}{99}$

$= \frac{23}{110}$

$= \underline{0{,}2091}$

| 64 | 2 | 9· 20 | 2



d) Mean

$$\frac{\text{Sum (mid Point} \times \text{Frequency)}}{100}$$

= 2+16+24 = 42

(b) Required is 30+16

= 70+16 = 86

= 46

= 86+10 = 96

$$= \frac{46}{100} + \frac{45}{99} = \frac{23}{110}$$

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4028/2

PAPER 2

REPLACEMENT PAPER

NOVEMBER 2012 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 13 printed pages and 3 blank pages.

Section A [64 marks]

Answer all the questions in this section.

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

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

(c) Factorise completely

(i) $x^2 + 2x - 3$,

(ii) $x^2 - 1$.

Hence write down the lowest common multiple (L.C.M) of $x^2 + 2x - 3$ and $x^2 - 1$.

(d) If $m = 2{,}6 \times 10^{-3}$ and $n = 4{,}0 \times 10^{7}$, calculate mn, giving your answer in standard form.

2 (a) It is given that $\xi = \{1; 2; 3; \ldots; 8; 9; 10\}$, with subsets A and B such that A is a set of perfect squares and B is a set of multiples of 3.

(i) Draw a Venn diagram to represent the sets above.

(ii) Find $n(A \cup B)$.

(b) A salesman's salary is partly constant and partly varies directly as the total sales he makes for the month. If sales are \$10 000, his salary is \$550 and if sales are \$15 000, his salary is \$600.

Find his salary if sales are \$25 000.

3 (a) (i) Simplify $2m^3 \times 3m^0$.

(ii) Evaluate $\sqrt{12\frac{1}{4}}$.

(b) (i) Express $\log_5(x+1) - \log_5(2x)$ as a single logarithm.

(ii) Solve the equation

$$\log_5(x+1) - \log_5(2x) = 1.$$

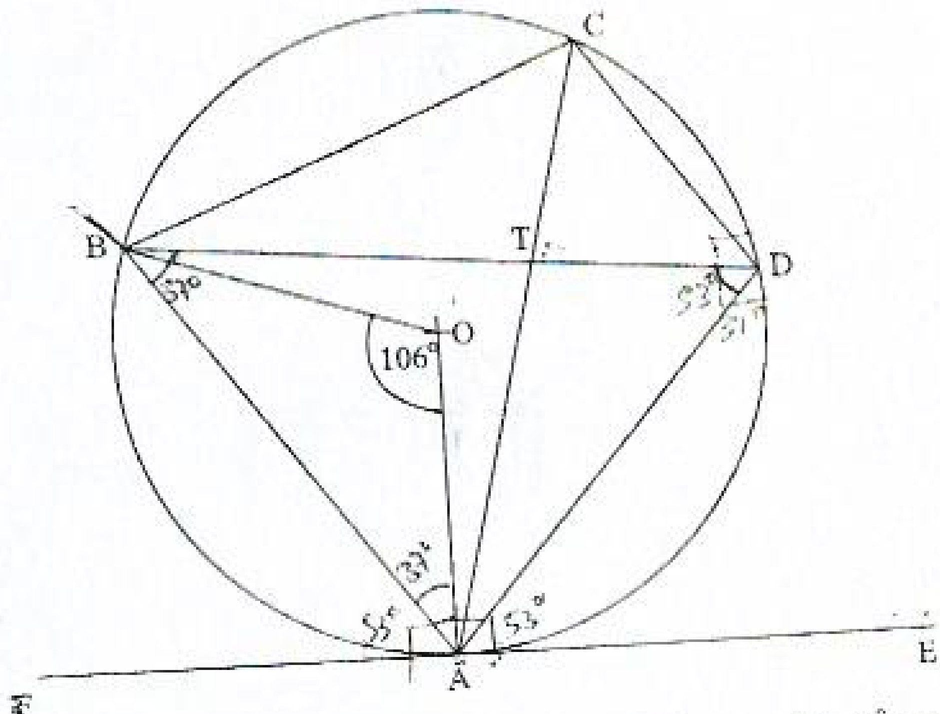
(c) Solve the equations

(i) $1\frac{1}{5} = x - 4$,

[4]

(ii) $3^{2x-1} = \frac{1}{9}$.

(a)



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

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

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

(iii) Calculate

1. $A\hat{D}B$,

2. $A\hat{B}O$,

3. $B\hat{A}F$.

[6]

(b) (i) Solve the inequality $5x - 6 < 2x - 3 \leq 3x + 1$, giving your answer in the form $a \leq x < b$, where a and b are integers.

(ii) Illustrate your solution on a number line.

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

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

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

(i) triangle PQR with QR = 8 cm, $P\hat{Q}R = 45^\circ$ and $Q\hat{R}P = 60^\circ$.

(ii) the bisector of $P\hat{R}Q$.

(iii) Measure and write the length of PR.

(iv) Calculate the area of triangle PQR.

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

(a) Solve the equation $3x^2 - 5x - 7 = 0$, giving your answers correct to 2 decimal places. [5]

(b)

Date	Account details	Amount (USD)
	Balance B/F	529,74
	Interest at 2,5%	....
	SUBTOTAL (1)	....
	RENTAL FROM 01/07/09 TO 31/07/09	10,00
26/06/09	METERED UNITS PREVIOUS READING CURRENT READING 55 778 55 926	31,08
	SUBTOTAL (2)	41,08
	VAT AT 15%	6,16
	AMOUNT DUE	....

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

Calculate

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

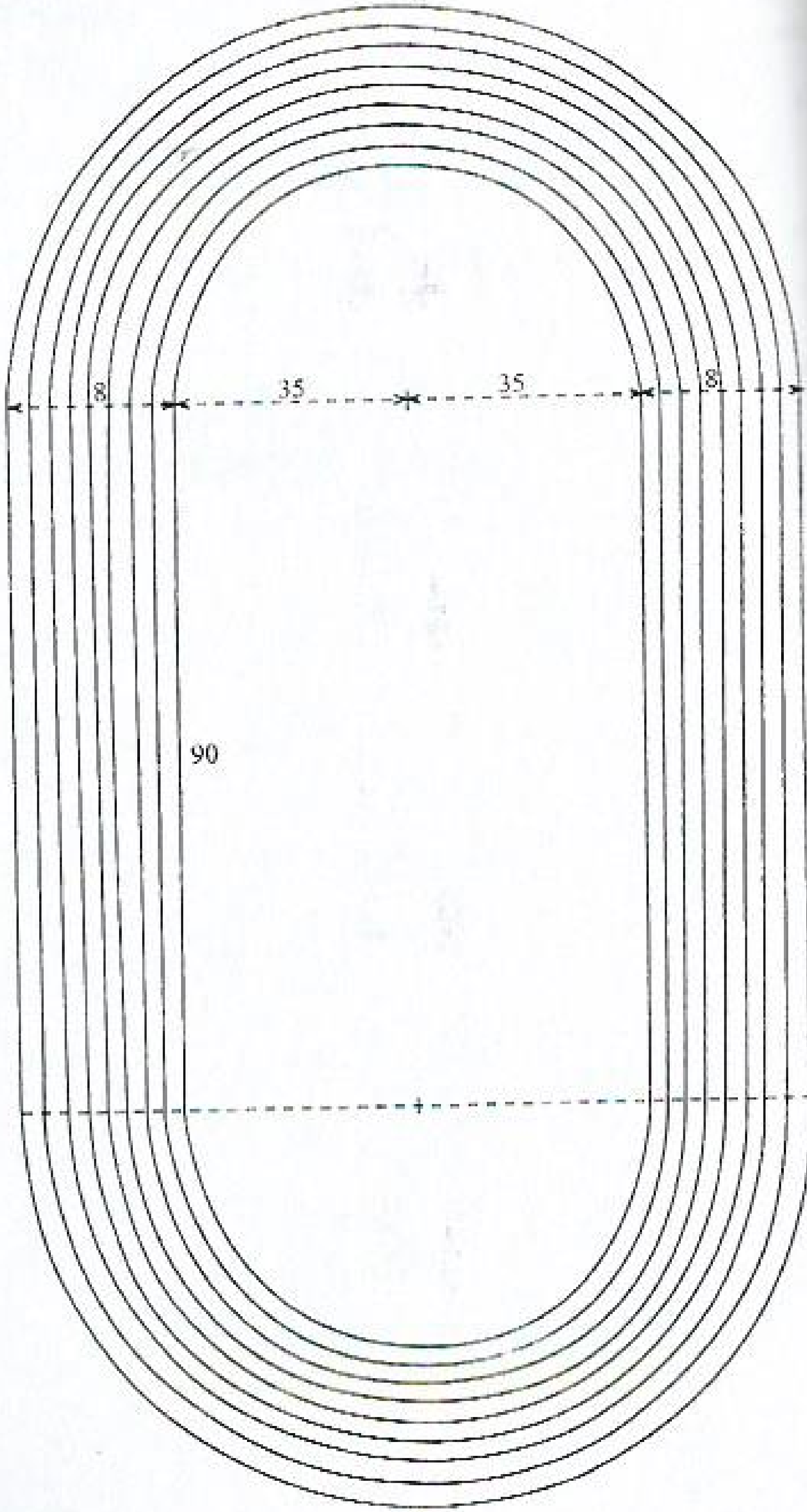
(ii) the subtotal (1),

(iii) the number of units used,

(iv) the cost of one unit,

(v) the total amount due. [7]

9



...agram shows an athletics running track enclosing a rectangular field 90 m ... m, with semi-circular ends. The track is made up of 8 lanes each 1 m wide.

... $\frac{22}{7}$ for π

Calculate

(i) the length of the inner boundary of the first lane,

(ii) 1. the length of the inner boundary of the second lane,

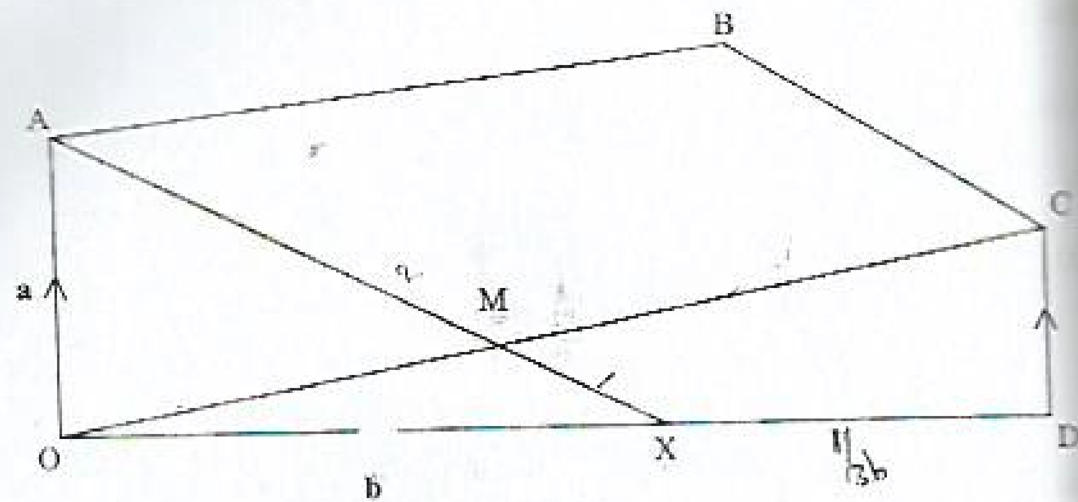
2. the distance between the starting points of lane 1 and lane 2 if competitors in lanes 1 and 2 are to run the same distance in one lap,

(iii) the area covered by the 8-lane running track. [10]

The track is to be covered by an artificial grass costing $200 per square metre.

Calculate the cost of covering the track. [2]

10



OABCD is a pentagon such that AB is parallel to OD and DC is parallel to OA. M is the mid-point of OC such that AM produced cuts OD at X.

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OD} = \mathbf{b}$ and $\overrightarrow{OD} = 3\overrightarrow{XD}$.

2 : 1

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

(i) $\overrightarrow{AD}$,

(ii) $\overrightarrow{OX}$,

(iii) $\overrightarrow{AX}$. [3]

(b) If $\overrightarrow{MX} = k\overrightarrow{AX}$, express $\overrightarrow{MX}$ in terms of **a**, **b** *and* k. [1]

(c) Given that $\overrightarrow{DC} = h\overrightarrow{OA}$, express in terms of **a**, **b** *and* h,

(i) $\overrightarrow{OM}$,
(ii) $\overrightarrow{MX}$. [3]

(d) Using your results in **(b)** and **c(ii)**, find the value of h and the value of k. [3]

(e) Using your values of h and k in **(d)**, express in terms of **a** and/or **b**,

(i) $\overrightarrow{MX}$,

(ii) $\overrightarrow{DC}$. [2]

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

The following is an incomplete table of values for $y = 2x^2 - 5x - 3$.

x	-2	-1	$-\frac{1}{2}$	0	1	2	3	4
y	15	4	p	-3	-6	q	0	9

(a) Calculate the value of p and the value of q. [2]

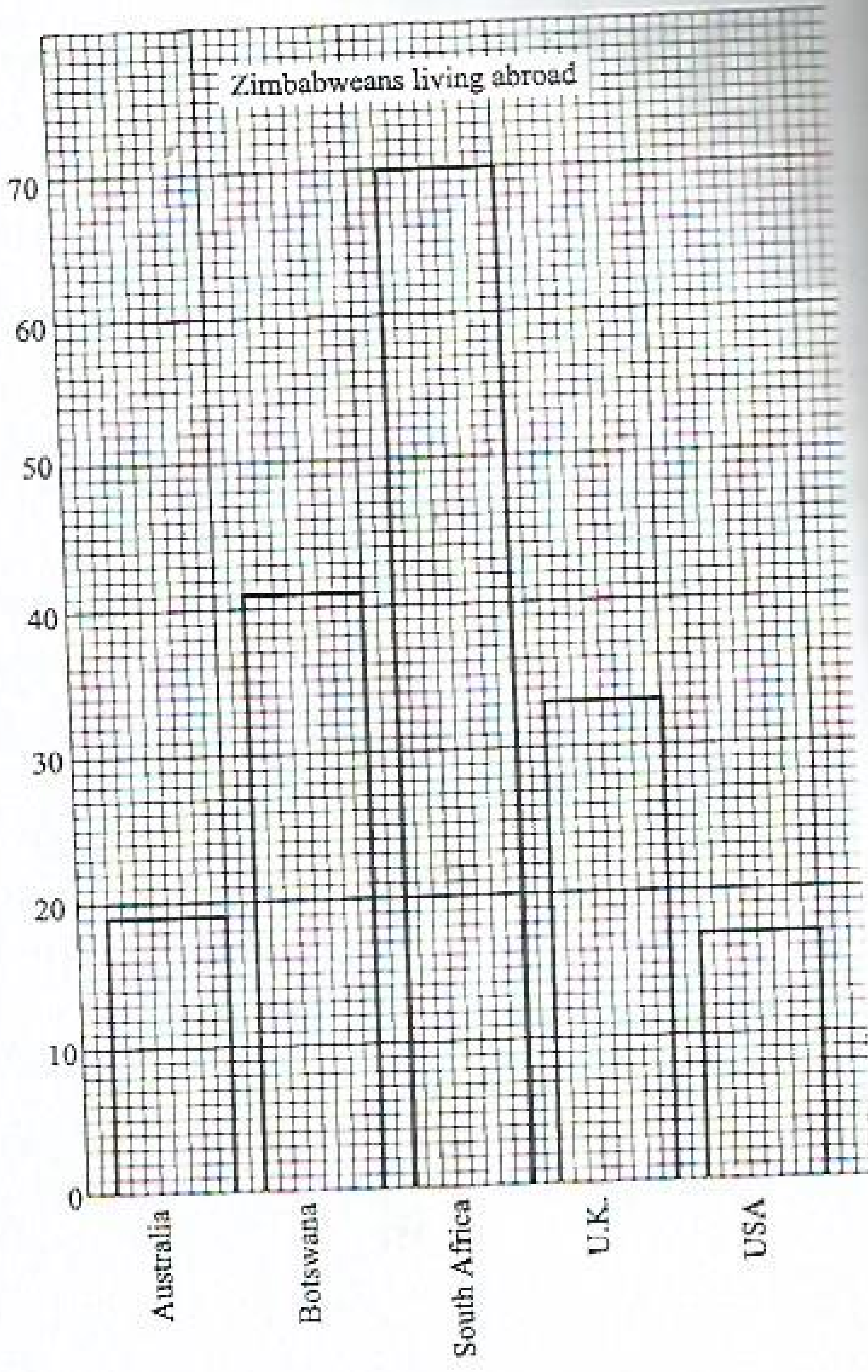
(b) Using a horizontal scale of 2 cm to represent 1 unit and a vertical scale of 2 cm to represent 2 units, draw the graph of $y = 2x^2 - 5x - 3$ for $-2 \leq x \leq 4$ and $-8 \leq y \leq 16$. [4]

(c) Find the gradient of the curve when $x = 1$. [2]

(d) Use your graph to solve the equation $2x^2 - 5x - 3 = -4$. [2]

(e) Find the area bounded by the curve and the x-axis from $x = 1$ to $x = 3$. [2]

12


Zimbabweans living abroad
70
60
50
40
30
20
10
0
Australia
Botswana
South Africa
U.K.
USA

The bar graph shows the results of a survey, carried out at a wedding party, on a group of Zimbabweans living abroad. Use the graph to answer the following questions.

(a) (i) Find the total number of Zimbabweans, living outside the country, who attended the wedding.

(ii) State the country in which most people in the survey live.

(iii) Calculate the percentage of Zimbabweans who live in Australia and the U.S.A combined. [5]

(b) Two people are chosen at random from the group in the survey, one after the other.

Find the probability that

(i) both live in Botswana,

(ii) the first lives in South Africa and the second lives in the U.S.A. [4]

(c) The survey results can be represented on a pie chart. Draw and label clearly the pie-chart. [3]

MATHEMATICS
NOVEMBER 2012
PAPER 2

1(a) $2\frac{1}{2} - 3\frac{5}{6} + 1\frac{2}{3}$

Apply BOMDAS

$\frac{5}{2} - (\frac{23}{6} + \frac{5}{3})$

$\frac{5}{2} - \frac{11}{2} = -\frac{6}{2}$

$\underline{= -3}$

(b) Who failed $= 400 - 150$

$= 250$

$\frac{250}{400} \times 100 = \underline{\mathbf{62{,}5\%}}$

(c) (i) $x^2 + 2x - 3 = \underline{(x + 3)(x - 1)}$

(ii) $x^2 - 1$ Difference of two squares

$x^2 - 1$ $\underline{(x + 1)(x - 1)}$

LCM $x^2 + 2x - 3 = (x + 3)(x - 1)$

$x^2 - 1 = (x + 1)(x - 1)$

LCM $= \underline{(x + 3)(x + 1)(x - 1)}$

(d) $(2{,}6 \times 10^{-3}) \times (4{,}0 \times 10^{7})$

$(2{,}6 \times 4) \times (10^{-3} \times 10^{7})$

$= 10{,}4 \times 10^{-3+7}$

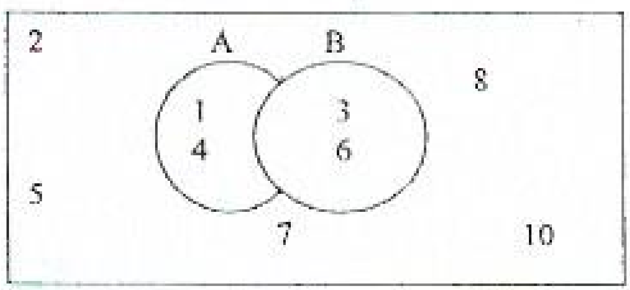
$= 10{,}4 \times 10^{4}$

$= 1{,}04 \times 10^{1} \times 10^{4}$

$= \underline{\mathbf{1{,}04 \times 10^{5}}}$

2(a)(i) Elements of A {1 , 4 , 9}

B {3 , 6 , 9}



(ii) n (AUB) $= \underline{5}$

(b)

S a + T

S = a + bT

550 = a + 10000b (1)

600 = a + 15000b (2)

(2) (1) $\$50 = 5000b$

$b = \frac{1}{100}$

$600 = a + 15\,00 \times \frac{1}{100}$

$600 = a + 150$

$\underline{a = 450}$

$S = 450 + \frac{1}{100}T$

$S = 450 + \frac{1}{100} \times 25\,000$

$= 450 + 250$

$= \underline{\$700}$

3(a)(i) $2m^3 \times 3^0 m = 2m^3 \times 3 \times 1$

$= 2m^3 \times 3$

$= \underline{6m^3}$

(ii) $\sqrt{12\tfrac{1}{4}} = \sqrt{\frac{49}{4}}$

$= \frac{7}{2}$

$= \underline{3\tfrac{1}{2}}$

(b)(i) $\log_5 (x + 1) - \log_5 (2x)$

$\log_5\left(\frac{x+1}{2x}\right)$

(ii) $\log_5 (x + 1) - \log_5 (2x) = 1$

$\log_5\left(\frac{x+1}{2x}\right) = 1$

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

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

$x + 1 = 10x$

$1 = 10x - x$

$1 = 9x$

$\underline{x = {}^1/_9}$

$1\,{}^{1}/_{5} = x - 4$
$\frac{6}{5} = x - 4$
$6 = 5(x - 4)$
$6 = 5x - 20$
$6 + 20 = 5x$
$26 = 5x$
$x = \frac{26}{5}$ $\qquad x = 5\,{}^{1}/_{5}$

(v) $3^{2x-1} = \frac{1}{9}$
$3^{2x-1} = 3^{-2}$
$2x - 1 = -2$
$2x = -2 + 1$
$2x = -1$ $\qquad x = -\frac{1}{2}$

4(a) (i) D A E = A B T and A C D

(ii) A B O $= (180 \quad 106) \div 2$
$= 74 \div 2$
$= \underline{37^\circ}$

(i) A D B $= 106 \div 2$
$= \underline{53^\circ}$

(3) B A F $= 90 - 37$
$= \underline{53^\circ}$

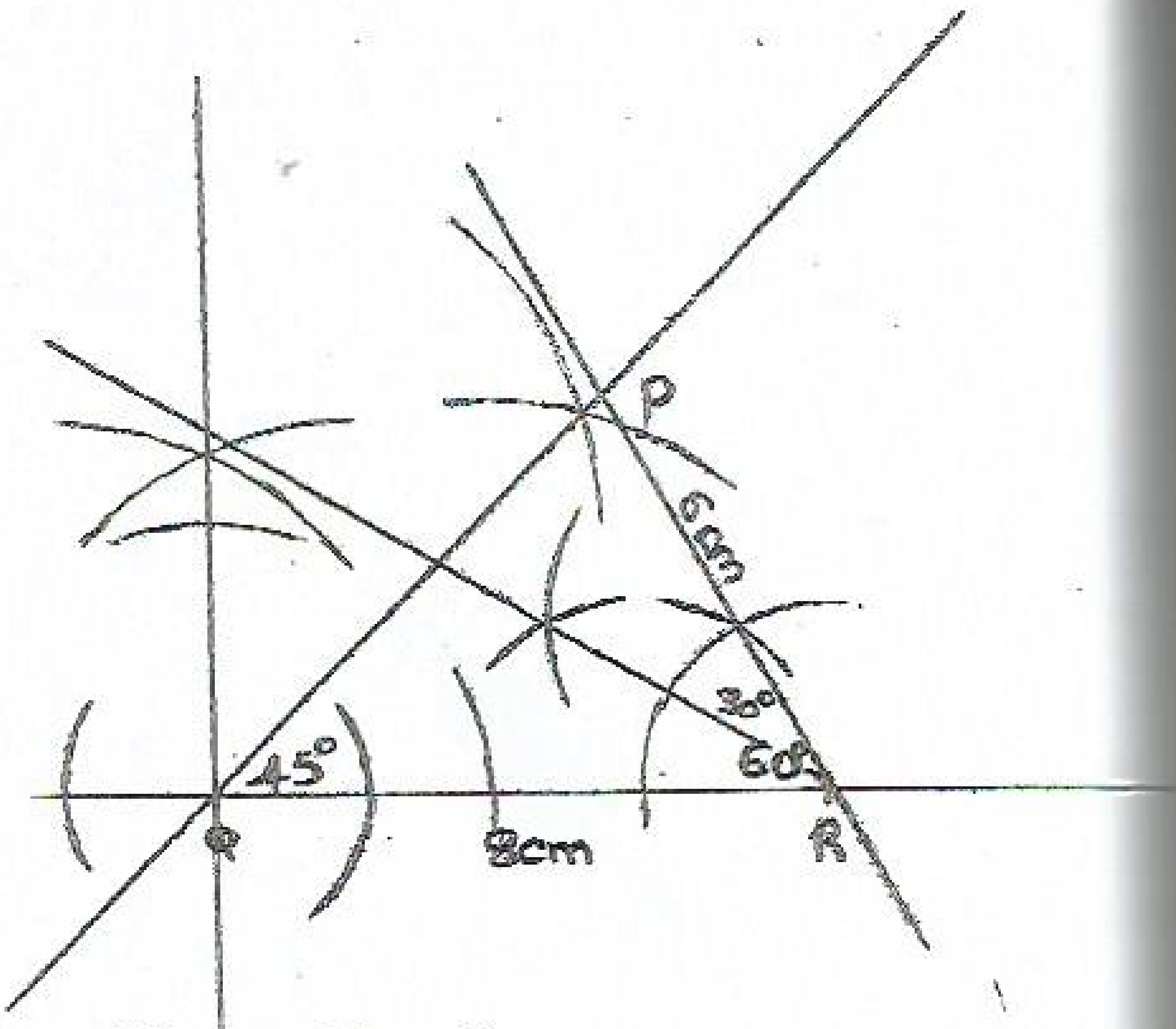
(ii) A D T = BTC

b(i) $5x - 6 < 2x - 3 \leq 3x + 1$
$5x - 6 < 2x - 3$
$5x - 2x < -3 + 6$
$3x < 3$
$\underline{x < 1}$

$2x - 3 \leq 3x + 1$
$2x - 3x \leq 1 + 3$
$-x \leq 4$
$x \geq -4$
$\underline{-4 \leq x < 1}$

(ii)

QUESTION 5, N 2012



(iii) PR = 6 cm

(iv) Area of PQR = $\frac{1}{2}ab\sin\theta$

$= \frac{1}{2}(8)(6)\sin 60$

$= 20{,}8\,cm^2$

(b) It is the locus of points equidistance from PR and RQ

$3x^2 - 5x - 7 = 0$

Apply Quadratic Formula

$$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$a = 3 \quad b = -5 \quad \& \quad c = -7$

$$= \frac{-(-5) \pm \sqrt{-5^2 - 4(3x - 7)}}{2(3)}$$

$$= \frac{5 \pm \sqrt{25 - 4(-21)}}{6}$$

$$= \frac{5 \pm \sqrt{25 + 84}}{6}$$

$$= \frac{5 \pm \sqrt{109}}{6}$$

$$= \frac{5 + \sqrt{109}}{6} \quad \text{or} \quad \frac{5 - \quad 109}{6}$$

$\underline{x = 2{,}57 \text{ or } 0{,}91}$

(ii) $\frac{2{,}5}{100} \times 529{,}74$

$= \underline{\$13{,}24}$

(iii) $529{,}74 + 13{,}24 = \underline{\$542{,}98}$

(iii) $55926 - 55\,778$

$= \underline{148 \text{ Units}}$

(iv) $\frac{31{,}08}{148} = \underline{\$0{,}21}$

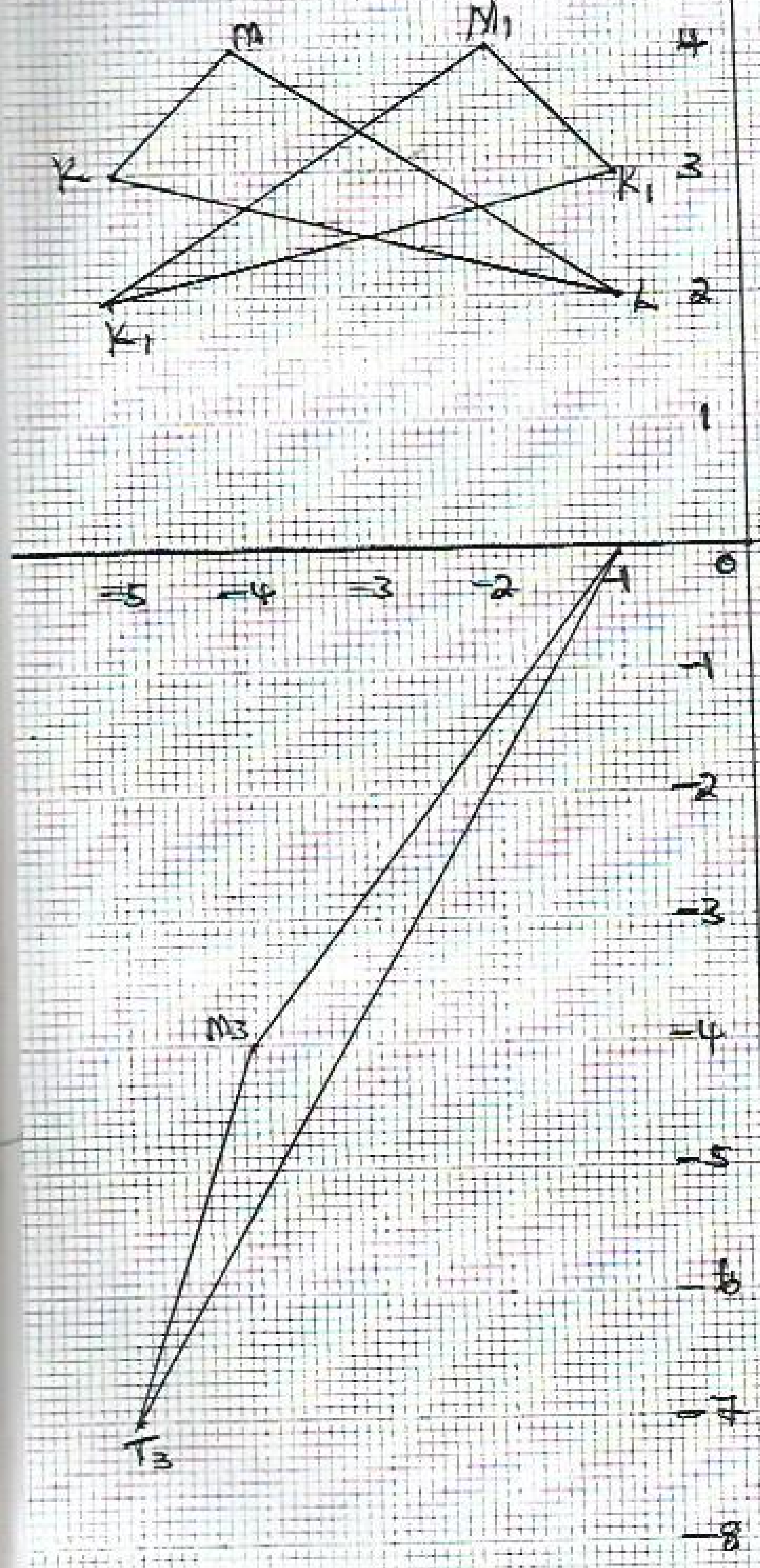
(v) $41{,}08 + 6{,}16 = 47{,}24$

$47{,}24 + \text{Sub Total (1)}$

$= 47{,}24 + 542{,}98$

$= \underline{590{,}22}$

QUESTION 7 Nov 2012



b Reflection line $x = -2$

c(i) $\begin{pmatrix}3\\1\end{pmatrix} - \begin{pmatrix}-4\\4\end{pmatrix} = ($

(ii) $K_2 = \begin{pmatrix}-5\\3\end{pmatrix} + \begin{pmatrix}7\\-5\end{pmatrix}$

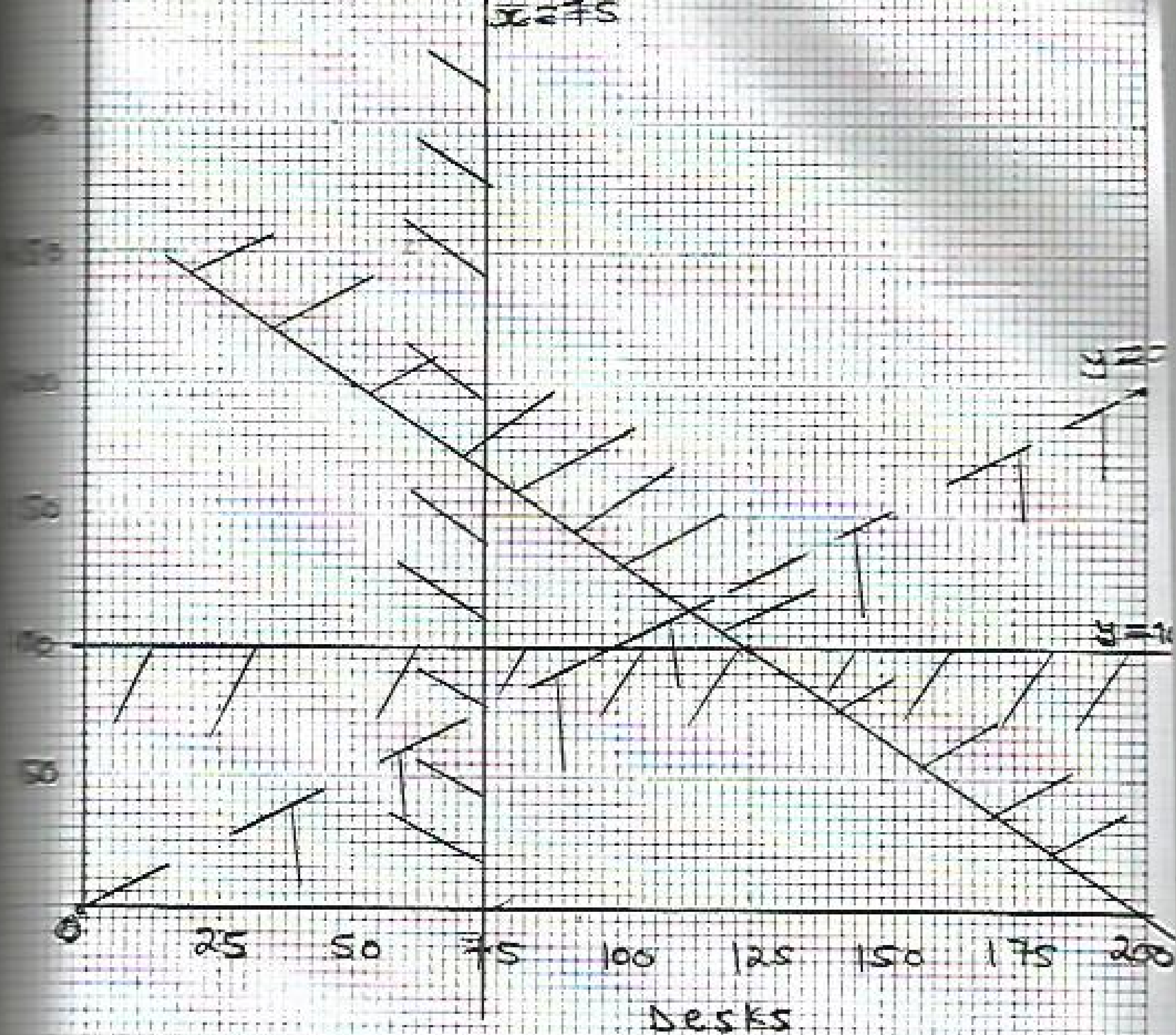
$L_2 = \begin{pmatrix}-1\\2\end{pmatrix} + ($

d(i) $\begin{pmatrix}1 & 0\\2 & 1\end{pmatrix}$

(ii) $\begin{pmatrix}1 & 0\\2 & 1\end{pmatrix}\begin{pmatrix}-5 & -1\\3 & 2\end{pmatrix}$

$= \begin{pmatrix}-5 & -1\\-7 & 0\end{pmatrix}$

N 8 Nov 2012



a(i) $x \geq 75$ and $y \geq 100$

(ii) $y > x$

(iii) $25x + 17{,}5y \leq 5000$

$250x + 175y \leq 50000$

$10x + 7y \leq 2000$

(c) 120 chairs and 120 desks

$(25 \times 120) + (17{,}5 \times 120) = 5100$

225 Chairs and 75 desks

$(17{,}5 \times 225) + (25 \times 75) = 5812{,}5$

9(a)(i) Length of arc

$\frac{180}{360} \times \pi d = \frac{180}{360} \times \frac{22}{7} \times 70$

$= \frac{1}{2} \times 22 \times 10$

$= 110$

$= (90 \times 2) + (110 \times 2)$

$= 180 + 220$

$= \underline{400m}$

(ii) $\frac{180}{360} \times \pi d$

$\frac{180}{360} \times \frac{22}{7} \times (70+2)$

$\frac{180}{360} \times \frac{22}{7} \times 72$

$= 113m$

$= (90 \times 2) + (113 \times 2)$

$= 180 + 226$

$= \underline{406m}$

(2) $406 - 400 = \underline{6m}$

(iii) Area of Circle + Area of Rectangle

$\pi r^2 + L \times W$

$\frac{22}{7} \times 43^2 + (90 \times 86)$

$\frac{22}{7} \times 1849 + (7740)$

$= 5811 + 7740$

$= 13551m^2$

$13551 - 6300 = \underline{906m^2}$

(b) Area of Track

Total Area – Area of field

$13551 - (90 \times 70)$

$13551 - 6\,300$

$= \underline{7251m^2}$

$= 7251 \times 200$

$\underline{\$1\,450\,200}$

(10a)(i) $\overrightarrow{AD} = \overrightarrow{AO} + \overrightarrow{OD}$

$= \underline{\vec{a} + \vec{b}}$

$\overrightarrow{OX} = \frac{2}{3}\overrightarrow{OD}$

$= \frac{2}{3b}$

$\overrightarrow{AX} = \overrightarrow{AO} + \overrightarrow{OX}$

$= \overrightarrow{a} + \frac{\overrightarrow{2b}}{3}$

MX = KAX

$MX = k(-a + \frac{2}{3}b)$

DC = LOA

$\overrightarrow{OC} = \overrightarrow{OD} + \overrightarrow{DC}$

$= \underline{b + ha}$

OM = ½ OC

$\underline{= ½ (b + ha)}$

(ii) MX = MO + OX

$= -½ b - ½ ha + \frac{2}{3b}$

$\underline{= {}^1/_6 b - ½ ha}$

d. MX = MX

$K(-a + {}^2/_3 b) = {}^1/_6 b - ½ ha$

$-Ka + \frac{2kb}{3} = {}^1/_6 b - ½ ha$

$-K + -½ h$

$\frac{2}{3}k = \frac{1}{6}$

$4k = 1$

$\underline{K = ¼}$

$-¼ = -½ h$

$-1 + -2h$

$h = ½$

---

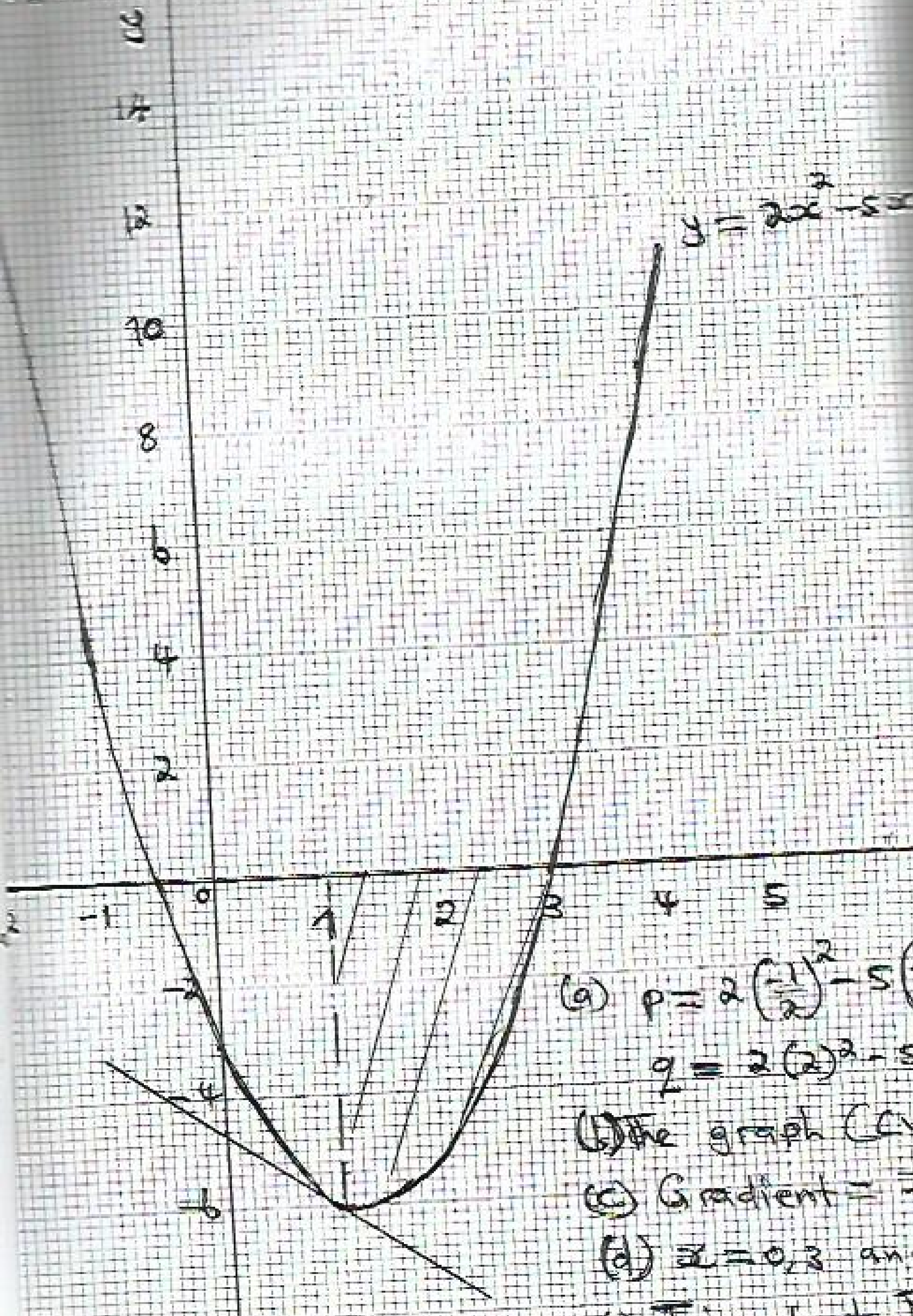
e (i) $Mx = \frac{1}{6b} - ½ \times ½ a$

$\underline{= {}^1/_6 b - ¼ a}$

(ii) DC = ha

$\underline{= ½ a}$

QUESTION 11 NOV 2012



(a) $p = 2\left(\frac{-1}{2}\right)^2 - 5\left(\frac{-1}{2}\right)$ ...

$q = 2(2)^2 - 5(2) -$ ...

(b) The graph (curve ...

(c) Gradient $= \frac{-2}{1} =$ ...

(d) $x = 0{,}3$ and $2{,}$ ...

(e) Triangle + Trape...

$\frac{1 \times 5}{2} + \left(\frac{5+6}{2}\right) \times$ ...

$= 2{,}75 + 5{,}5$

... square un...

$19 + 41 + 70 + 33 + 17$
$= 180$

...nce

$\frac{\text{Australia} + \text{USA}}{\text{Total}}$

$\frac{19 + 17}{180} \times 100$

$\frac{36}{180} \times 100$

20%

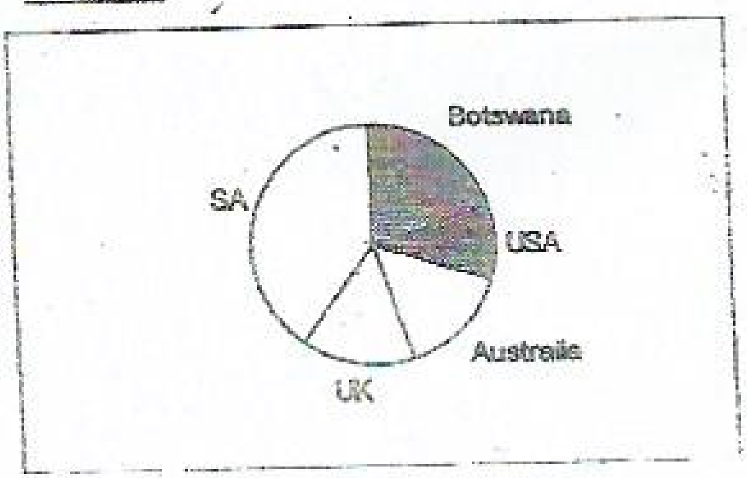
$= \frac{41}{180} \times \frac{40}{179}$

$= \frac{82}{1611}$

$\frac{70}{180} \times \frac{17}{179}$

$= \frac{119}{3222}$

Pie Chart



Section A [64 marks]

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

1 (a) Find the exact value of $20{,}71 - 8{,}2 \times 1{,}1$.

(b) Factorise completely

(i) $12m - 2n^2 + 6mn - 4n$,

(ii) $2a^2 - 5a + 3$.

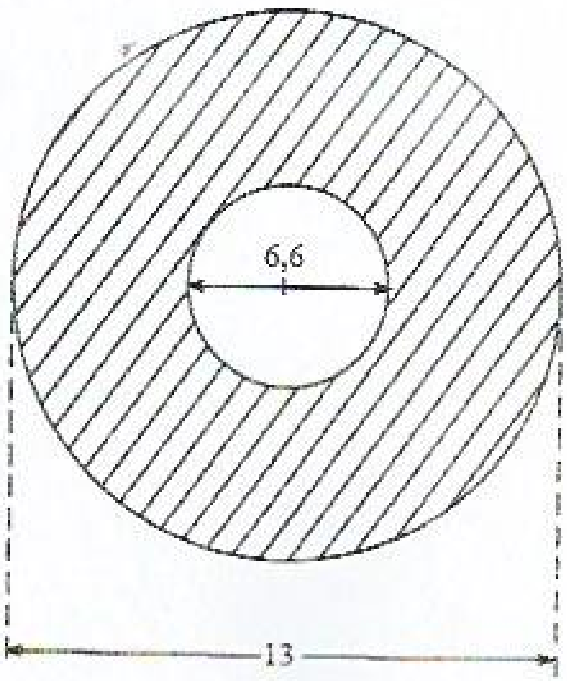
(c) Express as a single fraction in its lowest terms

$$\frac{x+1}{x-2} - \frac{x+2}{1-x}.$$

2 (a) Simplify

$$\frac{1}{3}\begin{pmatrix} -5 & -10 \\ 1 & -1 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}.$$

(b) Find the time in which \$20 000 will earn \$1 600 simple interest at [illegible] per annum.



Take π to be $\dfrac{22}{7}$

The diagram shows a Compact Disc (CD) for information storage. The useful part is shaded. The inside and outside diameters are 6.6 cm and 13 cm respectively.

Find (i) the shaded area,

(ii) the percentage area of the disc that is useful. [6]

(a) Solve the equation

$$\frac{2}{x+2}+\frac{1}{x}=1.$$ [4]

(b) It is given that $\mathbf{a}=\begin{pmatrix}3\\3\end{pmatrix}$ and $\mathbf{b}=\begin{pmatrix}-1\\2\end{pmatrix}$.

Find (i) $\mathbf{a}+\mathbf{b}$,

(ii) $\mathbf{a}-3\mathbf{b}$,

(iii) $|\mathbf{a}-3\mathbf{b}|$. [5]

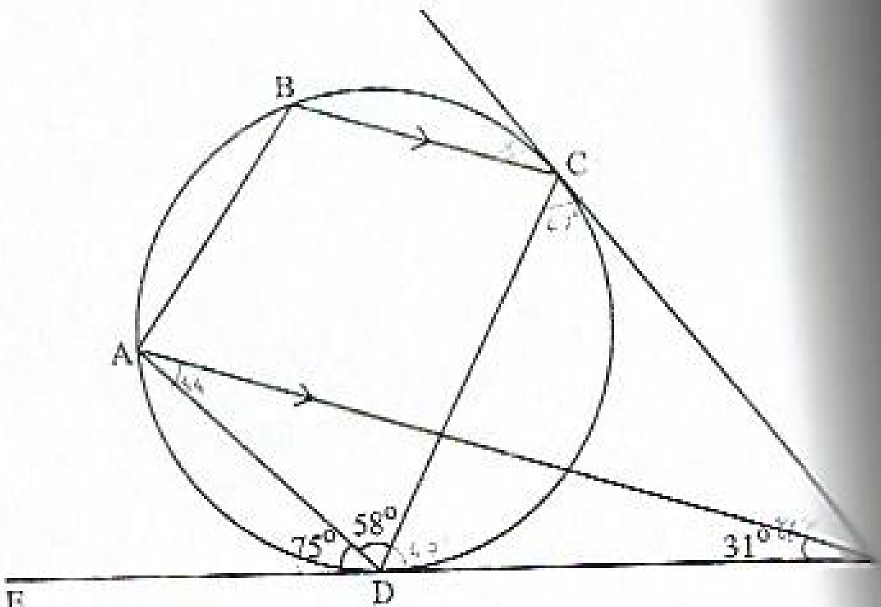
[Turn over

(c) Solve the inequality

$5 - 3x \leq 7 < -2x + 19.$

---

4 **(a)**



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

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

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

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

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

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

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

(i) Make h the subject of the formula.

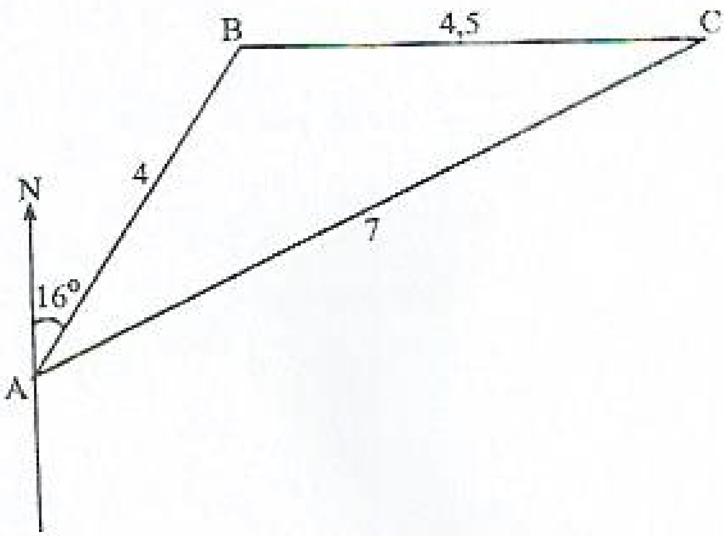
(ii) Find h when $A = 77\text{ cm}^2$, $r = 2.5$ cm and $\pi = \dfrac{22}{7}$.

(a) The dimensions of a rectangle, measured to the nearest centimetre, are 42 cm by 81 cm.

(i) State the least possible width of the rectangle.

(ii) Calculate the least possible perimeter of the rectangle. [3]

(b)



In the diagram, A, B and C are points on level ground. The bearing of B from A is 016°, AB = 4 km, BC = 4,5 km and AC = 7 km.

Find (i) $B\hat{A}C$, giving your answer to the nearest degree,

(ii) the bearing of C from A. [5]

(c) The volume, V, of a gas at constant temperature is inversely proportional to its pressure P.

(i) Express V in terms of P and a constant k.

(ii) Given that $V = 45$ litres when $P = 600$ Newtons per square metre, find V when $P = 1\,050$ Newtons per square metre. [3]

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

Use ruler and compasses only and show clearly all construction lines and ar

(a) On a single diagram, construct

(i) quadrilateral ABCD in which AD = BC = AB = 6 cm, DC = 9,5 cm and $B\hat{C}D = 60°$,

(ii) the locus of points 4,5 cm from A,

(iii) the locus of points equidistant from AD and DC,

(iv) the locus of points equidistant from D and C.

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

Section B [36 marks]

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

Each question carries 12 marks.

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

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

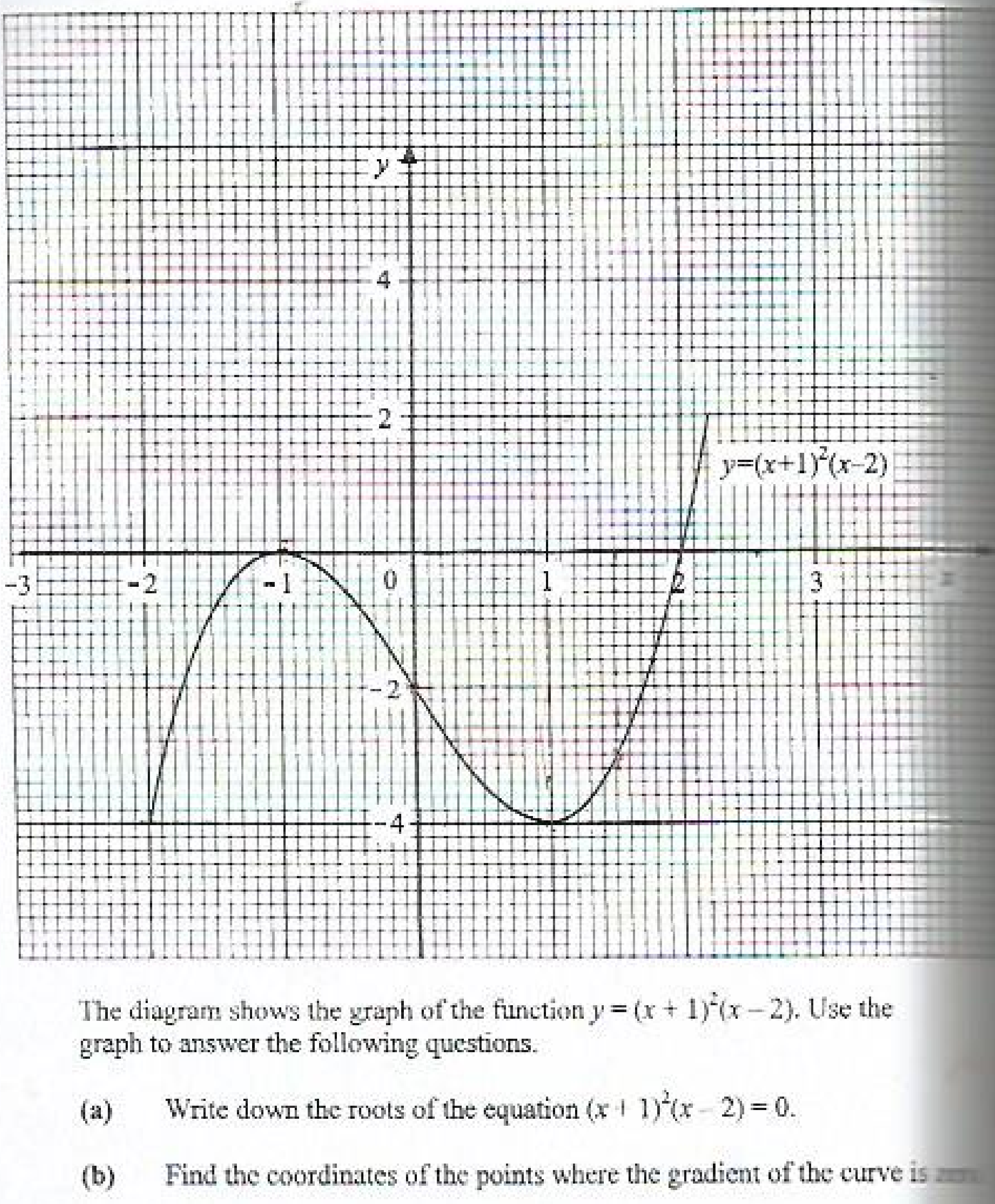
(b) Chido bought 20 pieces of fleece in South Africa and incurred $30 in travelling costs. If she sells all 20, calculate her net profit in dollars. [3]

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

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

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

8



The diagram shows the graph of the function $y = (x + 1)^2(x - 2)$. Use the graph to answer the following questions.

(a) Write down the roots of the equation $(x + 1)^2(x - 2) = 0$.

(b) Find the coordinates of the points where the gradient of the curve is zero.

(c) State the range of values of x for which the function is positive.

(d) Find the gradient of the curve at the point where $x = 1{,}5$.

(e) Use the graph to solve the equation $(x + 1)^2(x - 2) = -2$.

(f) Find the area bounded by the curve, the x-axis, the y- axis and the line $x = 1$.

9 **Answer the whole of this question on a sheet of graph paper.**

Triangle A has vertices at (2; 2), (5; 2) and (8; 4). Using a scale of 2 cm to represent 2 units on both axes, draw the x and y axes for $-8 \le x \le 10$ and $-8 \le y \le 8$.

(a) Draw and label triangle A. [1]

(b) Triangle A is mapped onto triangle B by a translation $\begin{pmatrix} -9 \\ 2 \end{pmatrix}$. Draw and label triangle B. [1]

(c) Triangle A is reflected onto triangle C in the line $y = -x$. Draw and label triangle C. [2]

(d) Triangle D with vertices at $(-2;4)$, $(4;4)$ and $(10;8)$ is the image of triangle A under a certain transformation.

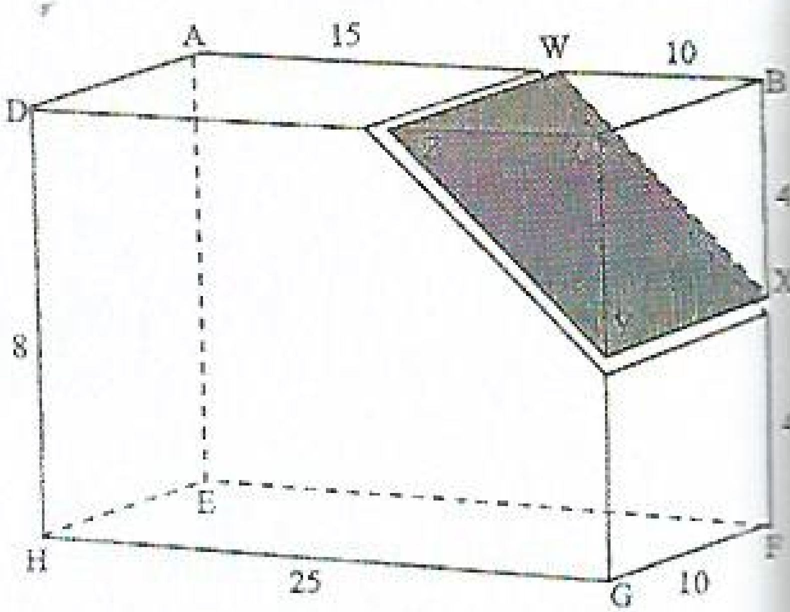
(i) Draw and label triangle D.

(ii) Describe completely the **single** transformation which maps triangle A onto triangle D. [4]

(e) Draw triangle E, the image of triangle A under a transformation represented by matrix $\begin{pmatrix} \frac{1}{2} & 0 \\ 0 & 1\frac{1}{2} \end{pmatrix}$. [2]

(f) Triangle F is the image of triangle A under a clockwise rotation of 90° about the point (2; −2). Draw and label triangle F. [2]

10



In the diagram, ABCDEFGH is a rectangular block of wood 25 cm lon[illegible] wide and 8 cm high. The block is sawn along the plane WXYZ to form [illegible] WBXYCZ.

Calculate

(a) the area of the plane WXYZ,

(b) the area of triangle ZCY,

(c) angle CZY,

(d) the surface area of the wedge,

(e) the percentage volume of wood removed.

11 **Answer the whole of this question on a sheet of graph paper.**

One hundred boys watched soccer on TV during the 2010 World Cup. The information is shown in the table.

time (x hours)	**number of boys**
$x \leq 15$	1
$15 < x \leq 20$	2
$20 < x \leq 25$	7
$25 < x \leq 30$	11
$30 < x \leq 35$	25
$35 < x \leq 40$	23
$40 < x \leq 45$	17
$45 < x \leq 50$	10
$50 < x \leq 55$	3
$55 < x \leq 60$	1

The following is an incomplete cumulative frequency table for the distribution.

time	$x \leq 15$	$x \leq 20$	$x \leq 25$	$x \leq 30$	$x \leq 35$	$x \leq 40$	$x \leq 45$	$x \leq 50$	$x \leq 55$	$x \leq 60$
frequency	1	3	10	21	46	p	q	96	99	100

(a) Find the value of p and the value of q. [2]

(b) Using a scale of 2 cm to represent 10 hours on the horizontal axis and 2 cm to represent 10 boys on the vertical axis, draw the cumulative frequency curve for the data. [4]

(c) Use your graph to find

(i) the number of boys who watched soccer for 30 hours and below,

(ii) the median number of hours spent watching soccer on TV,

(iii) the number of boys who watched soccer for more than 20 hours but not more than 45 hours. [4]

(d) If two boys were chosen at random from the group, find the probability that both watched soccer for 30 hours or less. [2]

12 **Answer the whole of this question on a sheet of graph paper.**

A green grocer offers a price reduction to customers who buy at least 1 kg of apples and more than 1 kg of grapes. The offer is limited to a total of 5 kg.

Let x represent the mass of apples and y the mass of grapes.

(a) Write down three inequalities which represent the given information.

(b) The point $(x; y)$ represents x kg of apples and y kg of grapes.

Using a scale of 2 cm to represent 1 kg on both axes, construct and indicate clearly by shading the **unwanted** regions, the region in which $(x; y)$ must lie.

(c) If the profit on apples is 40c per kg and that on grapes is 55c per kg, find the combination which gives the shop its greatest profit.

(d) Calculate the maximum profit.

MATHEMATICS
ANSWER PAPER
JUNE 2013

20,71 – 8,2 X 1,1
20,71 –(8,2 X 1,1)
20,71 – 9,02
<u>11,69</u>

$12m - 2n^2 + 6mn - 4n$
$12m + 6mn - 2n^2 - 4n$
Rearrange
$12m + 6mn - 4n - 2n^2$
$6m\,(2 + n)\ -2n\,(2 + n)$
$\underline{(2 + n)\,(6m - 2n)}$

$$\frac{x+1}{x-2} - \frac{x+2}{1-x}$$

$$\frac{(x+1)(1-x) - (X-2)(x+2)}{(x-2)(1-x)}$$

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

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

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

2(a) $$\tfrac{1}{3}\begin{pmatrix} -5 & -10 \\ 1 & -1 \end{pmatrix} \quad \begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}$$

$$= \tfrac{1}{3}\begin{pmatrix} -5\,-10 & -10 + 10 \\ 1 - 1 & 2 + 1 \end{pmatrix}$$

$$= \tfrac{1}{3}\begin{pmatrix} -15 & 0 \\ 0 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} -5 & 0 \\ 0 & 1 \end{pmatrix}$$

b) $I = \frac{PRT}{100}$

$1600 = \frac{20\,000 \times 8 \times T}{100}$

$160\,000 = 160\,000T$

<u>T = 1 year</u>

(c) Shaded Area = Bigger Circle - Smaller Circle

$= \pi \times 6{,}5^2 - \pi \times 3{,}3^2$

$= 132{,}7 - 34{,}2$

$= \mathbf{98{,}5cm^2}$

(ii) $\frac{98{,}5}{132{,}7} \times 100$

$= \underline{74{,}2\%}$

(3a) $\frac{2}{x+2} + \frac{1}{x} = 1$

LCM $= (x+2)x$

$x(x+2) \times \frac{2}{x+2} + \frac{1}{x} \times x(x+2) = 1x(x+2)$

$2x + x + 2 = x(x+2)$

$3x + 2 = x^2 + 2x$

$x^2 - x - 2 = 0$

$(x-2)(x+1) = 0$

$x - 2 = 0$ or $x + 1 = 0$

$\underline{x = 2 \text{ or } -1}$

(b)(i) $\begin{pmatrix} 3 \\ 3 \end{pmatrix} + \begin{pmatrix} -1/2 \\ \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$

(ii) $\begin{pmatrix} 3 \\ 3 \end{pmatrix} - 3\begin{pmatrix} ½ \\ \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix} - \begin{pmatrix} -3 \\ 6 \end{pmatrix}$

$= \begin{pmatrix} 6 \\ -3 \end{pmatrix}$

$\begin{bmatrix} 3 \\ 3 \end{bmatrix} \quad -3\begin{bmatrix} -\frac{1}{2} \end{bmatrix} = \begin{bmatrix} 6 \\ -3 \end{bmatrix}$

$(a - 3b) \quad = \sqrt{6^2 + (-3)^2}$

$= \sqrt{36 + 9}$

$= \sqrt{45}$

$\underline{= 6.7 \text{ Units}}$

$-3x \le 7 < -2x + 19$

$-3x \le 7$

$x \le 2$

$\underline{\ge -\frac{7}{3}}$

$< -2x + 19$

$x < 19 - 7$

$x < 12$

$\underline{< 6}$

$\underline{-\frac{7}{3} \le x < 6}$

$ABC = 180 - \underline{58^\circ}$

$DT = 180 - (75 + 58) = \underline{47^\circ}$

$TAD = 180 - (31 + 58 + 47) \quad = \quad \underline{44^\circ}$

$ATC = 180 - (47 \times 2) \quad = \quad 86$

$86 - 31 = \underline{55^\circ}$

$BAT = 47 + 55 \quad = 102^\circ$

$A \quad = 2\pi r(r + h)$

$\frac{A}{2\pi r} = r + h$

$h = \frac{A}{2\pi r} - r$

(ii) $h = \dfrac{77}{2 \times \pi \times 2,5} - 2,5$

$= \dfrac{77}{2 \times {}^{22}/_{7} \times 2,5} - 2,5$

$= \underline{24}$

5(a)(i) 41,5cm

(ii) $(41,5 \times 2) + (80,5 \times 2)$
$= 83 + 161$
$= \underline{244\text{cm}}$

(b)(i) BAC
$\text{Cos } A = \dfrac{4^2 + 7^2 - 4,5^2}{2 \times 4 \times 7}$

$= \dfrac{44,75}{56}$

$= 0,7991$

$A = \text{Cos}^{-1}\ (0,7991)$
$= \underline{40^\circ}$

(ii) $16 + 40^\circ = \underline{056^\circ}$

C (i) $V \quad \dfrac{1}{P}$

$V = \dfrac{k}{P}$

(ii) $V = \dfrac{k}{P}$

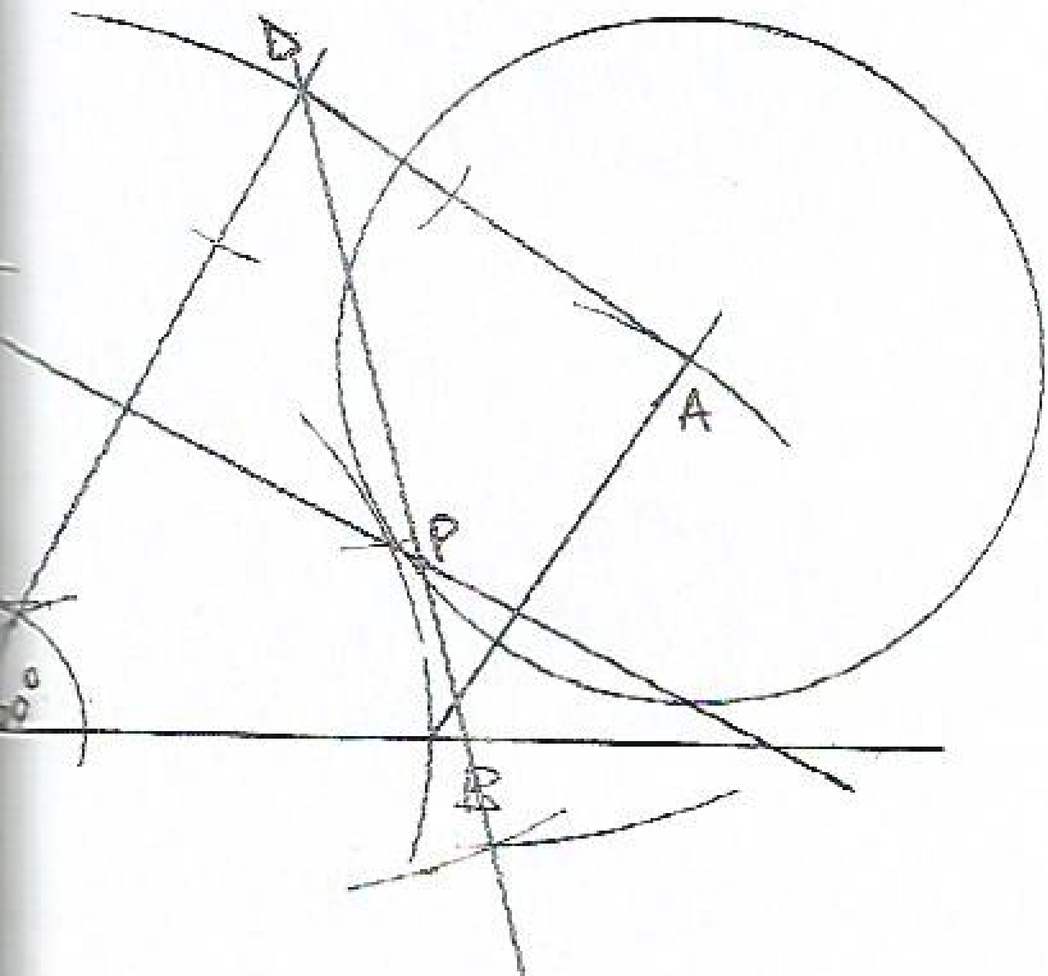
$45 = \dfrac{k}{600}$

$k = 27\ 000$

$V = \dfrac{27\ 000}{P}$

$V = \dfrac{27\ 000}{1050}$

$\underline{V = 25,7 \text{ litres}}$



D
A
P
B

7(a) $2,50 = R20

$\frac{20}{2,5} = 8$

<u>$1 = R8</u>

(b) (20 x 2,50) + 30 = $80
Total Sales = (20 x $5) = $100

Profit = 100 – 80

= **$20**

(c) 20 x 12 = 240 (Sales)

Profit = 240 – (20 x 2,5 + 30)
= 240 – 80
= **$160**

(d) (20 x 5) = 100 (Cost)
(20 x 12) = $240 (Sales)
Profit = 240 – 100
= **$140**

(e) $160 – 20 = **$140**

8(a) **x = -1 and 2**

(b) (Turning Points)
(-1 ; 0) and (1 ; -4)

(c) x > 2

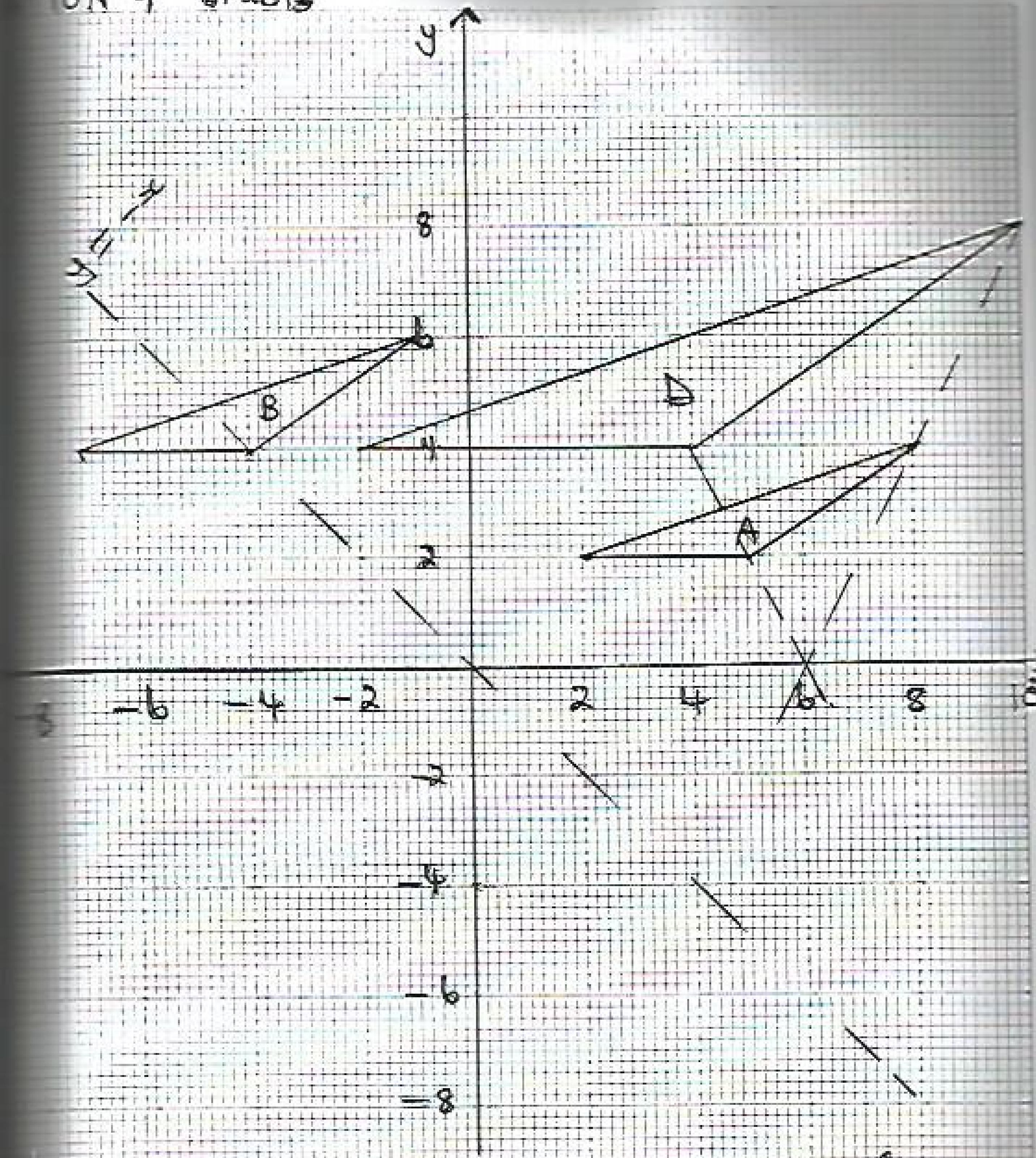
(d) Draw a Tangent at x = 1,5 and find its gradient
Grad = $\frac{-3.8}{1.7}$

= **-2,24**

e) Draw the line y = -2 and find the x value at point of Intersection
x = -1,7 ; 0 and 1,7

f) ½ (4 + 2) x 1 = **3**

ION 9 J. 2013



(ii) Enlargement scale factor 2 Centre (6, 0)

$$\begin{pmatrix} \frac{1}{2} & 0 \\ 0 & 1\frac{1}{2} \end{pmatrix}\begin{pmatrix} 2 & 5 & 8 \\ 2 & 2 & 4 \end{pmatrix} = \begin{pmatrix} 1 & 2\frac{1}{2} & 4 \\ 3 & 3 & 6 \end{pmatrix}$$

10(a) Length $= \sqrt{10^2 + 4^2}$

$= 100 + 16$

$= \sqrt{116}$

$\sqrt{116} \times 10 =$ **<u>108cm²</u>**

(b) ½ *b x h*

$= \frac{1}{2} \times 10 \times 4$

$=$ **<u>$20cm^2$</u>**

(c) $\text{Tan } Z = \frac{4}{10}$

$Z = \text{Tan}^{-1}\left(\frac{4}{10}\right)$

$=$ **<u>$21{,}8^\circ$</u>**

(d) (2,5 x 10) x 2 + (10 x 8) x 2 + (8 x 25) x 2

(250 x 2) + (80 x 2) + (200 x 2)

= 500 + 160 + 400

= **<u>$1060\ cm^2$</u>**

(e) Volume of Cuboid

= 25 x 10 x 8

= $2000cm^3$

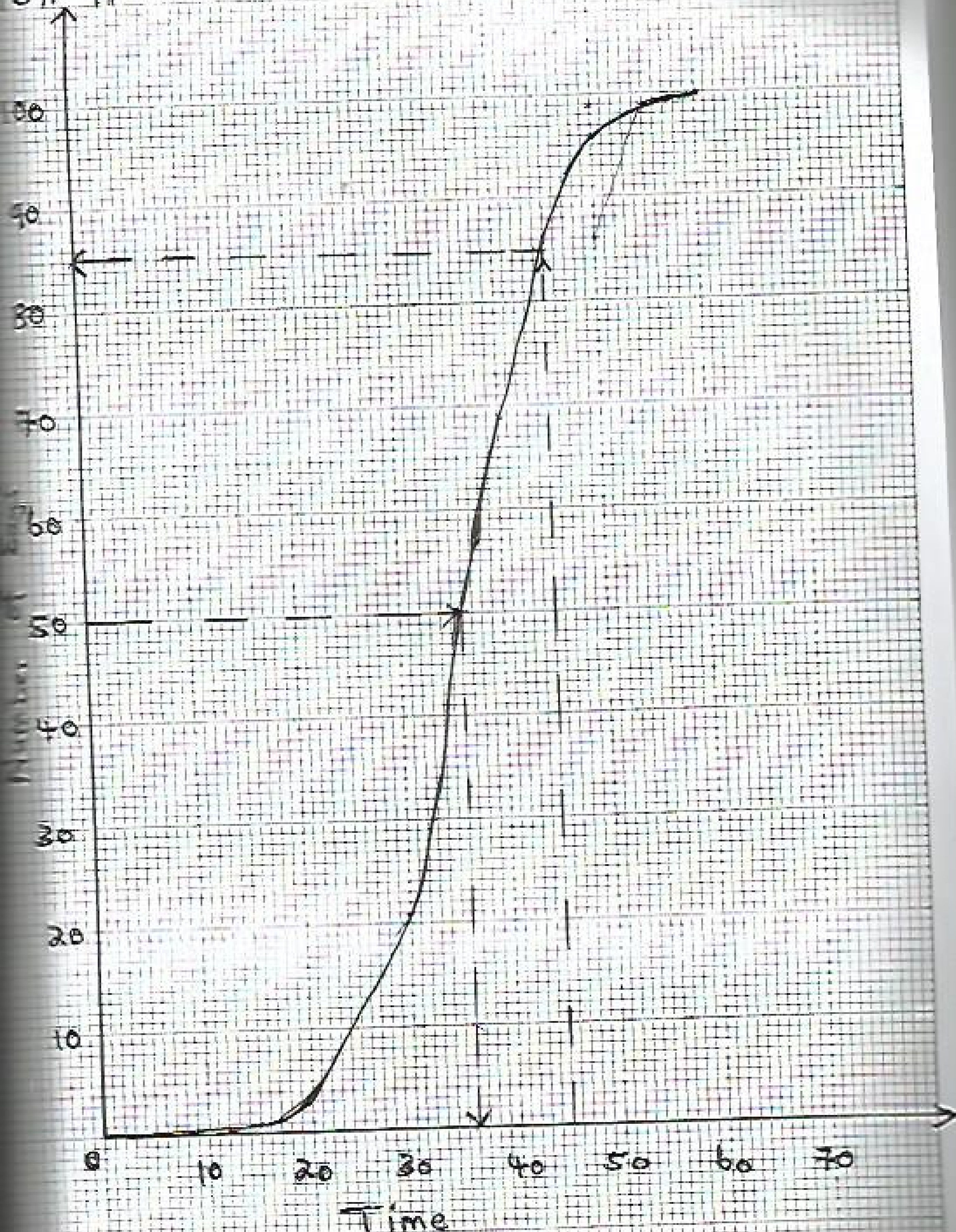
Volume of wood removed

= 20 x 10

= $200cm^3$

$\frac{200}{2000} \times 100 =$ **<u>10%</u>**

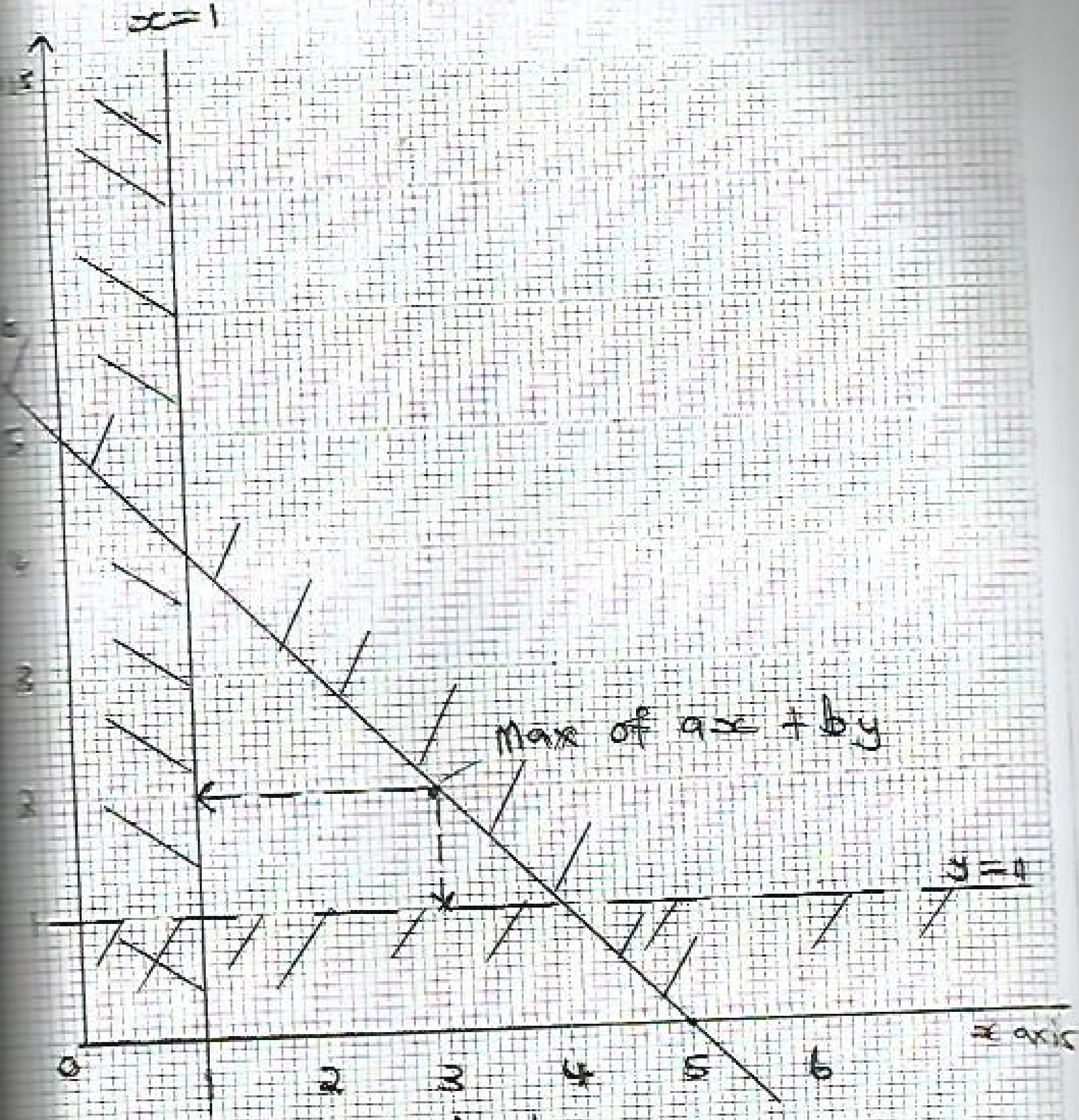
ON 11 J 2013



p = 46 + 23 = 69
q = 69 + 17 = 86

(i) 20 boys (ii) 36 hrs (iii) 85 − 3 = 82

TION 12 J. 2013



(a) $x \geq 1$

$y \geq 1$

$x + y \leq 5$

(c) 3 Apples and 2 Grapes

(d) $0{,}4 \times 3 + 0{,}55 \times 2 = \$3{,}30$

IMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

ATHEMATICS 4028/2

PER 2

NOVEMBER 2013 SESSION 2 hours 30 minutes

itional materials:
swer paper
ometrical instruments
aph paper (3 sheets)
thematical tables
in paper (1 sheet)

2 hours 30 minutes

UCTIONS TO CANDIDATES

ur name, Centre number and candidate number in the spaces provided on the
paper/answer booklet.

all questions in **Section A** and any **three** questions from **Section B**.

ur answers on the separate answer paper provided.
e more than one sheet of paper, fasten the sheets together.

king must be clearly shown. It should be done on the same sheet as the rest of the

n of essential working will result in loss of marks.
gree of accuracy is not specified in the question and if the answer is not exact, the
should be given to three significant figures. Answers in degrees should be given
ecimal place.

RMATION FOR CANDIDATES

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

This question paper consists of 13 printed pages and 3 blank pages.

Section A [64 marks]

*Answer **all** the questions in this section*

1 (a) Simplify $15{,}6 - 3 \times 4{,}6$.

(b) Express $\dfrac{8}{x+1} - 3$ as a single fraction in its simplest form.

(c) Solve the equation $\dfrac{2}{3}(p+1) = 2\dfrac{1}{5}$.

(d) Factorise completely (i) $2ax + 3ay + 4x + 6y$,

(ii) $8x^2 - 18$.

2 (a) Given that x is an odd number, find the possible values of x, which satisfy the inequalities

$x \geq 3$ **and** $5x - 10 < 35$.

(b) If $f(x) = x^2 - 2x + k$, where k is a constant, and $f(3) = -32$, find the value of k.

Hence, find the values of x for which $f(x) = 0$.

(c) Albert can weed the family garden in 4 hours. His sister, Biddy, takes 6 hours to complete the same job.

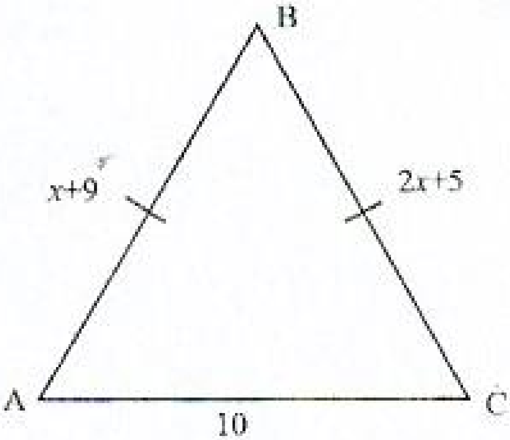
If they decide to work together, assuming they maintain their working rates, calculate

(i) the fraction of the garden that they can weed in 1 hour,

(ii) the total time that they can take to weed the whole garden.

(a) Given that $m = 2p + 1$ and $n = p - 2$, express mn in terms of p in its simplest form. [2]

(b)



In the diagram, ABC is an isosceles triangle with AB = BC.

AB = $(x + 9)$ cm, BC = $(2x + 5)$ cm and the base, AC = 10 cm.

(i) Form an equation in terms of x and solve it.

(ii) Write down the length of BC.

(iii) Calculate the area of triangle ABC.

(iv) Given that all the lengths of the sides of ΔABC were given to the nearest centimetre, calculate the **least** possible perimeter of the triangle. [9]

[Turn over

4 (a) If $dx = r + qx$,

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

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

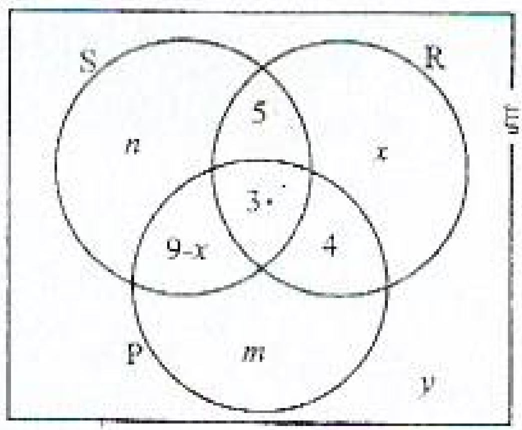
(b) Fifty five people attending a workshop were asked to indicate which food item they liked, choosing from 'sadza', rice or potatoes.

S is the set of people who liked 'sadza', where n(S) = 23,

R is the set of people who liked rice, where n(R) = 19 and

P is the set of people who liked potatoes, where n(P) = 12.

The information was displayed in a Venn diagram and the numbers in each region represent the numbers of people who liked at least one of those food items.



(i) Find the value of x.

(ii) Calculate the number of people who liked 'sadza' only.

(iii) Find the number of people who did **not** like any of the food items on offer. [6]

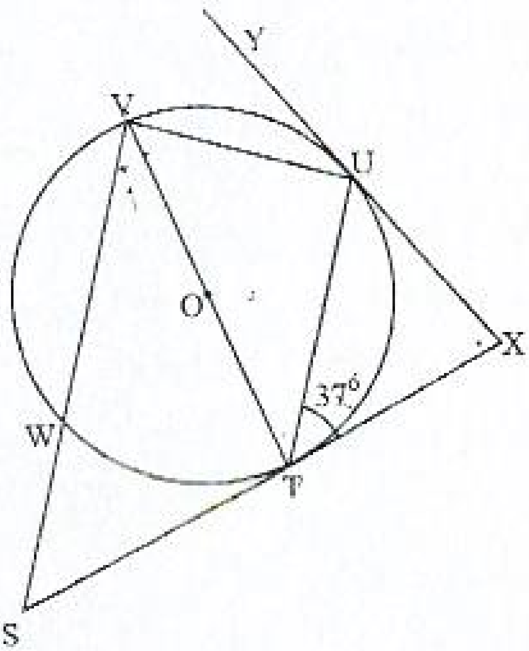
(a) Given that $\mathbf{P} = \begin{pmatrix} 3 & -4 \\ 5 & 1 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$,

find

(i) the value of n if $\mathbf{PQ} = \begin{pmatrix} 4n \\ 18 \end{pmatrix}$,

(ii) $\mathbf{P}^{-1}$. [4]

(b)



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

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

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

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

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

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

(iii) Given that TU = 4,7 cm,

calculate the radius of the circle. [8]

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

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

(a) Construct on a single diagram,

(i) quadrilateral ABCD in which AB = 6 cm, $A\hat{B}C = 120°$, BC = 7 cm, CD = 9 cm and AD = 7 cm,

(ii) the locus of points equidistant from AB and AD,

(iii) the locus of points, inside the quadrilateral ABCD, that are 3 cm from BC,

(iv) the shortest line from point C to AB produced.

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

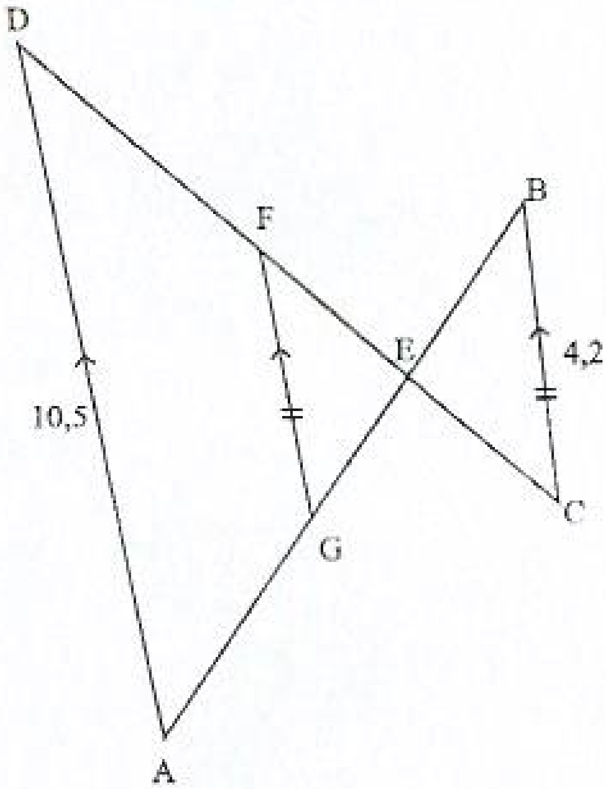
Section B [36 marks]

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

Each question carries 12 marks.

(a) Express $2 - 2\log 50$ as a logarithm of a single number. [2]

(b)



In the diagram, AB and CD intersect at E. the lines AD, GF and CB are parallel to each other. It is given that BC = GF = 4,2 cm and AD = 10,5 cm.

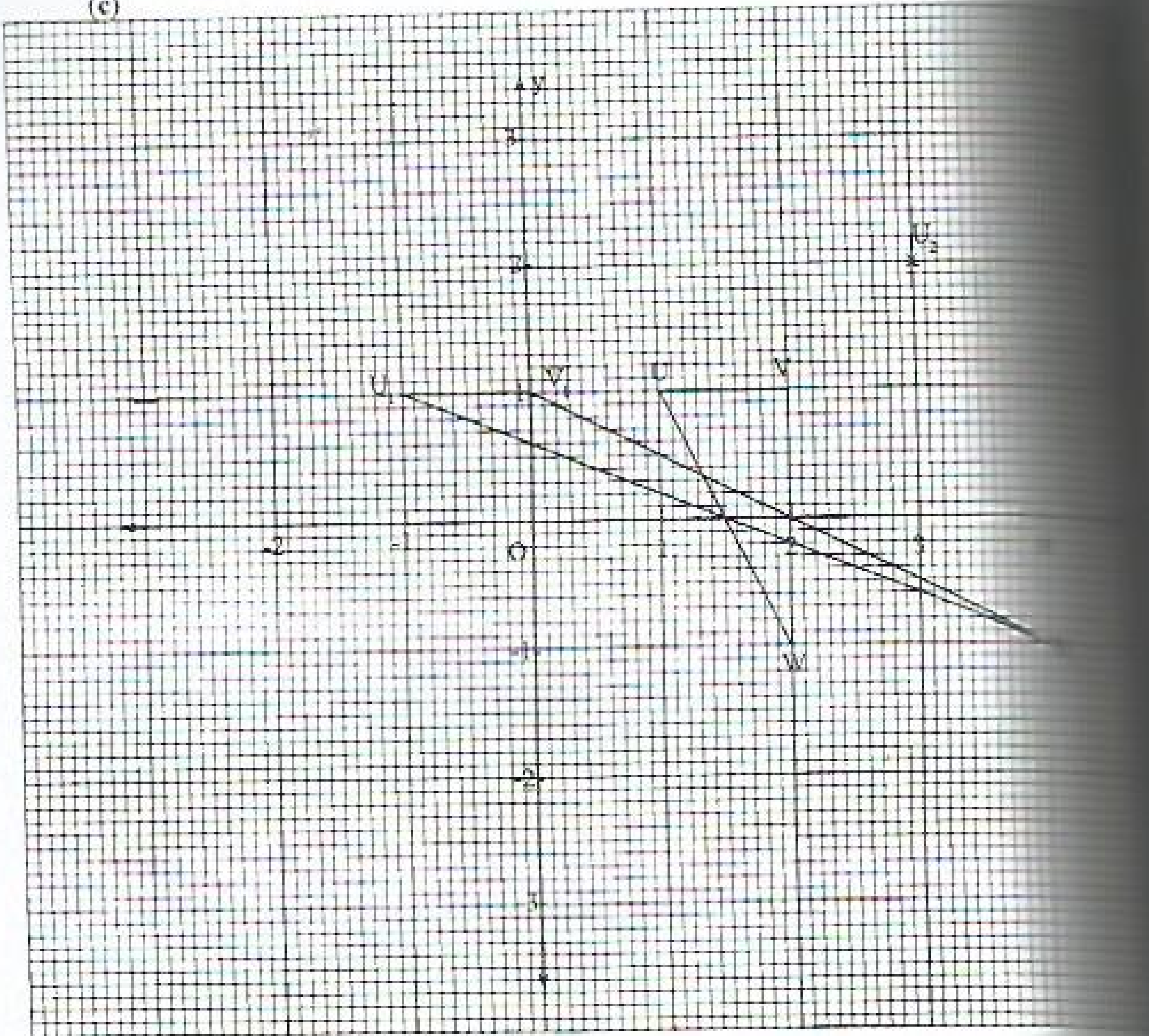
(i) Describe fully the **single** transformation that maps ΔBCE onto ΔGFE.

(ii) ΔADE is the image of ΔBCE under an enlargement.

State the centre and the scale factor of the enlargement. [5]

[Turn over

(c)



The diagram shows ΔUVW, $\Delta U_1V_1W_1$ and point U_2.

(i) Describe completely the **single** transformation that maps ΔUVW onto $\Delta U_1V_1W_1$.

(ii) Point U_2 is the image of point U under a two-way stretch.

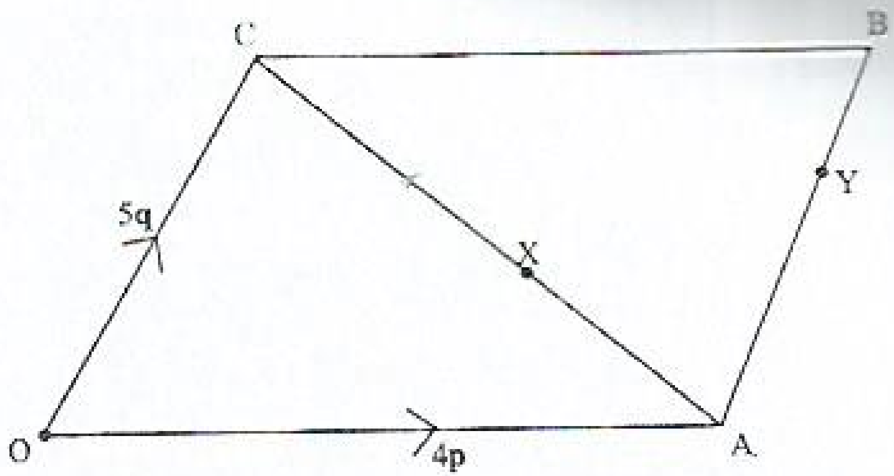
Find 1. the stretch factor with the y-axis invariant,

2. the co-ordinates of V_2, the image of V under this two-way stretch.

[5]

a) If $\mathbf{g} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$ and $\mathbf{h} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$, express $\mathbf{g} - 2\mathbf{h}$ in the form $\begin{pmatrix} x \\ y \end{pmatrix}$. [2]

b)



In the diagram, OABC is a parallelogram in which $\overrightarrow{OA} = 4\mathbf{p}$ and $\overrightarrow{OC} = 5\mathbf{q}$. X is a point on AC such that AX:XC = 2:3.

(i) Express in terms of **p** and/or **q**

1. $\overrightarrow{AC}$,

2. $\overrightarrow{OX}$ in its simplest terms.

(ii) Y is a point on AB such that $\dfrac{AY}{AB} = k$, where k is a constant.

Express $\overrightarrow{OY}$ in terms of **p**, **q** and k.

(iii) Given that OY = hOX, where h is a constant,

write down another expression for $\overrightarrow{OY}$ in terms of **p**, **q** and h.

(iv) Using results in **(ii)** and **(iii)**, find the value of h and the value of k.

(v) Express $\dfrac{\text{the area of } \Delta OAY}{\text{the area of parallelogram OABC}}$, as a fraction in its simplest form.

[10]

[Turn over

9 **Answer the whole of this question on a sheet of graph paper.**

The following is an incomplete table of values for the function $y = 2 + \frac{5}{x}$.

x	1	2	3	4	5	6	7	8
y	7	p	3.7	3.3	3	q	2.7	2.6

(a) Calculate the value of p and the value of q.

(b) Using a scale of 2 cm to represent 1 unit on each axis, draw the graph of $y = 2 + \frac{5}{x}$ for $1 \leq x \leq 8$.

(c) Use the graph to estimate

(i) the gradient of the graph of $y = 2 + \frac{5}{x}$ when $x = 2$,

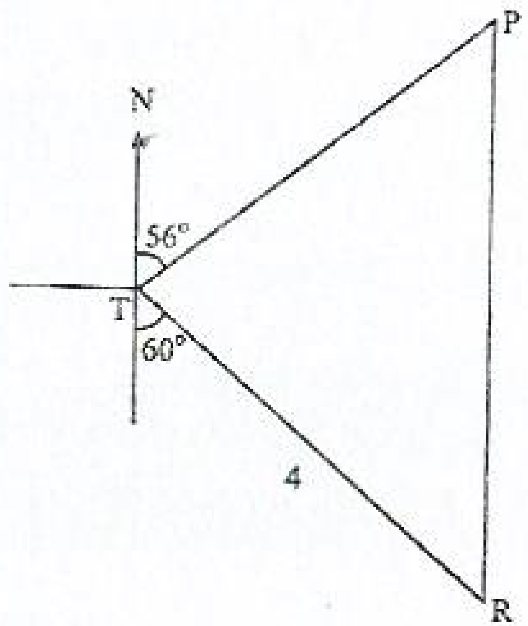
(ii) the area enclosed by the graphs $y = 2 + \frac{5}{x}$, $x = 1$, $x = 2$ and the x-axis.

(d) On the same axes, draw the graph of $y = x$.

Hence solve the equation $2 + \frac{5}{x} = x$.

(a) Solve the equation $2x^2 - 4x - 3 = 0$, giving your answers correct to one decimal place. [5]

(b)



The diagram shows three points, P, R and T which are on level ground and TR = 4 km. From T, the bearing of P is N 56° E, the bearing of R is S 60°E and P is due north of R.

(i) Calculate

1. the shortest distance between line PR and T,

2. PR.

(ii) From an aeroplane flying directly above point T the angle of depression of R is 20.3°.

Calculate the height of the aeroplane above the ground at T.

[7]

11 (a) The sum of interior angles of a polygon is 3 240°. Three of its interior angles are 140°, 110° and 100°. The rest are all equal.

Find the size of each of the equal angles. [4]

(b) Forty pupils took part in a race and the distances to the nearest metre, that they covered in a certain time interval, are given in the frequency table below.

distance (in m)	$10 \le x < 20$	$20 \le x < 50$	$50 \le x < 60$	$60 \le x < 70$	$70 \le x < 80$	$80 \le$ [illegible]
frequency (f)	4	6	8	4	13	5
frequency density	0.4	p	0.8	q	r	0.2[illegible]

(i) State the modal class.

(ii) If the information is to be represented on a histogram, find the values of p, q and r.

(iii) Calculate the mean distance covered.

(iv) Two of the pupils are selected at random to make a report on the race.

Find the probability that both pupils had covered 70 m or more in the race. [8]

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

Nomsa, a newspaper vendor, orders and sells two types of newspapers, The Messenger and The Arrival.

(a) Nomsa always orders at most 100 newspapers for resale daily.

If x represents the number of **The Messenger** and y the number of **The Arrival,** write down an inequality, in terms of x and/or y that satisfies the given condition. [1]

(b) She always sells more than 20 copies of **The Messenger** but the number of copies of **The Messenger** sold does **not** exceed double the number of copies of **The Arrival.**

Write down 2 inequalities involving x and/or y that satisfy these restrictions. [2]

(c) By the end of each day she ends up having sold more copies of **The Messenger** than of **The Arrival.**

Write down an inequality that satisfies this condition. [1]

(d) Using a scale of 2 cm to represent 20 newspapers on each axis, draw x-axis and y-axis each from 0 to 100.

Illustrate, by shading the **unwanted regions,** the region in which $(x ; y)$ must lie. [5]

(e) It is given that **The Messenger** sells for \$1,20 and **The Arrival** sells for \$0,80 per copy.

Nomsa is given $2\frac{1}{2}\%$ commission on her sales.

Calculate the **highest** possible commission she could get. [3]

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

POSSIBLE ANSWERS

NOVEMBER 2013

MATHEMATICS 4028/2

SECTION A

(1)(a) $15{,}6 - (3 \times 4{,}6)$

$= 15{,}6 - 13{,}8$

$= \underline{1{,}8}$

(b) $\dfrac{8}{x+1} - 3$

$= \dfrac{8}{X+1} - \dfrac{3}{1}$

$= \dfrac{1(8) - 3(x+1)}{(x+1)}$

$= \dfrac{8 - 3x - 3}{x+1}$

$= \dfrac{8 - 3 - 3x}{x+1}$

$= \dfrac{\mathbf{5 - 3x}}{\mathbf{x + 1}}$

(c) $2/3\,(p + 1) = 2\,{}^{1}/_{5}$

$\dfrac{2(p+1)}{3} = \dfrac{11}{5}$

$\dfrac{15}{1}\boxed{\dfrac{2}{1}} \quad \dfrac{(P+1)}{3} = \dfrac{15}{1} \quad \boxed{\dfrac{11}{15}}$

$10\,(p + 1) = 33$

$10\,p + 10 = 33$

$10p = 33 - 10$

$\dfrac{10p}{10} = \dfrac{23}{10}$

$P = 2\,{}^{3}/_{10}$ or $2{,}3$ or $\dfrac{23}{10}$

(d)(i) $2ax + 3ay + 4x + 6y$

$= a\,\underline{(2x + 3y)} + 2\,\underline{(2x + 3y)}$

$= \underline{(2x + 3y)\,(a + 2)}$

(ii) $8x^2 - 18$

$= 2(4x^2 - 9)$

$= \underline{2(2x + 3)\,(2x - 3)}$

---

(2)(a) First solve equation (ii)

i.e $5x - 10 = 35$

$\dfrac{5x}{5} = \dfrac{45}{5}$

$x < 9$

So $3 \leq x < 10$

Thus, values are {3;5;7}

(b) $f(x) = x^2 - 2x + k$

So $3^2 - 2(3) + k = -32$

$9 - 6 + k = -32$

$3 + k = -32$

$k = -32 - 3$

$\underline{\mathbf{k = -35}}$

2(b) Hence $x^2 - 2x - 35 = 0$

$(x-7)\,(x+5) = 0$

Either $x - 7 = 0$ Or $x + 5 = 0$

$\underline{x = 7 \text{ or } x = -5}$

) $\frac{1}{4}+\frac{1}{6}=\frac{3+2}{12}$

$=5/12$

) $\frac{6+4}{2}$

$=5hrs$

(i) 5/12

(ii) 5 hours

3(a) $m = 2p + 1$

$n = p - 2$

$mn = (2p + 1)(P-2)$

$2p^2 - 4p + p - 2$

$\underline{= 2p^2 - 3p - 2}$

b) (i) $x + 9 = 2x + 5$

$9 - 5 = 2x - x$

$4 = x$

$\underline{x = 4}$

(ii) $BC = 2(4)+5$

$= 8 + 5$

$= \underline{13cm}$

(iii)First calculate rge height h(i.e Pythagoras)

So $h^{2+} 5^2 = 13^2$

$h^2 = 13^2 - 25$

$h^2 = 169 - 25$

$\sqrt{h^2} = \sqrt{144}$

$\underline{h = 12}$

Thus Area = ½ (10)(12)

$\underline{= 60cm^2}$

(iv) The least possible Perimeter =

$= 2(12,5) + 9,5$

$= \underline{34,5}$

4(a)(i) $dx = r + qx$

$d = \frac{r + qx}{x}$

i.e $\frac{-1 + 2(3)}{2}$

$= 5/2$

$\underline{= 2,5 \text{ or } 2\tfrac{1}{2} \text{ or } 5/2}$

(ii) $dx = r + qx$

$dx - qx = r$

$\frac{x(d-q)}{d-q} = \frac{r}{d-q}$

$\frac{-r}{-d + q}$ or $x = \frac{r}{d - q}$

(b) $5 + 3 + 4 + x = 19$

(i) $x + 12 = 19$

$x = 19 - 12$

$\underline{x = 7}$

(ii) $n + 5 + 3 + (9-7) = 23$

$n + 10 = 23$

$\underline{n = 13}$

(iii) First find the value of m

i.e $2 + 3 + 4 + m = 12$

$9 + m = 12$

$m = 12 - 9$

$\underline{m = 3}$

So the No. of people who did not like any

-----55 –(13+3+2+3+5+7+4)

-----55- 37

→ 18

$P = \begin{pmatrix} 3 & -4 \\ 5 & 1 \end{pmatrix}$ and $Q = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$

$PQ = \begin{pmatrix} 3 & -4 \\ 5 & 1 \end{pmatrix}\begin{pmatrix} 2 \\ 8 \end{pmatrix}$ $3\times\boxed{2\ \ 2}\times 1$

$= \begin{pmatrix} 6 & -32 \\ 10 & +8 \end{pmatrix}$

$= \begin{pmatrix} -26 \\ 18 \end{pmatrix}$

So $\begin{pmatrix} -26 \\ 18 \end{pmatrix} = \begin{pmatrix} 4n \\ 18 \end{pmatrix}$

Thus $\frac{4n}{4} = \frac{-26}{4}$

$n = -6\frac{1}{2}$ or $-6{,}5$

(ii) $P^{-1} = \frac{1}{23}\begin{pmatrix} 1 & 4 \\ -5 & 3 \end{pmatrix}$

b(i) 1. $T\hat{S}V = 37^\circ$ (90-53)

2. $SVT = 53^\circ$ (Alt angles)

3 $UVT = 37^\circ$ (90-53).

4. $TXU = 106^\circ$ [90-(37+37)]

(ii) $\triangle TSV$

(iii) $\text{Cos } 53 = \frac{4{,}7}{H}$

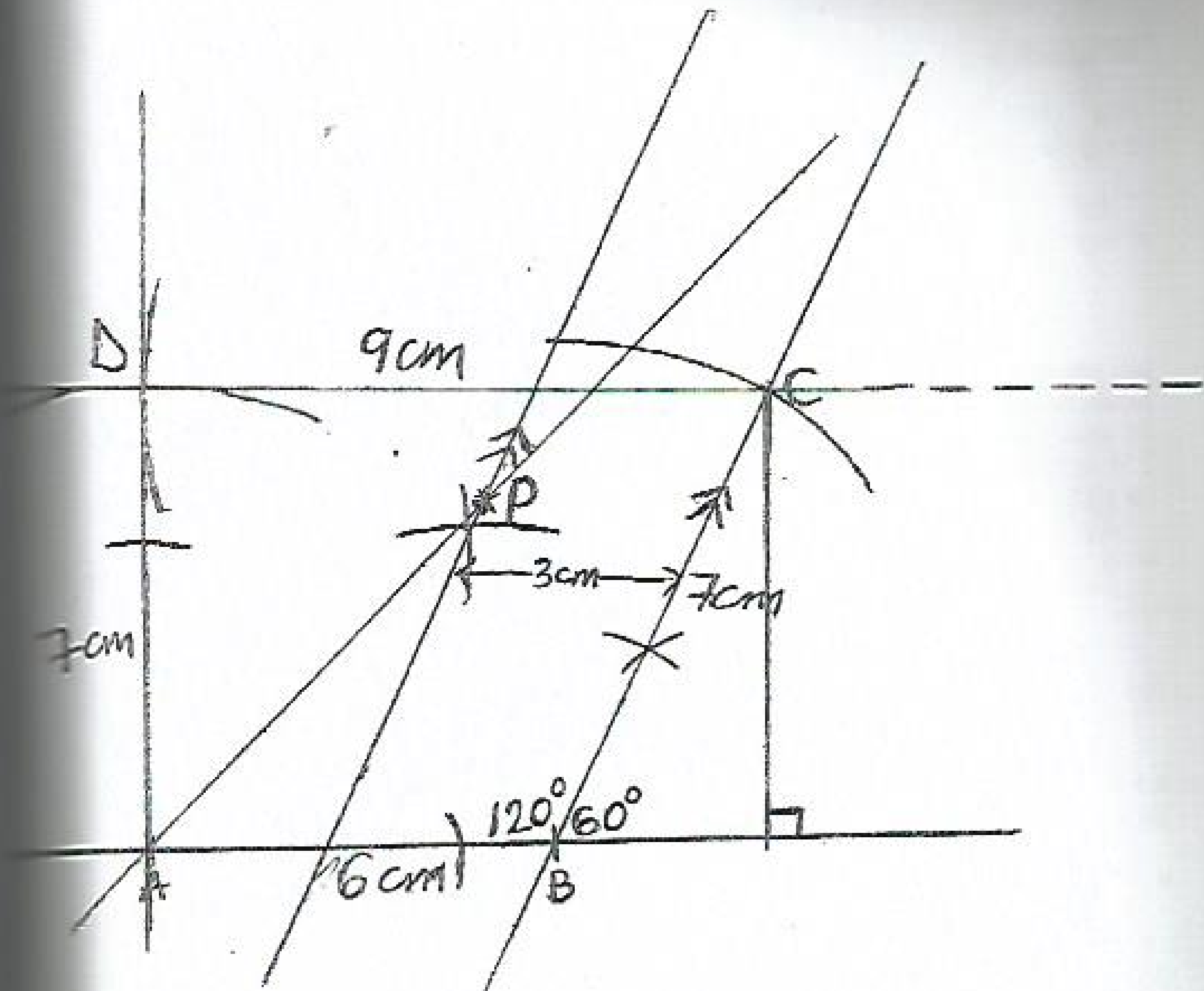
In Cos 53 = 4,7

$h = \frac{4{,}7}{\text{Cos } 53}$

h = 7,8 i.e diameter

<u>radius = 3,9</u>

Qudrilateral ABCD



SECTION B

7(a) 100^2
2 log 50

10^2
$= \log^2$ log $\frac{100}{50 \times 50}$

b(i) rotation (180^o) through E
Scale factor – 1
(ii) enlargement factor
2 ½ with centre E
i.e $\frac{10,5}{4,2}$ = - 2 ½ or – 2,5
or $-\frac{5}{2}$

(b)(i) $\overrightarrow{AC} = \overrightarrow{OC} + \overrightarrow{AO}$

AC = 5q -4p or -4p + 5q

1. <u>AC = 5q -4p</u> or -4p + 5q

2. OX = OA + AX

=4p + 2/5 (5q -4p)

= 4p + 2q – 8/5p

= 4p -8/5p + 2q

$= \frac{12}{5}p + 2q$ or $2q + \frac{12}{5}p$

(c) $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 1 & 2 & 2 \\ 1 & 1 & -3 \end{pmatrix} = \begin{pmatrix} -1 & 0 & 4 \\ -1 & 1 & -1 \end{pmatrix}$

a + b = -1 ....(i)
<u>2a + b =0 ......(ii)</u>

a = 1; b = -2

c + d = -1 ....(i)
<u>-2c + d = 1 ......(ii)</u>
c = 2
d = -3
mapped by $\begin{pmatrix} 1 & -2 \\ 2 & -3 \end{pmatrix}$

i.e shear with factor -2

(ii) $\overrightarrow{AB}$ = 5q

So $\overrightarrow{OY} = 4p + \overrightarrow{AY}$

= 4p + kAB

<u>=4p + 5kq</u>

(iii) $\overrightarrow{OY} = \frac{12hp}{5} + 2hq$

or

$h\left(2q + \frac{12}{5}p\right)$

8(a) $\frac{-5}{2}$ + 2 $\frac{3}{4}$

$= \begin{pmatrix} -5 \\ 2 \end{pmatrix} + \begin{pmatrix} 6 \\ 8 \end{pmatrix}$

$= \begin{pmatrix} 1 \\ 10 \end{pmatrix}$

11) $4 = \frac{12}{5}h$ ....(i)

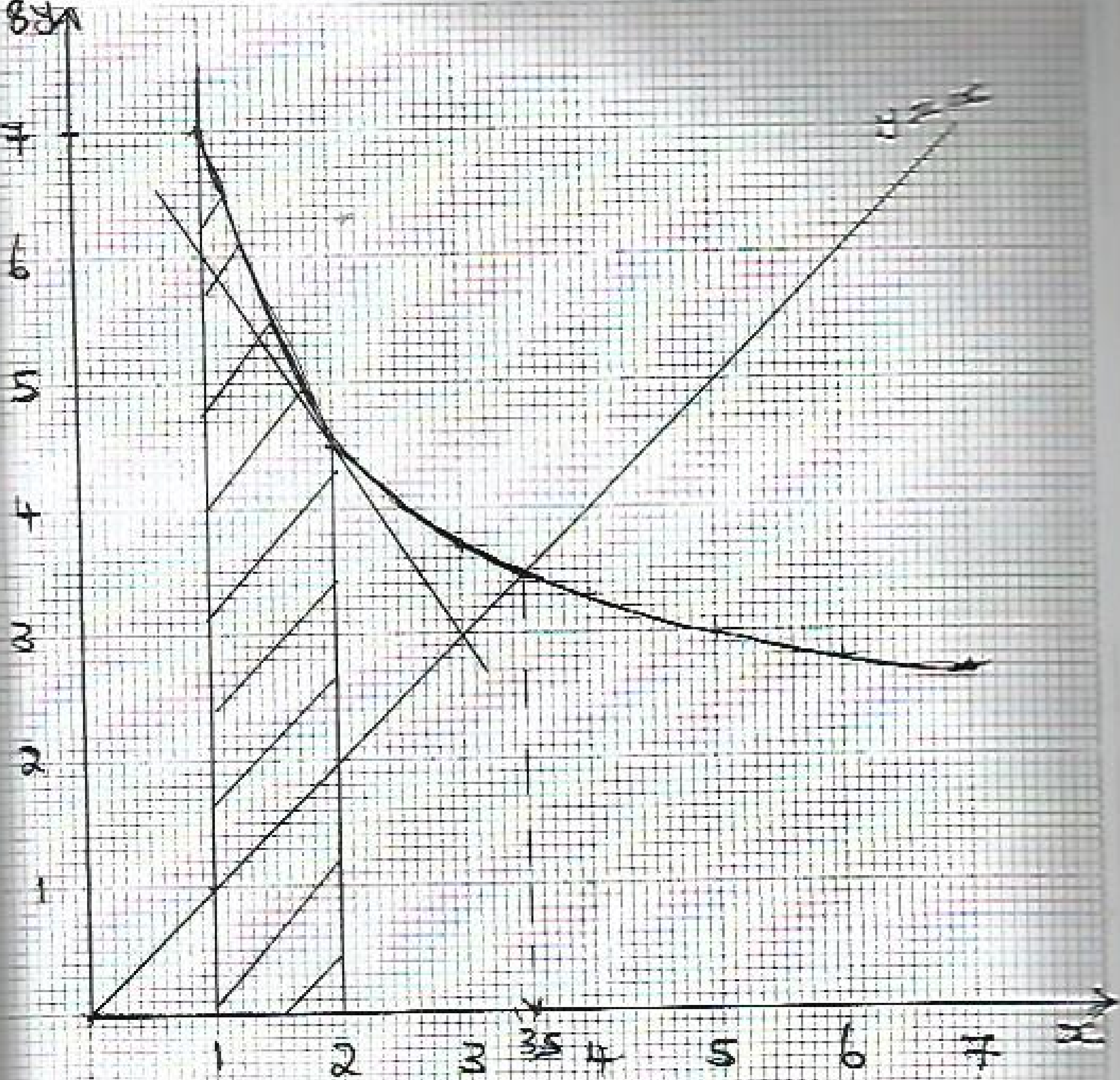
5k = 2h ......(ii)

<u>h = 1,7</u> or 5/3

5k = 2(1,7)
<u>K = 0,68 or 2/3</u>

(iv) 1/3 or 1:3

ESTION 9 NOV 13



a) $p = 4,5$ $q = 2,8$

c(i) Gradient $= -\frac{3}{2}$

(ii) Area $= \frac{1}{2}(a+b)h$

$= \frac{1}{2}(7 + 4,5)1$

$= \underline{5,75}$

(d) $x = 3,5$

10a) $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$

a = 2 ; b = -4 and c = -3

So $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-3}}{2\,(2)}$

$= \frac{4 + \sqrt{16 - 8\,(-3)}}{4}$

$= 4 \pm \frac{\sqrt{16 + 24}}{}$

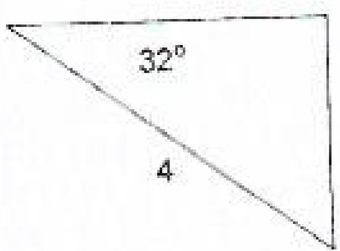
$= \frac{4 + \sqrt{40}}{4}$

$= 4 \pm \frac{6{,}3}{4}$

Either $\frac{4 + 6{,}3}{4}$ or $\frac{4 - 6{,}3}{4}$

x = 2,6 or -0,6

(b)(i) 1



Cos 32 $= \frac{\text{adj}}{\text{Hyp}}$

hyp cos 32 = adj

Therefore adj = 3,4 km (shortest distance or 3,464km

2. $(3{,}4^2) + x^2 = 4^2$

$x^2 = 4^2 - 3{,}4^2$

$= 16 - 11{,}56$

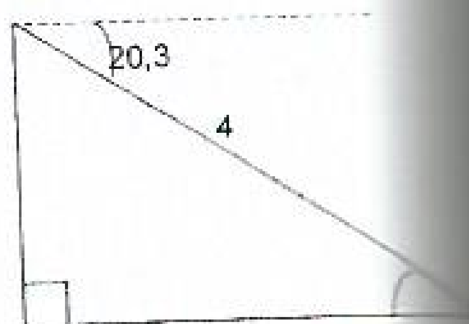
$\sqrt{X^2} = \sqrt{4{,}44}$

X = 2,1

Thus PR = 2,1 x 2

= 4,2 km

(ii)



Sin 20,3 $= \frac{h}{4}$

4 sin 20,3 = h

h = 1,4km or 1,48 km or 1480m

11a) (n – 2) 180 = 3240

180n – 360 = 3240

180n = 3240 + 360

180n = 3600

n = 20

so 3240 –(140 + 110 + 100+

3240 – 350 = 2890

$\frac{2890}{17}$ i.e (20-3)

Each angle is 170°

(b)(i) 70≤ x < 80 or 70-80
P =0,2

(ii) q = 0,4 & r = 1,3

(iii) $\frac{100 + 10}{2}$ =55

4(15)+6(35) +8(550 +4(65)+ 13(75)+5(90)
= 59,9

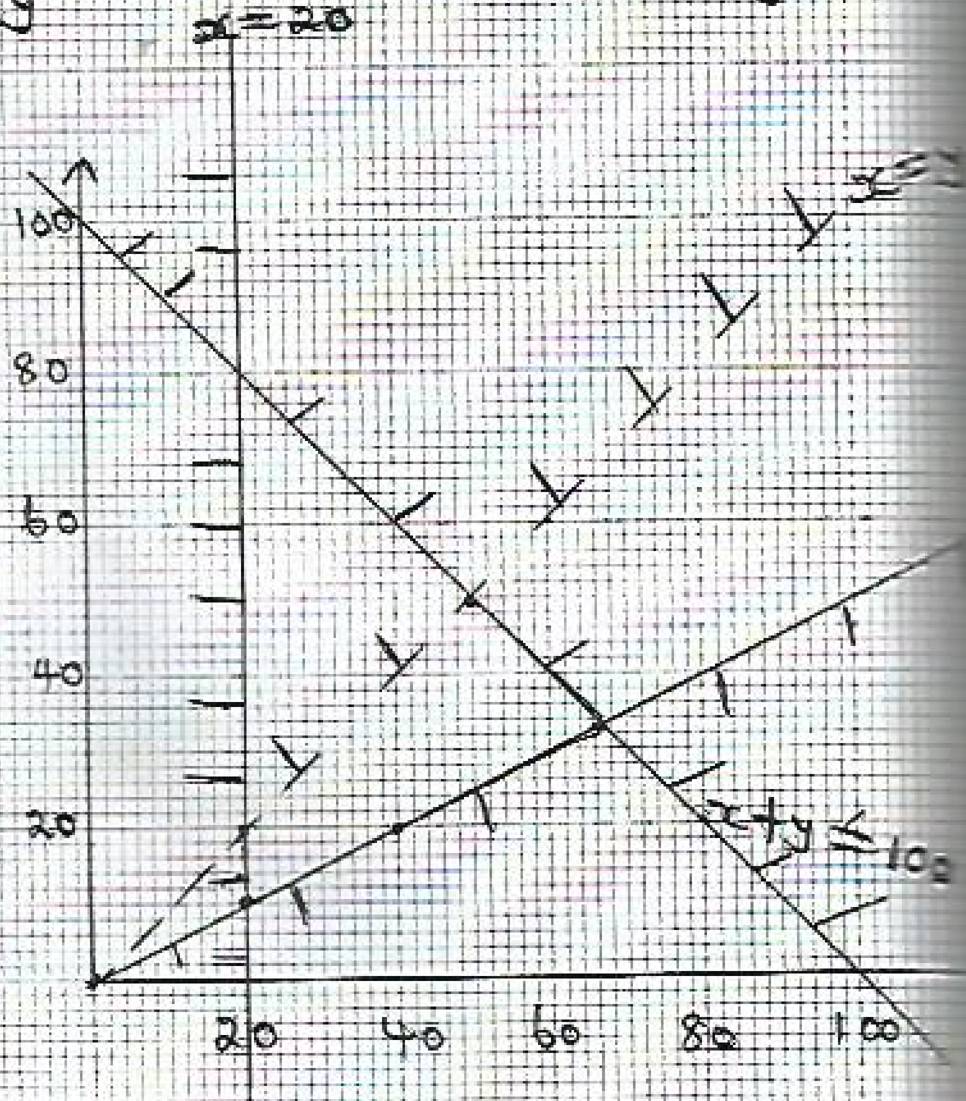
iv) One = 0,45
both = (0,45) (0,45)
or 18/40 x 17/39
=0,2 i.e (0,196)
= 0,2

Question 12

(a) $x + y \leq 100$ (b) $x \geq 20$

$x \leq 2y$

(c) $x > y$



d Highest Sales $(66 \times 1{,}2 + 3$

$= \underline{106{,}4}$

Highest Commission

$\frac{5}{200} \times 106{,}4$

$= \underline{\$2{,}66}$

IMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

ATHEMATICS 4028/2

APER 2

JUNE 2014 SESSION 2 hours 30 minutes

itional materials:
nswer paper
eometrical instruments
raph paper (3 sheets)
athematical tables
lain paper (1 sheet)

E 2 hours 30 minutes

UCTIONS TO CANDIDATES

ur name, Centre number and candidate number in the spaces provided on the paper/answer booklet.

all questions in Section **A** and any **three** questions from Section **B**.

our answers on the separate answer paper provided.
se more than one sheet of paper, fasten the sheets together.

king must be clearly shown. It should be done on the same sheet as the rest of the

n of essential working will result in loss of marks.
egree of accuracy is not specified in the question and if the answer is not exact, the should be given to three significant figures. Answers in degrees should be given decimal place.

RMATION FOR CANDIDATES

mber of marks is given in brackets [ ] at the end of each question or part ion. Mathematical tables or electronic calculators may be used to evaluate numerical expressions.

This question paper consists of 11 printed pages and 1 blank page.

[Turn over

Section A [64 marks]

Answer all the questions in this section.

1 (a) Simplify

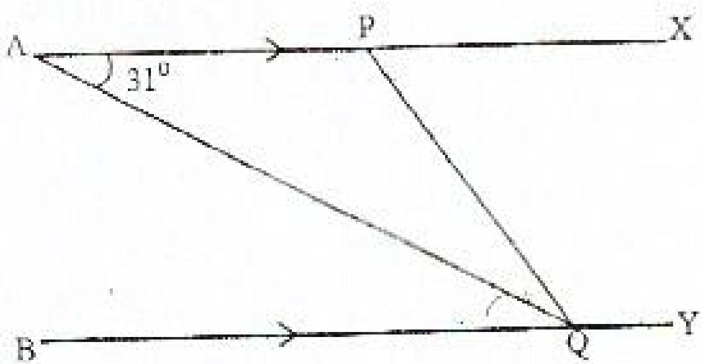
(i) 0,85 – 0,6 giving your answer as a common fraction in its lowest terms,

(ii) $1\frac{3}{4} \div 1\frac{2}{5} + 1\frac{5}{8}$.

(b) Remove the brackets and simplify $(a+2)(a-3)-3(a-5)$.

(c) Giving your answer in standard form, find 25% of $3{,}168 \times 10^{-4}$.

(d)



In the diagram, APX and BQY are parallel straight lines and AQ is the bisector of $P\hat{Q}B$.

Given that $P\hat{A}Q = 31°$, calculate $A\hat{P}Q$.

2 (a) Solve the following equations

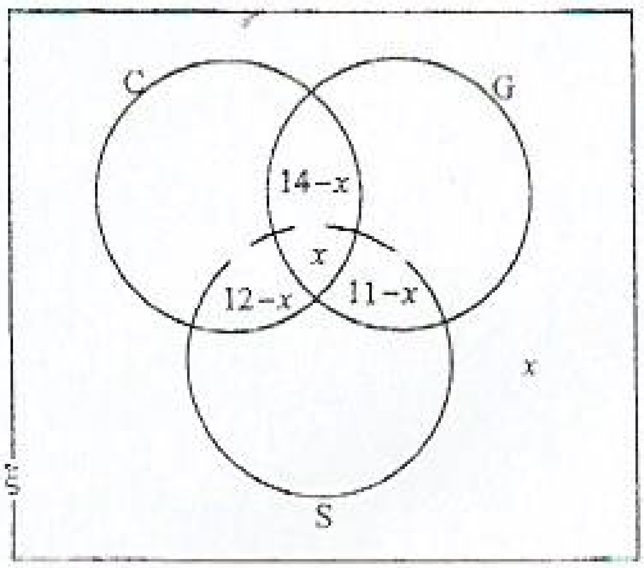
(i) $0{,}3x - 1{,}7 = 1{,}8 - 0{,}4x$

(ii) $3x = (-64)^{\frac{1}{3}}$

(b) Factorise completely $6m^2n^2 - mn - 15$.

(c) Express as a single fraction in its simplest form

$$\frac{x-4}{16-x^2} + \frac{2}{x+4}.$$



The Venn diagram shows some information about all the 52 families in a village. C is a set of 37 families that have cattle, G is a set of 24 families that have goats and S is the set of 20 families that have sheep.

It is also given that 14 families have cattle and goats, 11 families have cattle and sheep, x families have all three types of animals and another x families have no animals.

(a) Find, in terms of x, the number of families with

(i) cattle only,

(ii) goats only,

(iii) sheep only.

[6]

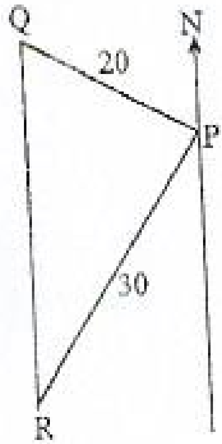
(b) Find

(i) the value of x.

(ii) the number of families with goats but have no cattle.

[4]

4



In the diagram, P, Q and R are three points on level ground. PQ = 20 m, PR = 30 m and $\cos R\hat{P}Q = -\frac{1}{3}$.

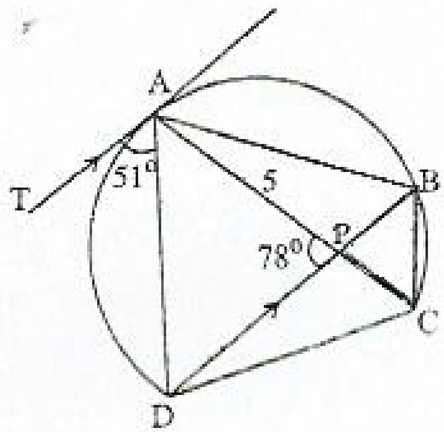
If R is due south of Q, calculate

(a) $R\hat{P}Q$,

(b) the length of QR,

(c) $P\hat{R}Q$,

(d) the three-figure bearing of Q from P correct to the nearest degree.



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

(a) Given that $T\hat{A}D = 51°$ and $A\hat{P}D = 78°$, calculate

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

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

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

[5]

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

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

(d) Name in the correct order, the triangle which is

(i) similar to ΔAPD,

(ii) congruent to ΔABP.

[2]

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

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

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

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

(ii) the locus of points which are equidistant from

1. W and Y,

2. X and Z.

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

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

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

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

Section B [36 marks]

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

Each question carries 12 marks.

(a) Calculate the volume of a copper ball of radius 3 cm. [2]

(b) The copper ball in **(a)** is melted and recast into cylindrical rods each of diameter 0,3 cm and length 15 cm.

(i) Calculate the volume of each rod.

(ii) Find the number of copper rods that can be made from the copper ball.

[4]

(c) Each of the copper rods in **(b)** is bent to form a circular bangle. Calculate the radius of the bangle. [2]

(d) If each bangle is to be coated with silver paint at a cost of 5c per cm^2, calculate the total cost of coating all the bangles so formed, giving your answer correct to the nearest cent. [4]

$$\left[\begin{array}{ll} \text{Volume of a sphere} & = \dfrac{4\pi r^3}{3} \\ \pi & = \dfrac{22}{7} \end{array}\right]$$

8 **Answer the whole of this question on a sheet of graph paper.**

The following is an incomplete table of values for $y = 12 + 2x - x^2$.

x	-3	-2	-1	0	1	2	3	4
y	-3	p	9	12	13	12	q	4

(a) Find the value of p and the value of q.

(b) Using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 2 units on the y-axis draw the graph of $y = 12 + 2x - x^2$.

(c) Use your graph to find

(i) the roots of the equation $12 + 2x - x^2 = 0$,

(ii) the gradient of $y = 12 + 2x - x^2$ at $x = 2$,

(iii) the equation whose roots are -1 and 3, giving your answer in the form $12 + 2x - x^2 = k$ where k is an integer.

---

9 A salary of \$P, of a saleswoman who sells cars of the same type, is partly constant and her commission partly varies as N, the number of cars that she sells in one month. If she sells 7 cars in one month, her salary is \$675. If she sells 10 cars, her salary is \$900.

(a) Express P in terms of N and constants h and k.

(b) Find the value of h and the value of k.

(c) Write down

(i) the equation connecting P and N,

(ii) the saleswoman's salary when she has not sold any car.

(d) Calculate the saleswoman's salary when she sells 9 cars in one month.

(e) Given that her commission is $2\frac{1}{2}$% of the price of one car, calculate the price of each car.

---

10 (a) Solve the equation $3x^2 - 5x - 15 = 0$, giving your answers correct to 2 decimal places. [5]

(b) **Answer this part of the question on a sheet of graph paper.**

The following is a cumulative frequency table for a survey carried out on the masses of 80 secondary school pupils.

mass (kg)	$m \le 45$	$m \le 50$	$m \le 55$	$m \le 60$	$m \le 65$	$m \le 70$	$m \le 75$	$m \le 80$
cumulative frequency	2	10	21	41	60	72	78	80

(i) Using a scale of 2 cm to represent 5 kg on the horizontal axis and 2 cm to represent 10 pupils on the vertical axis, draw a cumulative frequency curve for the data.

(ii) Use your graph to find

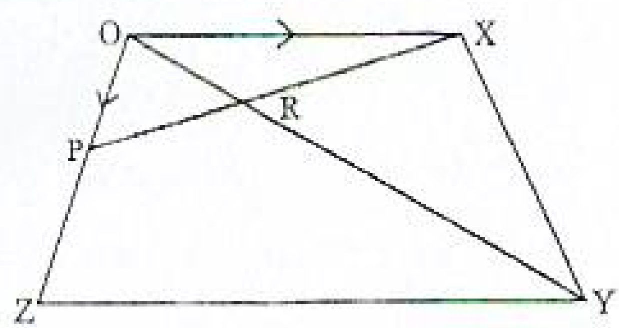
1. the median mass of the pupils,

2. the number of pupils whose masses are more than 72 kg.

[7]

[Turn over

11



In the diagram, OXYZ is a quadrilateral in which P is a point on OZ such that $\overrightarrow{OP} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ and $\overrightarrow{OX} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$. OY and XP intersect at R.

(a) Find $\overrightarrow{XP}$.

(b) Given that $\overrightarrow{XR} = h\overrightarrow{XP}$,

(i) express $\overrightarrow{XR}$ in terms of h,

(ii) show that $\overrightarrow{OR} = \begin{pmatrix} 5-6h \\ -2h \end{pmatrix}$.

(c) Given also that $\overrightarrow{OZ} = 3\overrightarrow{OP}$ and $\overrightarrow{ZY} = 2\overrightarrow{OX}$, find $\overrightarrow{OY}$.

(d) If $\overrightarrow{OR} = k\overrightarrow{OY}$

(i) express $\overrightarrow{OR}$ in terms of k,

(ii) use the results of (b)(ii) and (d)(i) to find the value of h and the value of k.

(e) Write down the numerical value of the ratio $\frac{XR}{RP}$.

Answer the whole of the question on a sheet of graph paper.

Triangle W has vertices at $(1;-1)$, $(7;-1)$ and $(4;4)$. Using a scale of 2 cm to represent 2 units on both axes, draw the x and y-axes for $-10 \le x \le 10$ and $-10 \le y \le 10$.

(a) Draw and label clearly triangle W. [1]

(b) Triangle X is the image of triangle W under a reflection in the line $y = x + 2$.

Draw and label clearly,

(i) the line $y = x + 2$,

(ii) triangle X. [3]

(c) (i) Draw and label clearly triangle Y, the image of triangle W under an enlargement of scale factor $-\frac{1}{2}$ with the origin as centre.

(ii) Write down the matrix which represents this transformation. [4]

(d) Triangle Z with vertices at $(1;-3)$, $(1;-9)$ and $(6;-6)$, is the image of triangle W under a certain transformation.

(i) Draw and label clearly triangle Z.

(ii) Describe **fully** the **single** transformation which maps triangle W onto triangle Z. [4]

MATHEMATICS PAPER 2
JUNE 2014

1a)i) 0,85

$$\begin{array}{r} 0,85 \\ \underline{0,60} \\ 0,25 \end{array} = \frac{25}{100} = \frac{1}{4}$$

(ii) $1\,\frac{3}{4} \div 1\,\frac{2}{5} + 1\,\frac{5}{8}$ Use BOMDAS

$\frac{7}{4} \div \frac{7}{5} + \frac{13}{8}$ Changing to improper fractions

$(\frac{7}{4} \div \frac{7}{5}) + \frac{13}{8}$ Introduce Brackets

$(\frac{7}{4} \times \frac{5}{7}) + \frac{13}{8}$ Brackets First

$\frac{5}{4} + \frac{13}{8}$ Using the L.C.M

$\frac{4 \times 5 + 2 \times 13}{16}$

$= \frac{20 + 26}{16}$

$= \frac{46}{16}$

$=$ $\mathbf{2\,\frac{7}{8}}$ **OR** **2,875** **OR** $\mathbf{\frac{23}{8}}$ (3)

(b) $(a + 2)(a - 3) - 3(a-5)$

Remove brackets by expansion

$a(a - 3) + 2(a-3) - 3(a-5)$

$a^2 - 3a + 2a - 6 - 3a + 15$

$a^2 - 4a + 9$ Grouping like terms (3)

(c) $25\% \times 3,168 \times 10^{-4}$

$\frac{3,168}{4} \times \frac{10^{-4}}{10^{0}}$ [Multiplying by 25% is iving by 4]

$0,792 \times 10^{-4}$ [Change the A to standard form]

$7,92 \times 10^{-1} \times 10^{-4}$

$7,92 \times 10^{-1-4}$ [Apply the laws of indices]

$\mathbf{7,92 \times 10^{-5}}$

---

d) $AQB = 31^{\circ}$ [Alternate Angles]

$APQ = 180 - [31^{\circ} \times 2]$

$= 180 - [62]$

$= \mathbf{118^{\circ}}$

2 a (i) $0.3x - 1.7 = 1.8 - 0.4x$

$\frac{3x}{10} - \frac{17}{10} = \frac{18}{10} - \frac{4x}{10}$

$3x + 4x = 18 + 17$

$7x = 35$

$\frac{7x}{7} = \frac{35}{7}$

Therefore $x = 5$

(ii) $3x = (-64)^{1/3}$

$3x \quad \sqrt[3]{-64}$

$3x = -4$

$\frac{3x}{3} = \frac{-4}{3}$

Therefore x = $^{4}/_{3}$ **OR** $-1\,^{1}/_{3}$

---

b) $6m^2n^2 - mn - 15$

$6m^2n^2 + 9mn - 10mn - 15$

$3mn(2mn + 3) - 5(2mn + 3)$

$(3mn - 5)(2mn + 3)$

---

c) $\frac{x-4}{16-x^2} \div \frac{-2}{x+4}$

$= \frac{x-4}{(4+x)(4-x)} \times \frac{x+4}{-2}$

$= \frac{(x-4)}{2(4+x)} \quad \frac{(x+4)}{(4-x)}$

$= \frac{(x-4)(x+4)}{-2(4+x)(x-4)}$

$= -\frac{1}{2}$ **OR** $-0{,}5$

---

3 a(i) $37 - [14 - x + x + 12 - x]$

$37 - [26 - x]$

$37 - 26 + x$

$11 + x$ (2)

(ii) $24 - [14 - x + 11 - x + x]$

$24 - [14 + 11 - x - x + x]$

$24 - [25 - x]$

$24 - 25 + x$

$x + (-1)$

$x - 1$ OR $-1 + x$ (2)

(iii) $20 - [11 - x + 12 - x + x]$

$20 - [11 + 12 + x - x - x]$

$20 - 23 + x$

$x - 3$ OR $-3 + x$ *(2)*

---

b(i) $x - 3 + x - 1 + 11 + x + 37 - 2x = 52$

$x + 44 = 52$

$x = 52-44$

$x = 8$

(ii) $x - 1 + 11 - x$

= **10 families**

---

4 (a) Cos R P Q $= -{}^{1}/_{3}$

Therefore R P Q $= \text{Cos}^{-1}\ {}^{1}/_{3}$

$= 109.4712206$

$=$ **109.50**

---

b) $QR^2 = 30^2 + 20^2 - 2\,(30 \times 20)\ \text{Cos RPQ}$

$= 900 + 400 - 2\,(600 \times -{}^{1}/_{3})$

$= 900 + 400 + 400$

$= 1700$

Therefore $QR = \sqrt{1700}$

$=$ **41,23**

Or QR = 41.2 to 3 sf

c) $\frac{\text{Sin PRQ}}{20} = \frac{\text{Sin RPQ}}{41,23}$

$\text{Sin PRQ} = \frac{20 \times \text{Sin RPQ}}{41.23}$

$\text{Sin PRQ} = \frac{20 \times \text{Sin } 109.5}{41.23}$

Sin PRQ = **0.45726**

d) Therefore PRQ = **27,2°**

5(a)

(i) ACD = 51° [Alternate angles with TAD]

(ii) BAC = 180° -[102 + 51]

27°

(iii) BCA = 102° – 51° [Cyclic quadrilateral]

51°

---

b) – the base angles are equal

OR

L ADB = DAC

---

c) $\frac{\text{Sin } 51^\circ}{5} = \frac{\text{Sin } 78^\circ}{AD}$

Therefore $AD = \frac{5 \times \text{Sin } 78^\circ}{\text{Sin } 51^\circ}$

= 6.2932039

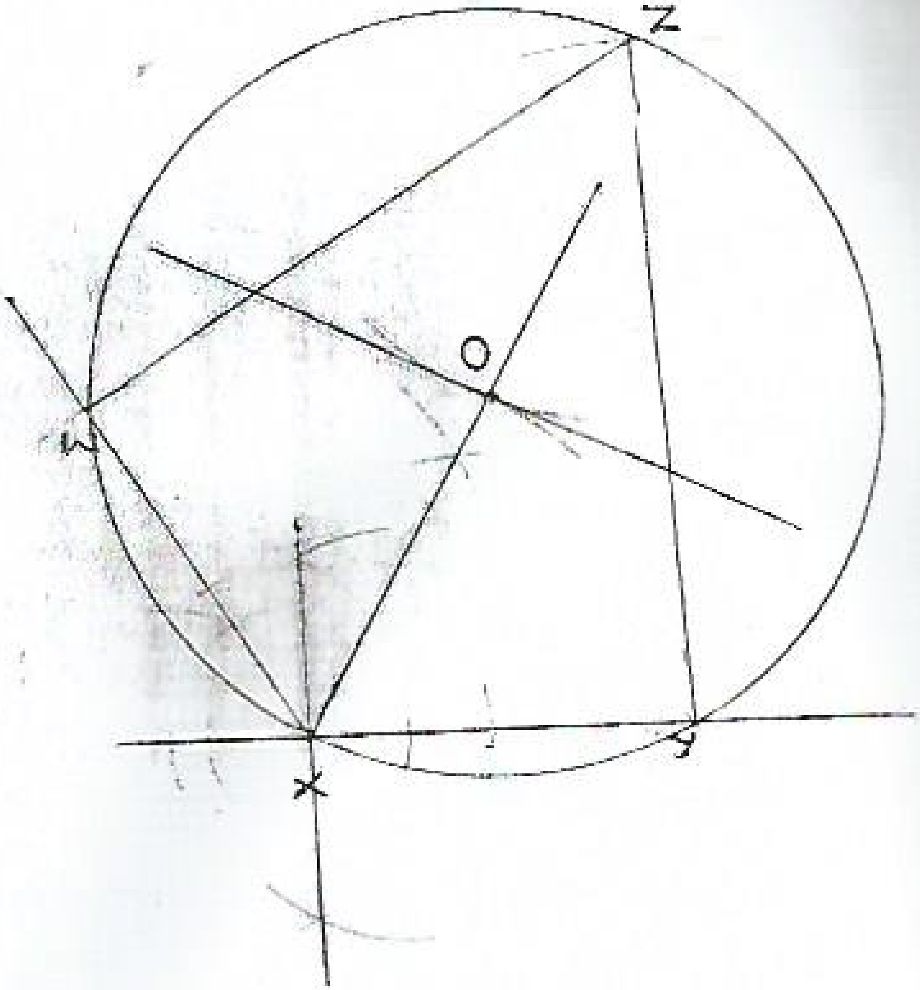
AD **6.29 cm**

d) (i) CPB

(ii) DCP

QUESTION 6. J.20..

6.



C ii) Radius = 5, 1 cm

d) Cyclic quadrilateral

7(a) Volume of sphere $= \frac{4}{3}\pi r^3$

$= \frac{4 \times \frac{22}{7} \times 3^3}{3}$

$= \frac{2376}{7} \div 3$

$= \underline{\mathbf{113,14\ cm^3}}$

(bi) Volume of Cylinder = Cross Sectional Area x Height

$= \frac{22}{7} \times (0.15)^2 \times 15$

$\underline{\mathbf{= 1.06cm^3}}$

(ii) Number of rods $= \frac{\text{Volume of Sphere}}{\text{Volume of Cylinder}}$

$= \frac{113,14}{1,06}$

$= 106,73$

$= \underline{\mathbf{106\ rods}}$

---

c) $2 \Lambda r = 15$

$2 \times \frac{22}{7} \times r = 15$

$\frac{44r}{7} = 15$

$44r = 105$

$\mathbf{r = 2,39cm}$

---

d) Area of bangle $= \pi r^2$

$= \frac{22}{7} \times (2.39)^2$

$= \underline{\mathbf{17,95cm^2}}$

Cost of one bangle = Area x Cost / cm^2

$= 17,95 \times 5c$

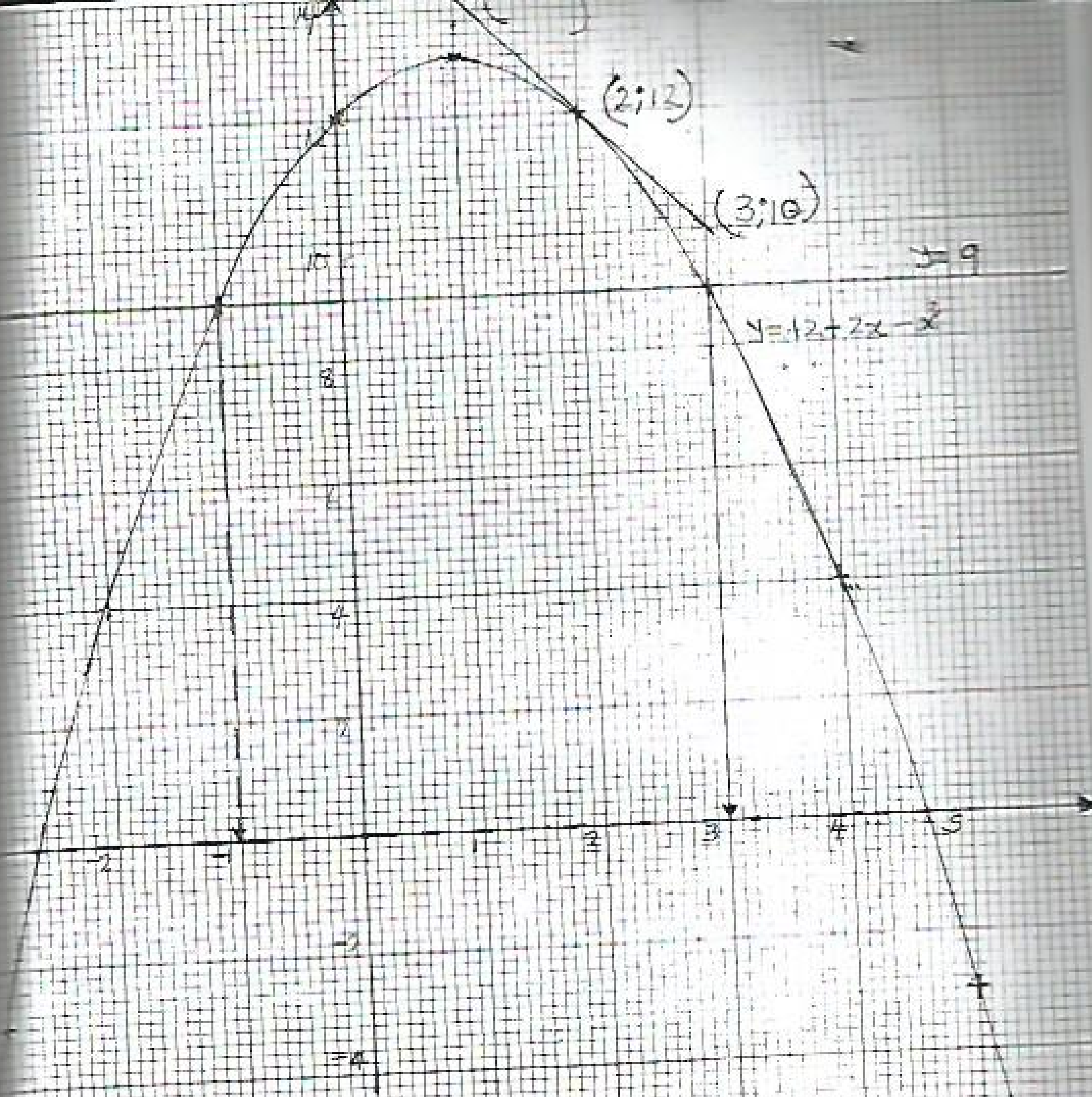
$= \underline{\mathbf{89,75c}}$

Cost of ALL bangles = 89,75

x <u>106</u>

<u>9513,5</u>

Therefore Total Cost = **<u>9514</u>** (to the nearest cent)



$p = 12 + 2(-2) - (-2)^2$
$= 12 - 4 = 4$
$= 12 - 8$
$= 4$

$q = 12 + 2(3) - (3)^2$
$= 12 + 6 - 9$
$= 18 - 9$
$= 9$

(c) (i) $x = -2.7$ OR 4.64

(ii) Gradient $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{12 - 10}{2 - 3}$
$= -\frac{2}{1}$
$= -2$

(iii) $12 + 2x - x^2 = +9$

9 (a)

$P = KN + L$ (where L and K are constants)

(b) $675 = 7k + h$ - - - - (i)

$\underline{900 = 10k + h}$ - - - - (ii)

$-225 = -3k$

$\frac{-225}{-3} = \frac{-3k}{-3}$

$75 = k$

Therefore $k = 75$

Substituting 75 for k in (i)

$675 = 7(75) + h$

$675 = 525 + h$

$675 - 525 = h$

Therefore $h = 150$

---

c (i) $P = 150 = 75N$

(ii) $N = 0$

$P = 150 + 75(o)$

$= 150 + o$

$=$ **$150**

---

d) $P = 150 + 75N$

$= 150 + 75(9)$

$= 150 + 675$

$= 825$

Her salary is **$825**

---

e) Commission $k = 75$

$2\frac{1}{2}$ of $x = 75$

Therefore $\frac{5}{200} \times x = 75$

$5x = 200(75)$

$5x = 3\,000$

Therefore $x = \frac{3000}{5}$

x = $3000

Therefore Price of one car = $3000

10(a) $3x^2 - 5x - 15 = 0$

$a = 3 ; b = -5 ; c = 5$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-(-5) \pm \sqrt{(-5)^2 - 4(3) - (15)}}{2 \times 3}$$

$$= \frac{5 \pm \sqrt{25 + 180}}{6}$$

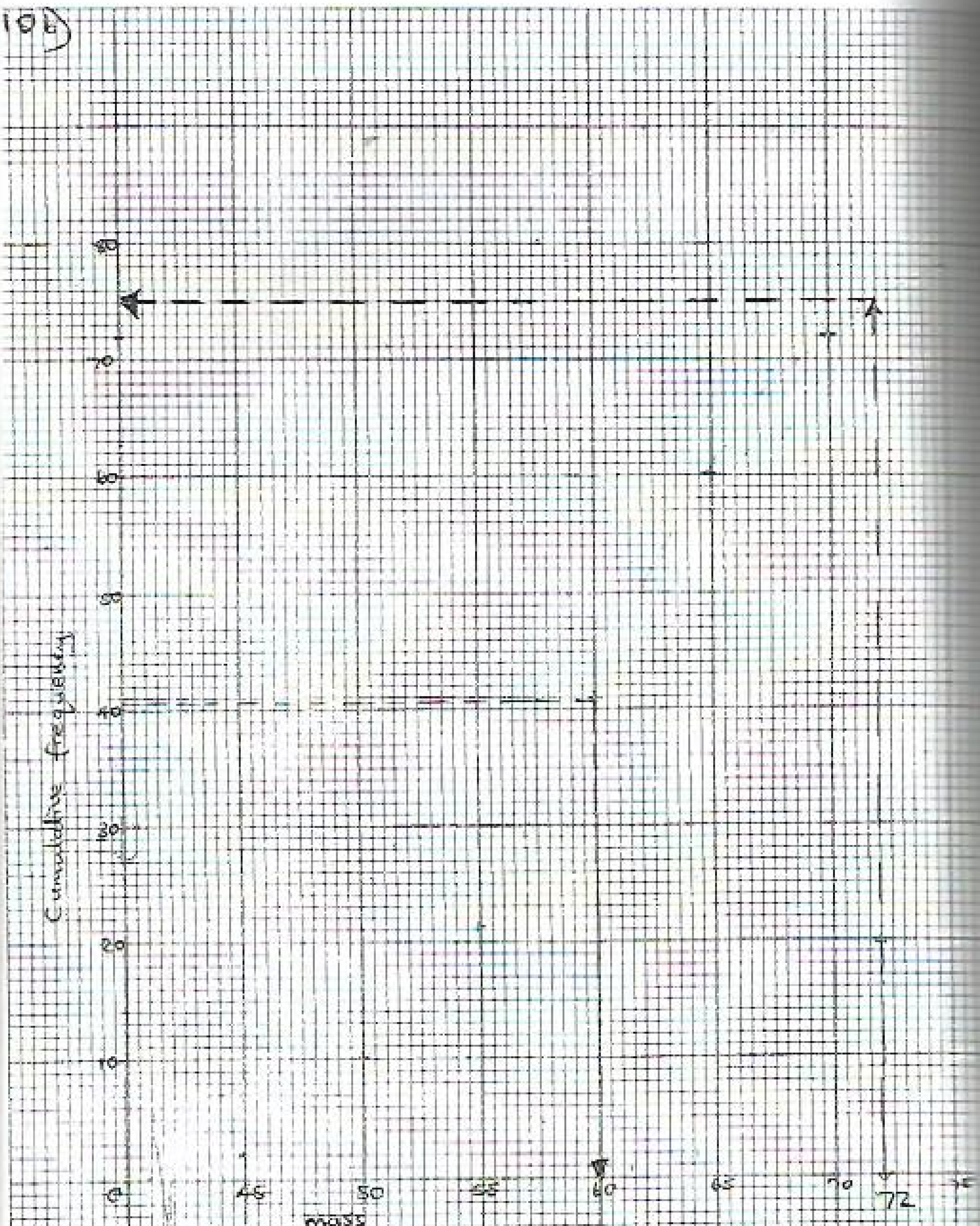
$$= \frac{5 + \sqrt{205}}{6} \quad \text{OR} \quad \frac{5 - \sqrt{205}}{6}$$

$$\frac{5 + 14{,}31}{6} \quad \text{OR} \quad \frac{5 - 14{,}31}{6}$$

$$= \underline{\mathbf{3{,}22}} \qquad \underline{\mathbf{-1{,}55}}$$

19. QUESTION 10. B. J. 2014

10b)



b(ii) $Q_2 = \frac{1}{2}(n + 1^{th} \text{ term})$

$= \frac{1}{2} \times 81$

$= 40.5$ term

$= \underline{60kg}$

2. 80 = 75

= $\underline{5 \text{ people}}$

11(a) $XP = XO + OP$

$= \begin{pmatrix} -5 \\ 0 \end{pmatrix} + \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$= \begin{pmatrix} \mathbf{-6} \\ \mathbf{-2} \end{pmatrix}$

---

b(i) $XR = h \times P$

$= h \begin{pmatrix} -6 \\ -2 \end{pmatrix}$

$= \begin{pmatrix} \mathbf{-6h} \\ \mathbf{-2h} \end{pmatrix}$

(ii) $OR = \overrightarrow{OX} + \overrightarrow{XR}$

$= \begin{pmatrix} 5 \\ 0 \end{pmatrix} + \begin{pmatrix} -6h \\ -2h \end{pmatrix}$

$= \begin{pmatrix} 5 - 6h \\ 0 - 2h \end{pmatrix}$

$= \begin{pmatrix} \mathbf{5 - 6h} \\ \mathbf{-2h} \end{pmatrix}$ Shown

c) $\bar{O}Y = OZ + ZY$

$= 3 \begin{pmatrix} -1 \\ -2 \end{pmatrix} + 2 \begin{pmatrix} 5 \\ 0 \end{pmatrix}$

$= \begin{pmatrix} -3 \\ -6 \end{pmatrix} + \begin{pmatrix} 10 \\ 0 \end{pmatrix}$

$= \begin{pmatrix} \mathbf{7} \\ \mathbf{-6} \end{pmatrix}$

d(i) $OR = K\ OY$

$= K \begin{pmatrix} 7 \\ -6 \end{pmatrix}$

$= \begin{pmatrix} \mathbf{7k} \\ \mathbf{-6k} \end{pmatrix}$

(ii) $7K = 5 - 6h$ ---- (i)

$6K = 2h$ ---- (ii)

From equation (2)

$K = {}^1/_3 h$

Sub ${}^1/_3 h$ for K in (i)

$7 \times {}^1/_3 h = 5 - 6h$

$7h = 15 - 18h$

$25h = 15$

$h = \frac{15}{25}$

Therefore $h = {}^3/_5$

$K = {}^1/_3 h$

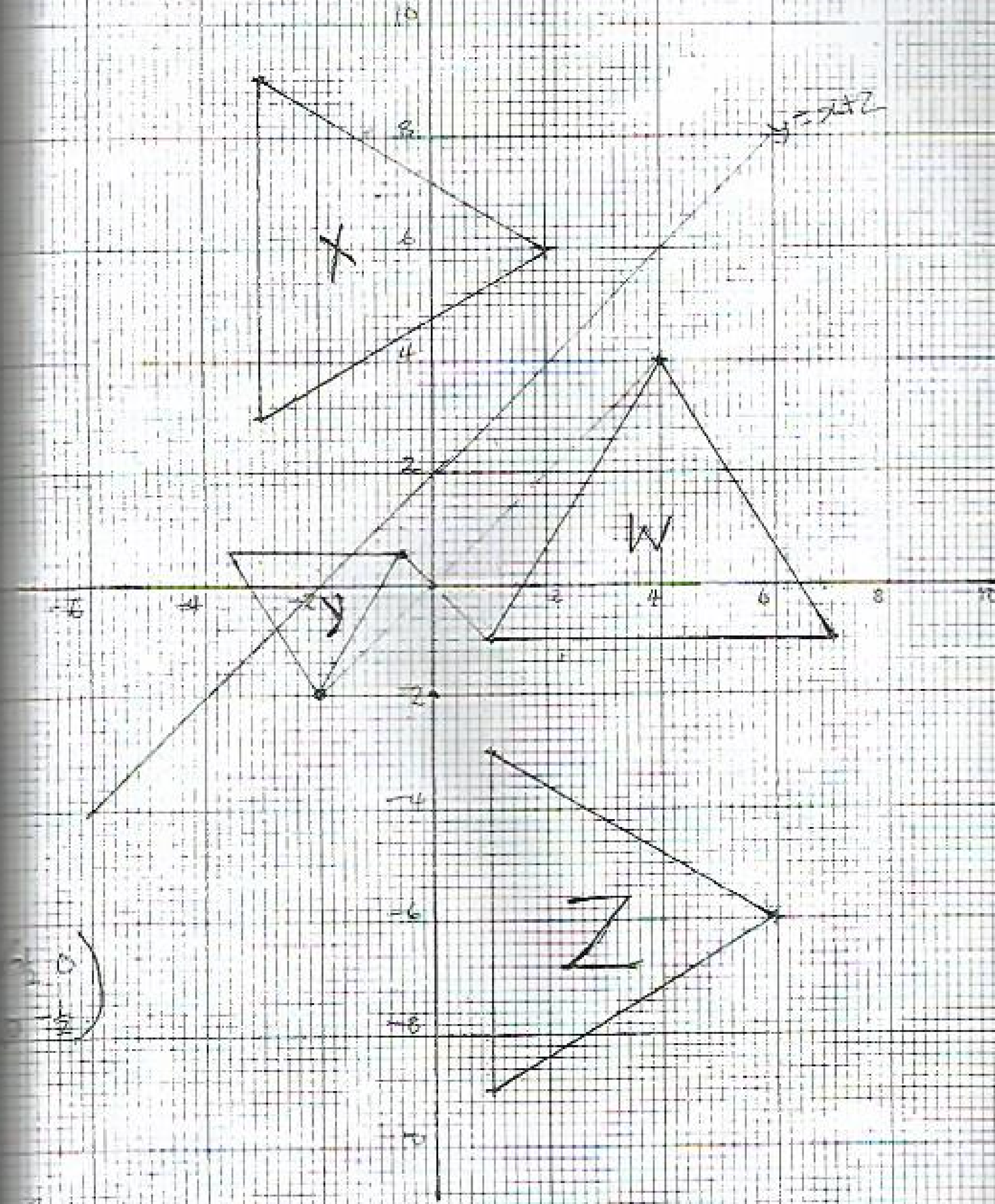
$= {}^1/_3 \times {}^3/_5$

$= {}^1/_5$

Therefore K = 1,5

---

e) $\frac{XR}{RP} = \frac{{}^3/_5}{{}^2/_5} = \frac{3}{2}$ OR 3:2



Rotation
90° clockwise
centre (0; -2)

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MATHEMATICS

PAPER 2 **4028/2**

REPLACEMENT PAPER

NOVEMBER 2014 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

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

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

Electronic calculators may be used.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given 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 12 printed page.

Section A [64 marks]

Answer all the questions in this section.

1 (a) Simplify

(i)

	hrs	min	sec
	10	25	42
+	8	41	30

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

(b) A car tank holds $22\frac{1}{2}$ litres of fuel when it is $\frac{3}{8}$ full.

Calculate the amount of fuel when it is full.

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

(d) Given that $x = 2{,}25 \times 10^6$ and $y = 4 \times 10^{-20}$, find the numerical value of $\sqrt{\frac{x}{y}}$, giving the answer in standard form.

2 (a) Factorise completely

(i) $9m^2 - 3m - 6$,

(ii) $(y + x)^2 - 4$.

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

(ii) Hence or otherwise solve the equation

$$\frac{2}{x+2} - \frac{1}{3} = -\frac{1}{5}$$

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

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

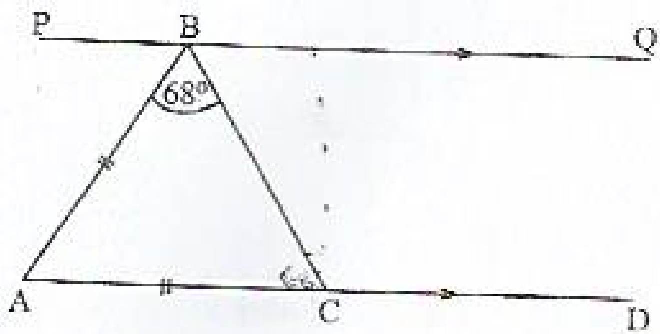
(b) Triangle ABC is right-angled at B. AB = 2,5 cm, BC = 6 cm and the perpendicular from B meets AC at D.

Find the length of

(i) AC,

(ii) BD. [4]

(c)

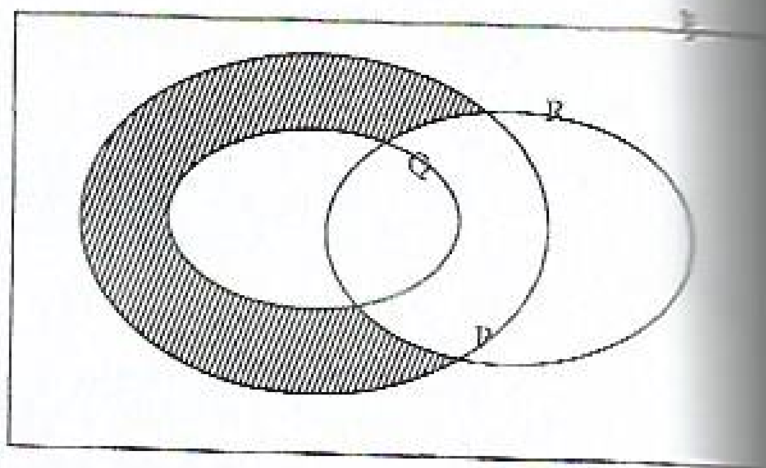


In the diagram, ABC is an isosceles triangle with AB = AC and $A\hat{B}C = 68°$. ACD is parallel to PBQ.

Calculate (i) $B\hat{C}D$,

(ii) $P\hat{B}A$, [4]

4 (a) Write down, in set notation and in terms of P, Q and R, the set ... represented by the shaded part in the Venn diagram.



(b) (i) Solve the inequality $x-3<4-2x \leq x+13$.

(ii) Illustrate your solution in part b(i) on a number line.

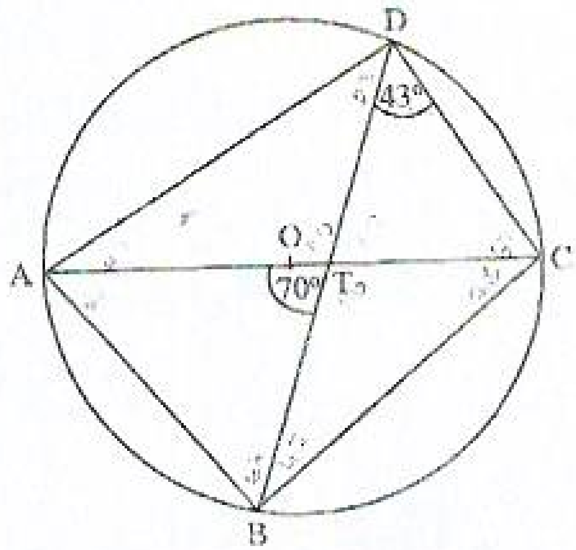
(c) Solve the equation $2x^2+3x-84=0$, giving the answers correct ... decimal places.

5 (a) Given that $A = P + \frac{PRT}{100}$,

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

(ii) make P the subject of the formula.

(b)



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

(i) Calculate

1. $B\hat{A}C$,

2. $D\hat{B}C$,

3. $B\hat{A}D$.

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

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

[6]

[Turn over

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

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

All constructions should be done on a single diagram.

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

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

(c) Construct the locus of a point

(i) that is 4,5 cm from B,

(ii) X, on the same side of AD as C, such that the area of triangle ACD = area of triangle AXD.

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

Section B [36 marks]

Answer any three questions in this section

Each question carries 12 marks.

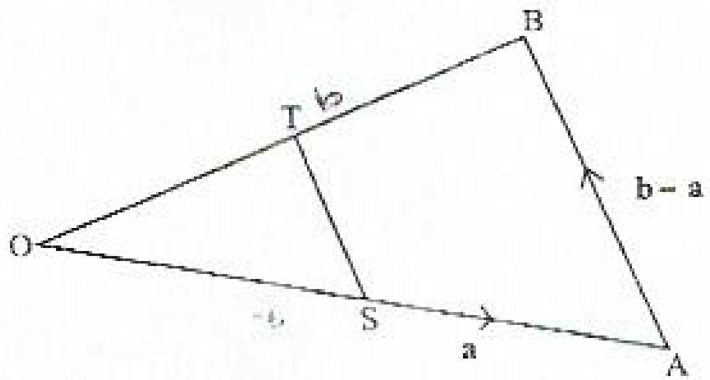
(a) It is given that $P = \begin{pmatrix} 3 & 5 \\ 4 & x \end{pmatrix}$ and $Q = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$.

(i) Find PQ in terms of x.

(ii) Find the value of x that makes $|P| = 7$.

(iii) Hence write down P^{-1}. [6]

(b)



In the diagram, BT and AS produced meet at O. $\overrightarrow{OA} = \mathbf{a}$,

$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ and $\dfrac{OS}{OA} = \dfrac{1}{4}$.

(i) Express

1. $\overrightarrow{OB}$ in terms of **a** and /or **b** in its simplest form,

2. $\overrightarrow{OS}$ in terms of **a** and/or **b** in its simplest form

[Turn over

(ii) It is also given that $\overrightarrow{ST} = k\overrightarrow{AB}$

1. Express $\overrightarrow{OT}$ in terms of a, b, and k, in its simpl[illegible]

2. Given that $\overrightarrow{OT} = h\overrightarrow{OB}$, use the result in b(ii) 1. [illegible] the numerical value of k.

(iii) Hence, express $\overrightarrow{ST}$ in terms of a and b.

8 **Answer the whole of this question on a sheet of graph paper.**

The following is an incomplete table of values for the function $y = 2x^2$ [illegible]

x	$-3\frac{1}{2}$	-3	-2	-1	0	$\frac{1}{2}$	1
y	4	0	P	-6	-3	0	4

(a) Find the value of P.

(b) Using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm [illegible] represent 2 units on the y-axis, draw the graph of

$y = 2x^2 + 5x - 3$ for $-4 \leq x \leq 1$.

(c) Use your graph to

(i) find the equation of the line of symmetry,

(ii) find the gradient of the curve when $x = 0$,

(iii) solve the equation $2x^2 + 5x - 3 = 2$,

(iv) estimate the area bounded by the curve, the axes and the [illegible] $x = -1$.

9 (a) The trapezium PQRS, in which QR is parallel to PS, is such that PS = 11 cm, PQ = 5 cm and $Q\hat{P}S = 90°$. If the area of the trape[illegible] is 45 cm^2,

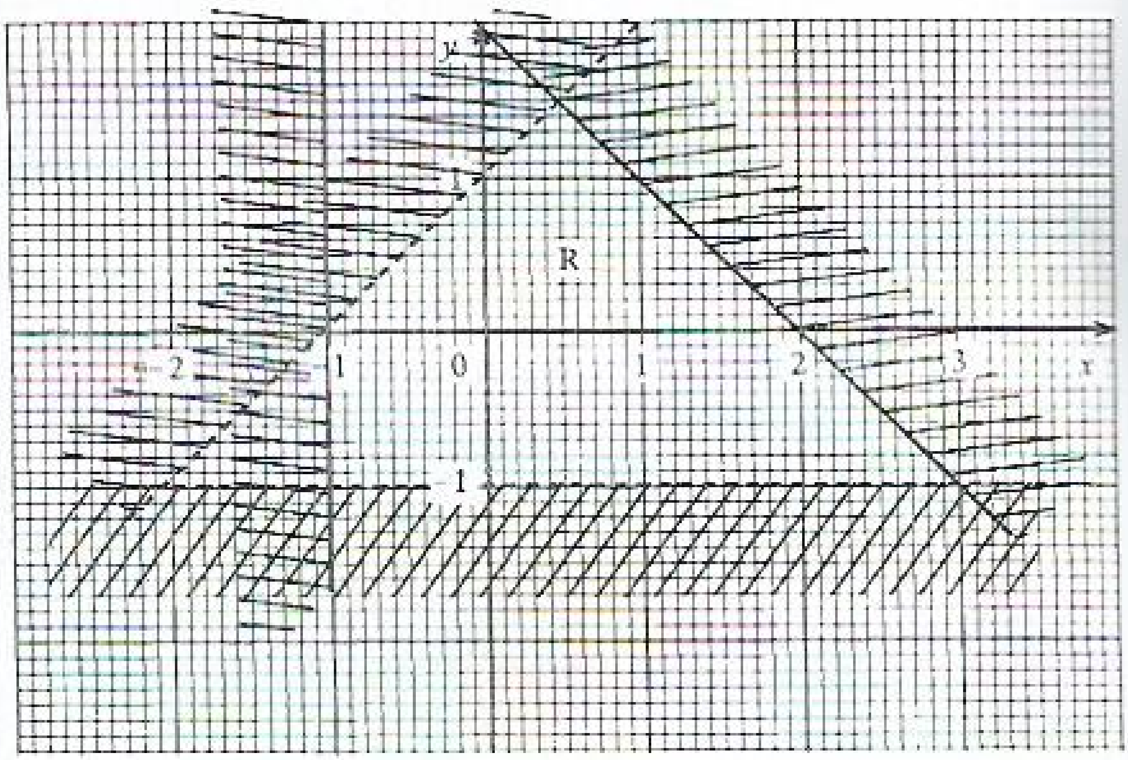
find the length of QR.

(b) It is given that d varies jointly as e^2 and f. If $d = 5$ when $e = 3$ and $f = 2$, find

(i) the formula for d in terms of e and f,

(ii) the value of d when $e = 2$ and $f = 3$. [4]

(c)

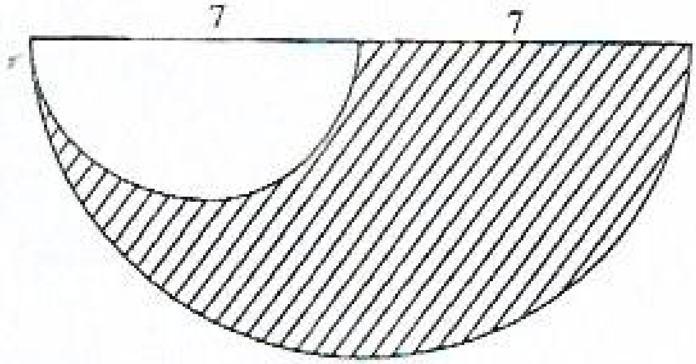


The region, R, is defined by **four** inequalities, one of which is $y < x + 1$.

(i) Write down the other **three** inequalities.

(ii) Find the maximum value of $3x + 2y$ in R, where x and y are integers. [6]

10 (a)



Use $\frac{22}{7}$ **for** π

The diagram shows two semi-circles with diameters 7 cm and 14 cm

Calculate

(i) the area of the shaded part,

(ii) the perimeter of the shaded part.

(b) **Answer the whole of this part of the question on a sheet of graph paper.**

Use a scale of 2 cm to represent 2 units on x-axis and 2 cm to represent unit on y-axis for $-4 \leq x \leq 14$ and $-5 \leq y \leq 5$.

(i) Triangle ABC has vertices A (4; 1), B (6; 1) and C (6; 2).

Draw and label triangle ABC.

(ii) Transformation **T** represents a translation vector $\begin{pmatrix} -2 \\ -6 \end{pmatrix}$.

Draw and label triangle $A_1B_1C_1$, the image of triangle ABC under **T**.

(iii) Transformation **R** represents a clockwise rotation of 90° about (4; 4).

Draw and label triangle $A_2B_2C_2$, the image of triangle ABC under

(iv) 1. Triangle $A_3B_3C_3$ has vertices at $A_3(8; 2)$, $B_3(12; 2)$ and $C_3(12; 4)$.

Draw and label triangle $A_3B_3C_3$.

2. Describe **fully** the single transformation that maps triangle ABC onto triangle $A_3B_3C_3$. [8]

(a) Study the number pattern below:

2; 3; 5; 9; 17; ...

Write down

(i) the next two numbers,

(ii) the formula that is used to get the next number, (r^{th} term) in terms of r. [3]

(b) The sum of the interior angles of an n-sided polygon is 6120°.

Find the value of n. [2]

(c) If three of the angles of a heptagon are 162°, 150° and 132° and the rest of the angles are equal, calculate the size of each of the equal angles. [2]

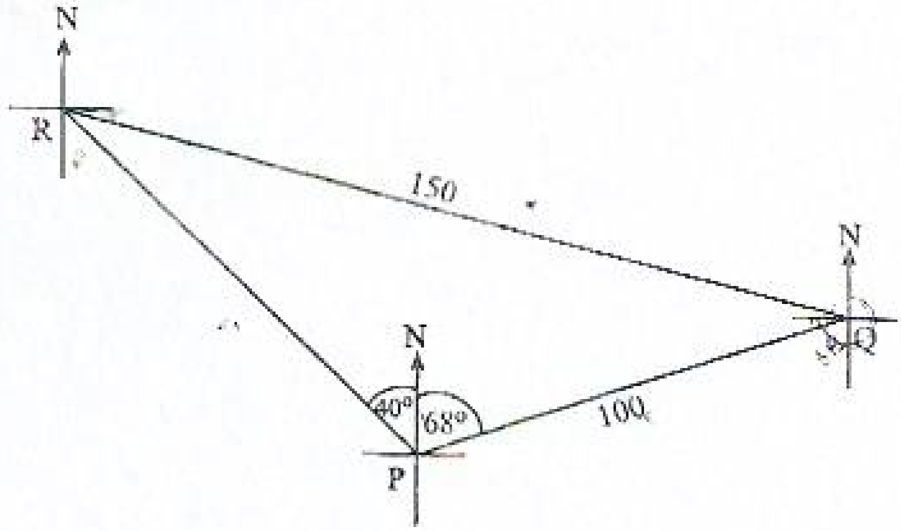
(d) John had four \$1 notes and five \$2 notes in his pocket. He wanted to buy an item costing \$2. He just pulled out two notes, one after another, without first checking.

Find the probability that he pulled out notes that

(i) were worth the same value,

(ii) added up to more than the price of the item. [5]

12



In the diagram are three points P, Q and R on level ground. Q is 100 m away from P on a bearing of N68°E. R is on a bearing of N40°W from P and the distance between R and Q is 150 m.

(a) Calculate

(i) the distance that Q is to the east of P,

(ii) $P\hat{R}Q$ giving the answer correct to the nearest degree,

(iii) the three figure bearing of R from Q,

(iv) the area of the triangle PQR in hectares.

(b) From P, the angle of elevation of the top of a vertical mast at Q is 31°.

Calculate the height of the mast to the nearest 10 m.

MATHEMATICS

NOVEMBER 2014 PAPER 2/ REPLACEMENT

ANSWERS

Section A

1a (i)

Hrs	Min	Sec
10	25	42
8	41	30
19	07	32
19hrs	7mins	12 seconds

(ii) $2\frac{1}{4} \div \left(2\frac{1}{16} - \frac{3}{4}\right)$

$= \frac{9}{4} \div \left(\frac{33}{16} - \frac{3}{4}\right)$

$= \frac{9}{4} \div \frac{33-12}{16}$

$= \frac{9}{4} \div \frac{16}{21} \qquad = \qquad \underline{1\frac{5}{7}}$

b. $\frac{8}{3} \times 22\frac{1}{2} \qquad = \frac{8}{3} \times \frac{45}{2}$

60 ltrs.

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

$3^2 \times 5^2 \times 7^2 \times 11$

Taking the lowest index of each factor

$3 \times 5^2 \times 7^2 \times 11$

$2 \times 25 \times 49 \times 11$

40 425

d $\sqrt{\frac{x}{y}} \qquad = \sqrt{\frac{2{,}5 \times 10^6}{4 \times 10^{-2}}} \qquad = \sqrt{\frac{0{,}5625 \times 10^{26}}{1}}$

$= \quad 0{,}75 \times 10^{13}$

$= \quad \underline{\mathbf{7{,}5 \times 10^{12}}}$

Q2 a) Factorise by grouping

(i) $9m^2 - 3m - 6$

$9m^2 + 3m - 6m - 6$

$3m(m+1) - 6(m+1)$

$(m+1)(m-2)3$

OR

$\underline{3(m-2)(m+1)}$

(ii) $(y + x)^2 - 4 = (y + x) - 2)(y + x) + 2$

b(i) $\dfrac{2}{x+2} - \dfrac{1}{3}$

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

$= \dfrac{6 - (x+2)}{3(x+2)}$

$= \dfrac{6 - x - 2}{3x + 6}$

$= \mathbf{\dfrac{4 - x}{3x + 6}}$ **OR** $\mathbf{\dfrac{4 \times x}{3(x + 2)}}$

(ii) $\dfrac{4 - x}{3x + 6} = -1/5$

$5(4 - x) = -1(3x + 6)$

$20 - 5x = -3x - 6$

$2x = 26$ $\quad x = \dfrac{26}{2}$

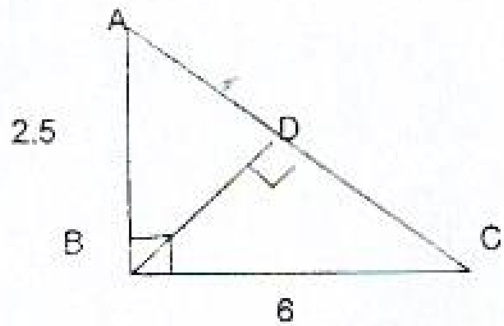
$= 13$

Therefore $\underline{x = 13}$

3a) $\dfrac{5 \times 22 + 2 \times 29}{7}$

$= \dfrac{\$168}{7} = \$24$ per day

b(i)



$A^2C = 6^2 + 2.5^2 \qquad - 36 + 6.25$

$= 42.25$

Therefore AC $= \sqrt{42.25} =$ **6.5cm**

(ii) $BD^2 = 6^2 - 3{,}25^2 = 25{,}4375$

Therefore BD $= \sqrt{25.4375}$

$=$ **5.04cm**

c (i) $180^\circ - 68^\circ = 112^\circ$

(ii) $180^\circ - (68^\circ \times 2) = 44^\circ$

Q4 a) $P \cap (R \cup Q)^1$ OR $P \cap (R^1 \cup Q^1)$

b(i) $x - 3 < 4 - 2x \leq x + 13$

$x - 3 < 4 - 2x$ *OR* $4 - 2x \leq x + 13$

$3x < 4 + 3 \qquad 4 - 3x \leq 13$

$3x < 7 \qquad -3x \leq 9$

$\frac{3x}{3} < \frac{7}{3} \qquad x \geq \frac{9}{-3}$

Therefore $x < 2\ ^1/_3$ *Therefore* $x \geq -3$

Answer $-3 \leq x < 2\ ^1/_3$

(ii)

c) $2x^2 + 3x - 84 = 0$

$a = 2, \quad b = 3 \quad c = -84$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(2)(-84)}}{2(2)}$$

$$= \frac{-3 \pm \sqrt{9 + 677}}{4}$$

$$= \frac{-3 + \sqrt{681}}{4} \quad \text{or} \quad \frac{-3 - \sqrt{681}}{4}$$

$$= \underline{5.77 \quad \text{or} \quad -7.27}$$

5a) (i)
$$A = P + \frac{PRT}{100}$$

$$= 350 + \frac{350 \times 5 \times 1.5}{100}$$

$$= 350 + 26{,}25$$

$$= \underline{\mathbf{376{,}25}}$$

(ii)
$$A = \frac{P}{1} + \frac{PRT}{100}$$

$$A = \frac{100P + PRT}{100}$$

$$100A = 100P + PRT$$

Therefore $P = \dfrac{\mathbf{100A}}{\mathbf{100 + RT}}$

---

b(i) $B\hat{A}C = 43^\circ$ (Angles subtended by the same angle)

(ii) $D\hat{B}C = 180^o - (47^o + 110^o)$

$180^o - 157$

$\underline{\underline{23^o}}$

(iii) $B\hat{A}D = 66^o \; (43^o + 23^o)$

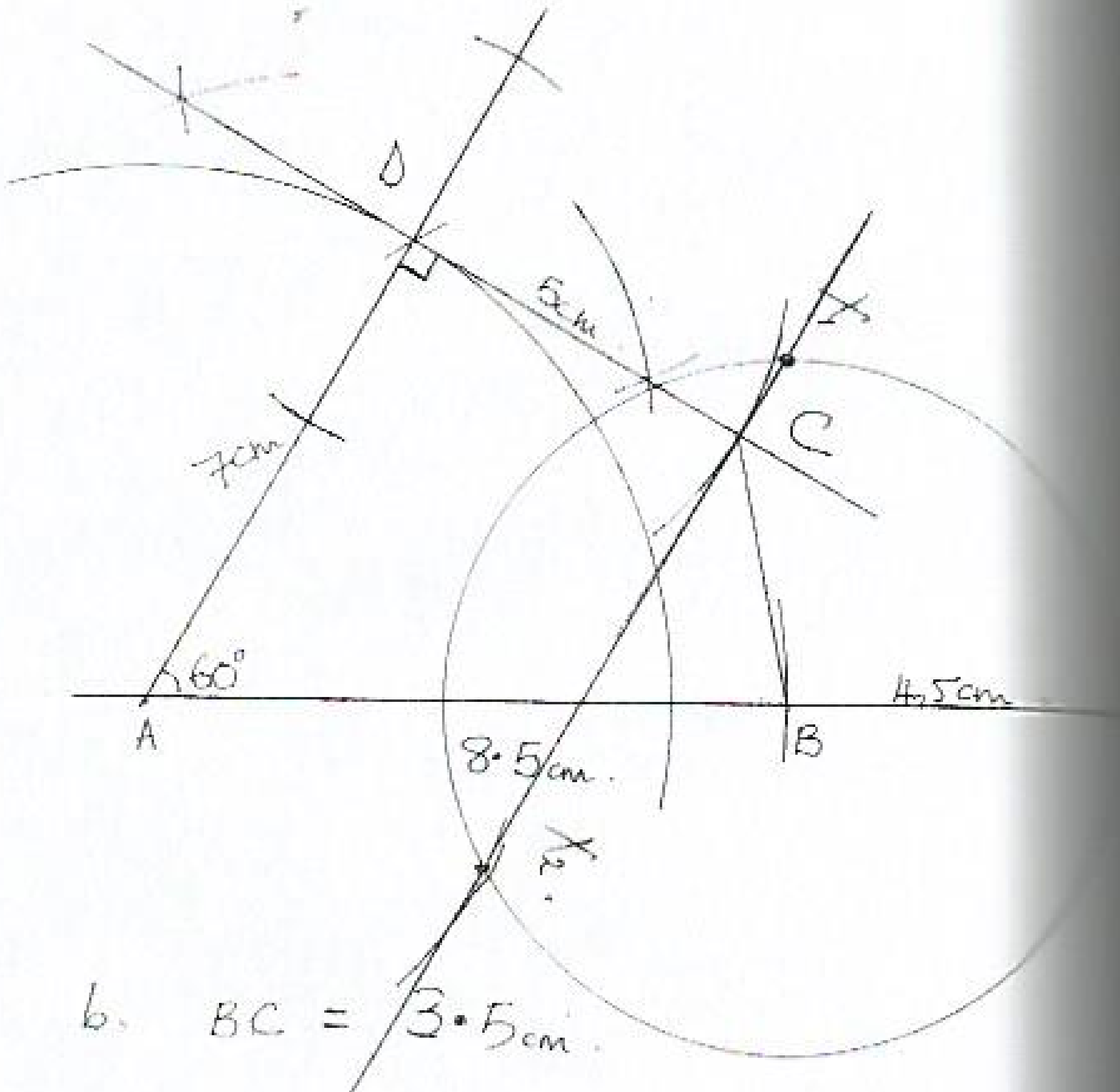
$ATB = DTC$

C(ii) $\frac{AT}{DT} = \frac{3}{2}$

Therefore Ratio of areas $= \left(\frac{3}{2}\right)^2$

$= \underline{\underline{9/4}}$

Question 6.



b. BC = 3.5cm

7a) (i) $P = \begin{pmatrix} 3 & 5 \\ 4 & x \end{pmatrix} \qquad Q = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$

$$PQ = \begin{pmatrix} 3 & 5 \\ 4 & x \end{pmatrix} \begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} -6 & + & 15 \\ -8 & & 3x \end{pmatrix}$$

$$= \begin{pmatrix} \mathbf{9} \\ \mathbf{3x\ -8} \end{pmatrix}$$

(ii) $3x - 20 = 7$

$3x = 27$

$\frac{3x}{3} = \frac{27}{3} \qquad x = 9$

(iii) $\mathbf{P^{-1} = {}^{1}/_{7} \begin{pmatrix} 9 & -5 \\ -4 & 3 \end{pmatrix}}$

(b)(i) 1. $\underline{OB} = \underline{OA} + \underline{AB}$

$= a + b - a$

$= \underline{\boldsymbol{b}}$

2. $\underline{OS} = \frac{1}{4} OA$

$\underline{\mathbf{= \frac{1}{4}\,a}}$

(ii) 1. $\underline{OT} = \underline{OS} + \underline{ST}$

$= \frac{1}{4} a + k(b - a)$

$= \frac{1}{4} a + kb - ka$

$= \frac{1}{4} a - ka + kb$

$= \underline{\frac{(1-4k)a}{4} + kb}$ OR $\underline{(\frac{1}{4} - k) a + kb}$

2. $OT = h(\overline{OB})$

$= h(b)$

$= \underline{hb}$

$\frac{(1-4k)}{4} = 0$

$1 - 4k = 0$

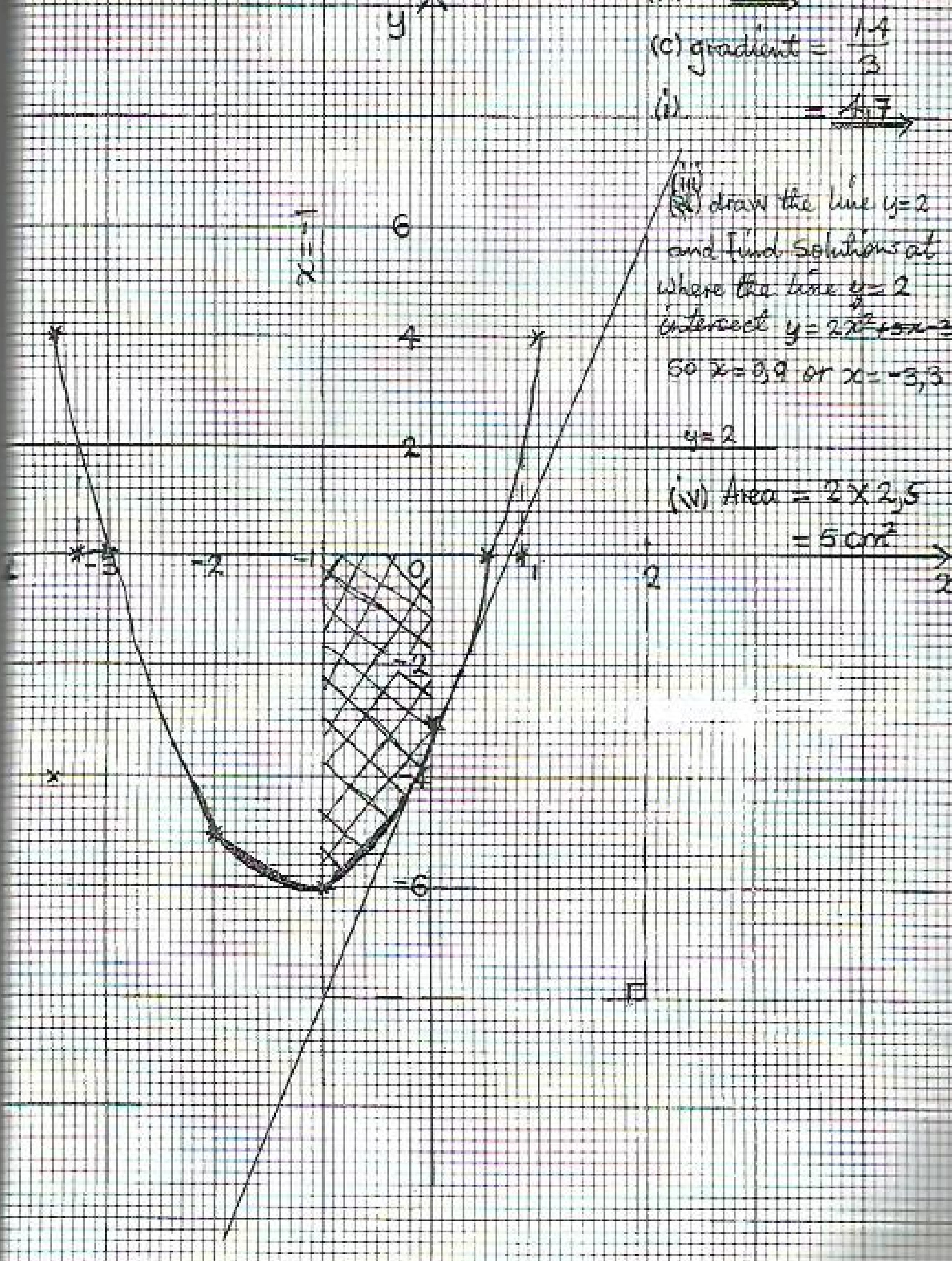
$4k = 1$

$\underline{k = \frac{1}{4}}$

$ST = \frac{1}{4}(b-a)$

Q8

<u>Question 8</u>



(a) $P = -5$

(c) gradient $= \frac{14}{3}$

(ii) $= 4{,}7$

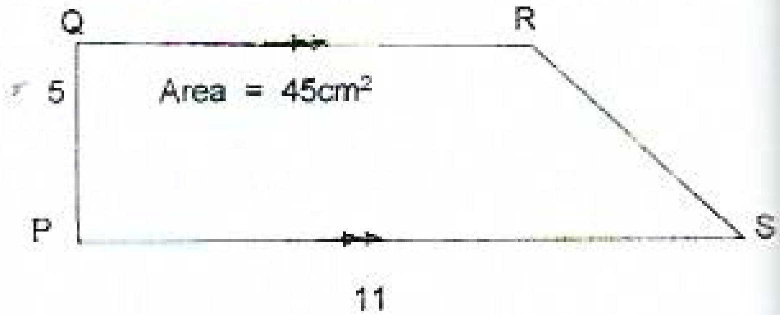
(iii) draw the line $y=2$ and find solutions at where the line $y=2$ intersect $y=2x^2+5x-3$.

so $x=0{,}9$ or $x=-3{,}3$

(iv) Area $= 2 \times 2{,}5$

$= 5\,cm^2$

9 (a)



$A = \frac{1}{2}(11 + QR) \times 5$

$45 = \frac{1}{2}(1 + QR)\, 5$

$18 = 11 + QR$

Therefore $QR = 18 - 11$

$= \underline{7cm}$

---

b) $d \alpha e^2 f \rightarrow d = ke^2 f$

$5 = k \times 9 \times 2$

Therefore $k = {}^{5}/_{18}$

$\rightarrow$ **d** $= \frac{5}{\mathbf{18}} e^2 f$

$d = \frac{5}{18} \times 4 \times 3$

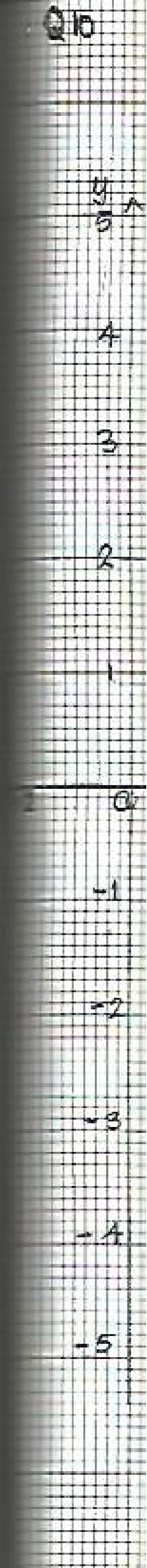
$= \frac{10}{9} \times 3 = \frac{10}{3}$

$= 3\,{}^{1}/_{3}$ **or 3.337**

C(i) $x \geq -1$

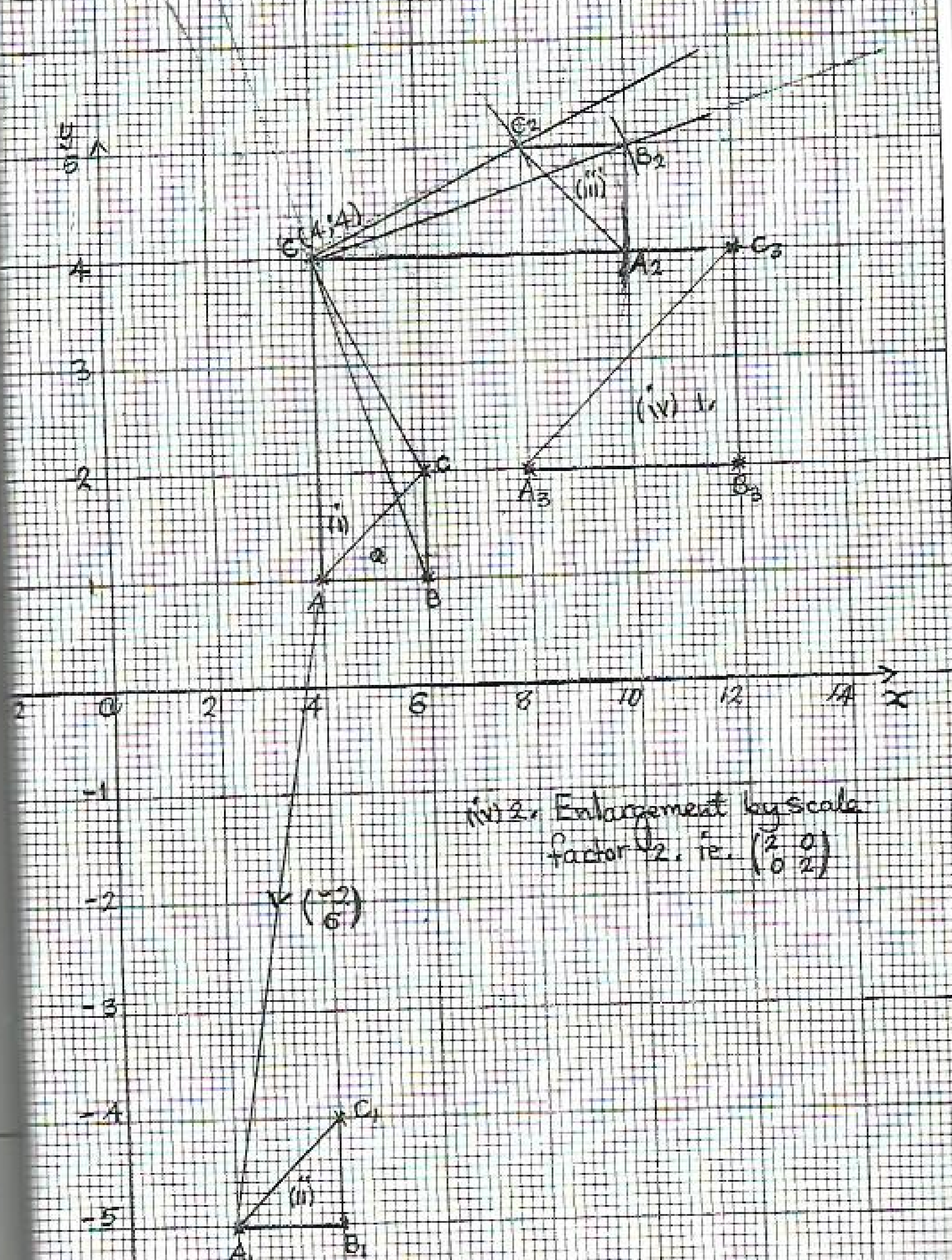
$y > -1$

$y - x \leq 2$



Q10

Question 10



(ii) $3x + 2y$

$3(2) + (2(0)$

$6 + 0$

<u>6</u>

10 a(i) Shaded Area $= \frac{1}{2}\pi R^2 - \frac{1}{2}\pi$

$= \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 - \frac{1}{2} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$

$= 77 - \frac{77}{4}$

$= \underline{57.75 \text{ or } 57\tfrac{3}{4}\ cm^2}$

(ii) Perimeter $\frac{1}{2} \times 2\pi R + \frac{1}{2} \times 2\pi r + 7$

$= \frac{1}{2} \times 2 \times \frac{22}{7} \times 7 + \frac{1}{2} \times \frac{22}{7} \times 3.5 + 7$

$= 18 + 22$

$= \underline{40cm}$

11. a(i)

Diff 2 v 3 v 5 v 9 v 17 v v

1 2 4 8 16 32

$$\begin{array}{r} 17 \\ +\underline{16} \\ \underline{33} \end{array} \qquad \begin{array}{r} 33 \\ +\underline{32} \\ \underline{65} \end{array}$$

33 and 65

(ii) r^{th} term $= 2^r - 1$ OR

$\underline{(r + 1) + r^{r+1}}$

b) $(n - 2)\,180 = 6120$

$n - 2 = \dfrac{6120}{180}$

$n - 2 = 34$

Therefore $n = 36$

c) Heptagon has 7 sides

$162^o + 150^o + 132^o + 4x = 900$

$444^o + 4x = 900$

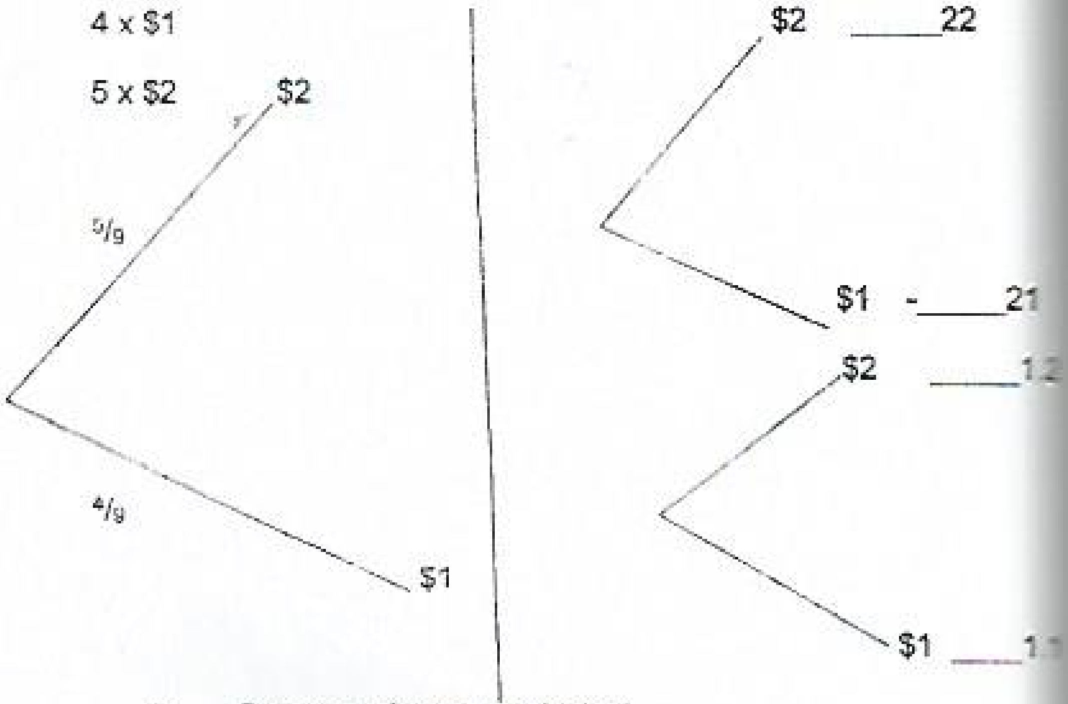
$4x = 456$

Therefore $x = \dfrac{456}{4}$

Therefore each of the $\underline{< \ = 114^o}$

4 x $1

5 x $2



(i) P (notes of the same Value)

$= \left(\frac{5}{9} \times \frac{4}{8}\right) + \left(\frac{4}{9} \times \frac{3}{8}\right)$

$= \frac{20}{72} + \frac{12}{72}$

$= \frac{32}{72} = {}^{4}/_{9}$

(ii) P (add up to morthan the price of item)

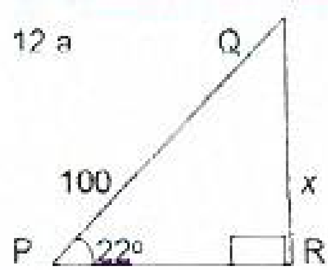
1 – P ($1 , $1)

$1 - \frac{12}{72}$

$= {}^{5}/_{6}$

---

12 a



(i) $\sin 22^{o} = \frac{d}{100}$

$d = 100 \sin 22$

$= \underline{37.5\text{m}}$

(ii) $\frac{\text{Sin R}}{100} = \frac{\text{Sin }108}{150}$

$\text{Sin R} = \frac{100 \text{ Sin } 108}{150}$

= 0,634037677

R = Sin-1 (0,634037677) = 39.4°

Therefore R = 39°

(iii) R from Q = 180 + 68 + 180 (108 + 39)

= 180 + 68 + 33

= **281°**

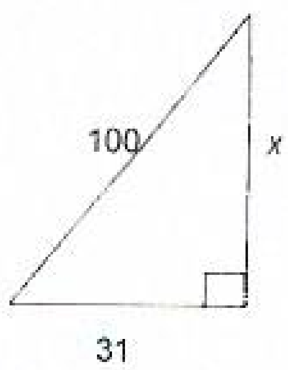
(iv) Area = ½ ab Sin C

= ½ x 100 x 150 Sin 33°

= 50 x 150 Sin 33

= 0,408hc

(b)



$\text{Sin } 31 = \frac{x}{100}$

Therefore x = 100 Sin 31

= 57,50

Therefore **x = 50m**

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4028/2

PAPER 2

JUNE 2015 SESSION 2 hours 30 minutes

dditional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)
- Electronic calculator

ME 2 hours 30 minutes

TRUCTIONS TO CANDIDATES

e your name, Centre number and candidate number in the spaces provided on the er paper/answer booklet.

wer **all** questions in Section A and any **three** questions from Section **B**.

e your answers on the separate answer paper provided.
u use more than one sheet of paper, fasten the sheets together.

working must be clearly shown. It should be done on the same sheet as the rest of the wer.
ission of essential working will result in loss of marks.
he degree of accuracy is not specified in the question and if the answer is not exact, the wer should be given to three significant figures. Answers in degrees should be given ne decimal place.

FORMATION FOR CANDIDATES

e number of marks is given in brackets [ ] at the end of each question or part estion. Mathematical tables or electronic calculators may be used to evaluate plicit numerical expressions.

This question paper consists of 11 printed pages and 1 blank page.

Section A [64 marks]

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

1 (a) Express $\frac{5}{16}$ as a

(i) decimal fraction,

(ii) percentage.

(b) Simplify

(i) $27^{\frac{2}{3}} - \left(\frac{1}{8}\right)^{\frac{1}{3}}$,

(ii) $3\frac{4}{5} - \left(1\frac{2}{3} + \frac{7}{15}\right)$, giving the answer in its lowest terms.

(c) Given that $p = 0,045$ and $r = 2,513 \times 10^{-4}$,

(i) express p in standard form,

(ii) evaluate pr giving the answer in standard form.

2 (a) It is given that $\xi = \{x : 1 \leq x \leq 10, \text{where } x \text{ is an integer}\}$

$A = \{x : x \text{ is a prime number}\}$ and
$B = \{x : x \text{ is a factor of } 20\}$.

(i) List all the elements of A.

(ii) List all the elements of $(A \cup B)'$.

(iii) Find $n(A \cap B)$.

(iv) Draw a clearly labelled Venn diagram to show the sets and their elements.

Solve the equation $\frac{3x+1}{3} - \frac{x-4}{5} = \frac{1}{2}$. [3]

It is given that 300 cattle are to be shared in the ratio 12 : 10 : 8.

(i) Express the ratio in its simplest form.

(ii) Calculate the difference between the largest and smallest shares. [5]

(b) An advert in a shop read,

"VALENTINE SPECIAL 25 % OFF ALL RED SHIRTS".

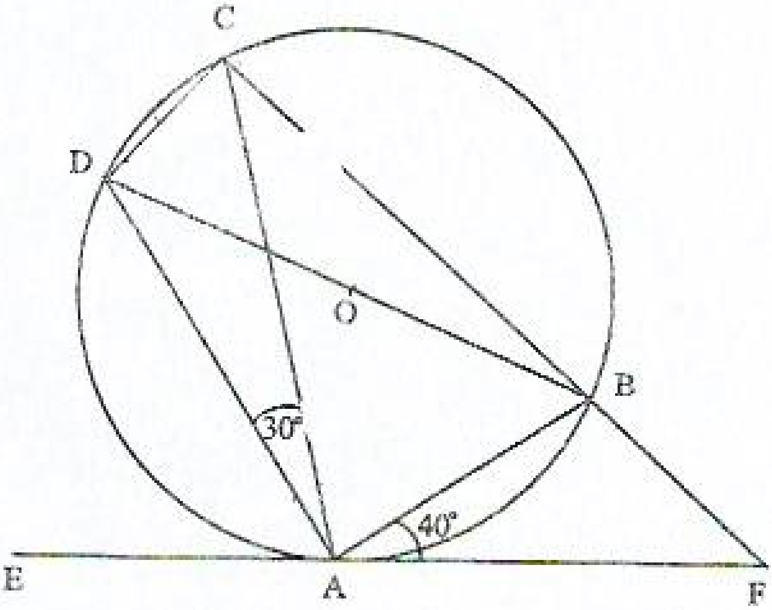
The red shirts were originally marked at \$25, 00 each.

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

(ii) Tindo bought 10 such shirts and sold them at \$23, 00 each.

Calculate the total profit Tindo made. [6]

4 (a)



The diagram shows points A, B, C and D on the circumference of a circle centre O. EAF is a tangent to the circle at A.

Given that $B\hat{A}F = 40°$ and $C\hat{A}D = 30°$, calculate

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

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

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

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

(b) (i) Convert 65_{10} to a number in base 3.

(ii) Simply $3102_4 + 11101_2$, giving the answer in base 4.

5 (a) Given that $f(x) = 3x^2 - 7x + 1$,

(i) evaluate $f(-1)$,

(ii) find the values of x when $f(x) = -1$.

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

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

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

[5]

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

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

All constructions should be done on a single diagram.

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

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

[6]

(b) Use the diagram to find the

(i) height of the pole,

(ii) distance of M from the bottom of the pole.

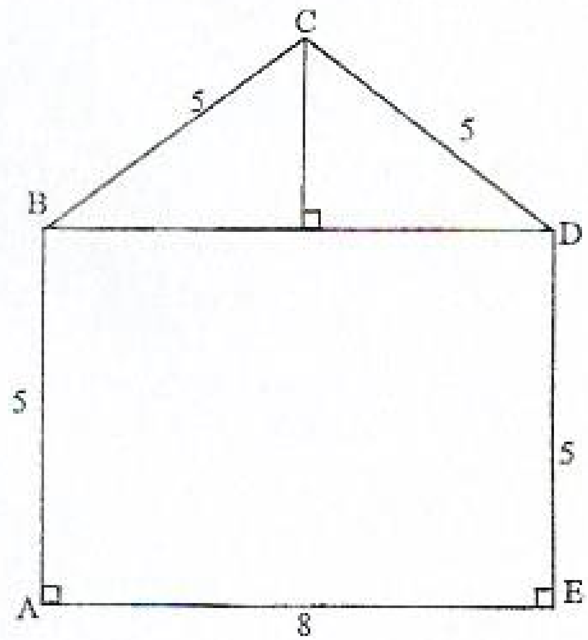
[5]

Section B [36 marks]

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

7 (a) M is directly proportional to $(d-1)^2$. Given that $M = 12$ when $d = 4$, calculate M when $d = 7$.

(b)



The diagram ABCDE is a cross-section of a tobacco shed that is 20 m long. AB = BC = CD = DE = 5 m and AE = 8 m.

Calculate the

(i) perpendicular height of C above the side BD,

(ii) area of the cross-section ABCDE,

(iii) volume of the shed,

(iv) number of bales of tobacco that can be stored in the shed up to BD, given that each bale has a volume of 4 m^3.

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

A girl is given \$ 6,00 to buy fireworks for her birthday party. She buys x rockets at 60 c each and y crackers at 30 c each.

(a) Write down an inequality in x and y and show that it reduces to $2x + y \leq 20$. [2]

(b) She wants to buy at least 4 rockets and the number of crackers should be more than or equal to twice the number of rockets.

Write down two inequalities that satisfy these conditions. [2]

(c) Using a scale of 2 cm to 2 units on both axes, show by shading the **UNWANTED** regions, the region in which $(x; y)$ must lie. [5]

(d) Use your graph to find

(i) the combination that uses the maximum amount of money available,

(ii) 1. the combination that uses the minimum amount of money,

2. the change she would get in (ii) 1. [3]

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

Quadrilateral ABCD has vertices at A(1; 0), B(2; 0) C(2; 2) and D(1; 2)

Using a scale of 2 cm to represent 1 unit on each axes, draw the x and y axes for $-4 \leq x \leq 6$ and $-5 \leq y \leq 5$.

(a) (i) Draw and label ABCD.

(ii) State the special name given to quadrilateral ABCD. [2]

(b) Quadrilateral ABC_1D_1 has coordinates at A(1;0), B(2;0), $C_1(6;2)$ and $D_1(5;2)$.

(i) Draw and label quadrilateral ABC_1D_1.

(ii) Describe fully the single transformation that maps ABCD **onto** ABC_1D_1. [4]

(c) Quadrilateral ABCD is mapped **onto** quadrilateral $A_2B_2C_2D_2$ by a reflection in the line $y = x + 2$.

(i) Draw and label line $y = x + 2$.

(ii) Draw and label quadrilateral $A_2B_2C_2D_2$.

(d) $A_3B_3C_3D_3$ is the image of ABCD under an enlargement of scale factor – with $(-1; -1)$ as centre.

Draw and label quadrilateral $A_3B_3C_3D_3$.

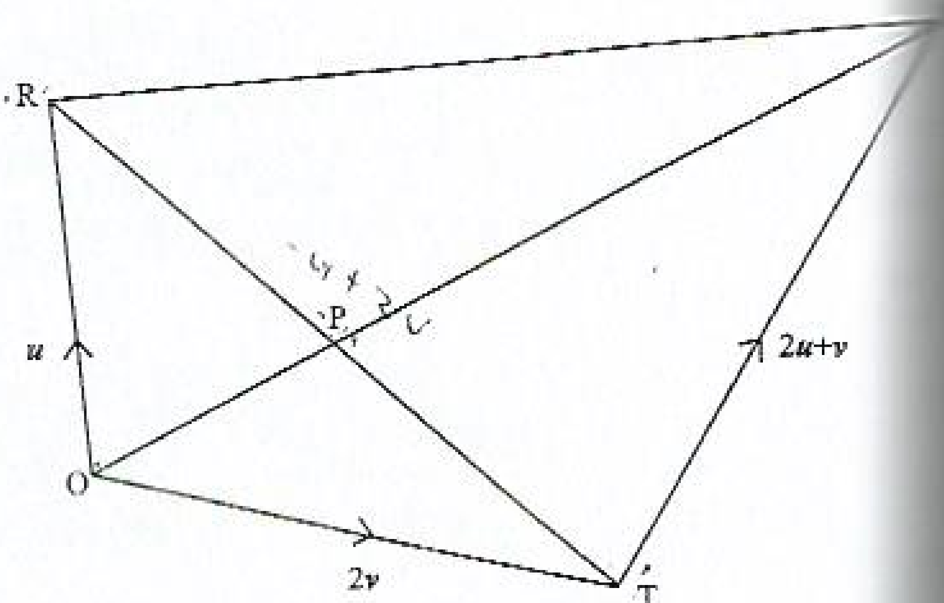
10 (a) The point, M, has coordinates $(7; -3)$ and $\overrightarrow{RM} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$.

Calculate

(i) the coordinates of R,

(ii) $\overrightarrow{MR}$.

(b)



The diagram is a quadrilateral ORST in which $\overrightarrow{OR} = u$,

$\overrightarrow{OT} = 2v$ and $\overrightarrow{TS} = 2u + v$.

Diagonals OS and RT intersect at P.

(i)

(ii)

(iii)

(iv)

(a) Sol

(i) Express in terms of $\boldsymbol{u}$ and/or $\boldsymbol{v}$.

1. $\overrightarrow{RT}$,

2. $\overrightarrow{OS}$.

(ii) Given that $\overrightarrow{OP} = k\overrightarrow{OS}$, express in terms of k, $\boldsymbol{u}$ and/or $\boldsymbol{v}$

1. $\overrightarrow{OP}$,

2. $\overrightarrow{RP}$ and show that it reduces to $(2k-1)\boldsymbol{u}+3k\boldsymbol{v}$.

(iii) Given also that $\overrightarrow{RP} = h\overrightarrow{RT}$, express $\overrightarrow{RP}$ in terms of h, $\boldsymbol{u}$ and/or $\boldsymbol{v}$.

(iv) Using the results in **(ii)** 2 and **(iii)**, calculate the value of h and the value of k.

[9]

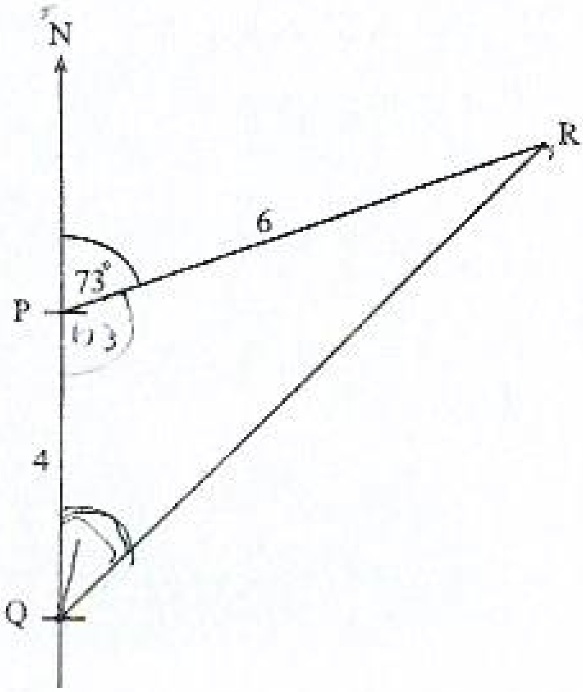
(a) Solve the simultaneous equations:

$$3x-2y=8$$

$$5x-4y=12$$

[3]

(b)



The diagram shows three points, P, Q and R such that P is 4 km North of Q and R is 6 km from P on a bearing of 073°.

Calculate

(i) QR,

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

(iii) the bearing of R from Q to the nearest degree.

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

The table below shows the distribution of Mathematics marks for 500 students in an examination.

(x)	$x \leq 10$	$x \leq 20$	$x \leq 30$	$x \leq 40$	$x \leq 50$	$x \leq 60$	$x \leq 70$	$x \leq 80$	$x \leq 90$	$x \leq 100$
lative ency(f)	10	50	150	245	325	400	465	490	495	500

(a) Using a scale of 2 cm to represent 10 marks on the horizontal axis and 2 cm to represent 50 students on the vertical axis, draw a cumulative frequency curve for this distribution. [4]

(b) Use your graph to find the

(i) median mark,

(ii) inter-quartile range.

[5]

(c) Two students are chosen at random.

Find the probability that both students got marks less than or equal to 50. [3]

MATHEMATICS

JUNE 2015 PAPER 2

ANSWERS

Section 'A'

1(i) $^5/_{16}$ = **0,313** as a decimal fraction

(ii) $^5/_{16} \times {}^{100}/_1$ = **31%** as a percentage

(b) $27^2/_3 - (^1/_8)^1/_3$

(i) = $\sqrt[3]{27}^{\,2} - (\sqrt[3]{1/8}\,)^1$ $\qquad 3^2 - ½$

9 - ½

= **$^{17}/_2$ or 8 ½ or 8,5**

(ii) $3\,^4/_5 - (1\,^2/_3 + {}^7/_{15})$

= $^{19}/_5 - {}^{32}/_{15}$

= $^5/_3 \qquad 1\,^2/_3$

(c)(i) P = 0,0,045 and r = $2,513 \times 10^{-4}$

$P = 4,5 \times 10^{-2}$

(ii) Pr = $4,5 \times 10^{-2} \times 2,513 \times 10^{-4}$

= $4,5 \times 2,513 \times 10^{-2} \times 10^{-4}$

= $11,3085 \times 10^{-6}$

= $1,13085 \times 10^1 \times 10^{-6}$

= $1,13085 \times 10^{-5}$

2(a) $\varepsilon = \{1 ; 2 ; 3 ; 4 ; 5 ; 6 ; 7 ; 8; 9; 10\}$

A = $\{2 ; 3 ; 5 ; 7\}$

B = $\{1 ; 2 ; 4; 5 ; 10\}$

(i) A = $\{2 ; 3 ; 5; 7\}$

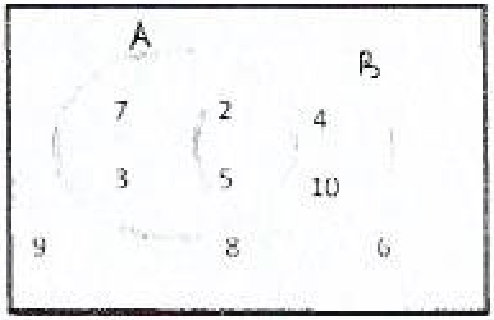
(ii) $A \cup B = \{2; 3; 4; 5; 7; 10\}$

Thus $(A \cup B)^1 = \{1; 6; 8; 9\}$

(iii) $A \cap B = \{2; 5\}$

Thus $n(A \cap B) = 2$

(iv)



(b) $\frac{3x + 1}{3} - \frac{x - 4}{5} = \frac{1}{2}$

$\frac{30}{1}\left(\frac{3x+1}{3}\right) - \frac{30}{1}\left(\frac{x-4}{5}\right) = \frac{30}{1}\left(\frac{1}{2}\right)$

$10(3x + 1) - 6(x - 4) = 15$

$30x + 10 - 6x + 24 = 15$

$30x - 6x = 15 - 24 - 10$

$\frac{24x}{24} = \frac{-19}{24}$

$\underline{x = 0{,}792}$

3(a) (i) 12 : 10 : 8 = 6:5:4

Thus total ratio = 15

So, largest share $= \frac{6}{15} \times \frac{300}{1}$

<u>120 Cattle</u>

and smallest share $= \frac{4}{15} \times \frac{300}{1}$

= 80 cattle

(ii) Difference = 120 - 80

= **<u>40 cattle</u>**

(b)(i) $\frac{75}{100} \times \frac{25{,}00}{1}$ $\left[100\% - 25\% = \frac{75}{100}\right]$

= **<u>$18,75</u>** (Joko)

(ii) 10 x 18,75 = **<u>$187,50</u>**

$23 x 10 = $230

Profit = $230 - $187,50

= **<u>$42,50</u>**

4(a)(i) $A\hat{D}B = 40^\circ$ (< in opp: segment)

(ii) $D\hat{A}E = 180 - (90 + 40)$
$= \underline{\mathbf{50^\circ}}$

(iii) Using ΔABF, $A\hat{B}F = 180 - (40 + 40)$
$= 100^\circ$

(iv) $A\hat{B}D$ 90-40
$= \underline{\mathbf{50^\circ}}$

So $D\hat{B}C = 180 - (100 + 50)$
$= \underline{\mathbf{30^\circ}}$

Thus CDB $= 90 - 30$
60°

(b) (i)

3	65	
3	21	rem 2
3	7	rem 0
3	2	rem 1
	0	rem 2

Therefore $65_{10} = \underline{\mathbf{2102_3}}$

(ii) $11101_2 = 29_{10}$
$= \underline{\mathbf{131_4}}$

Thus 3102_4
$\underline{+\ 131_4}$
$\underline{\mathbf{3\ 233_4}}$

5(a) $f(x) = 3x^2 - 7x + 1$

(i) $f(-1) = 3(-1^2) - 7(-1) + 1$
$= 3(1) + 7 + 1$
$= 3 + 7 + 1$
$= \underline{\mathbf{11}}$

(ii) $3x^2 - 7x + 1 = -1$
$3x^2 - 7x + 1 + 1 = 0$
$3x^2 - 7x + 2 = 0$ $\quad|3 \times 2 = 6|$
Factors are -6 and 1

Thus $3x^2 - 6x - x + 2$
$3x\ \underline{(x - 2)}\ -1\ \underline{(x - 2)}$
$x - 2 \qquad x - 2$
$(x-2)(3x - 1) = 0$
$\underline{\mathbf{x = 2 \text{ or } {}^1/_3}}$

(b)(i) $P \frac{n}{2}\left[2a + (n-1)d\right]$

$\frac{P}{1} = n\left\{2a + (n-1)d\right\}$

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

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

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

$$\mathbf{a = \frac{P}{n} - \underline{(n-1)\,d}}$$

---

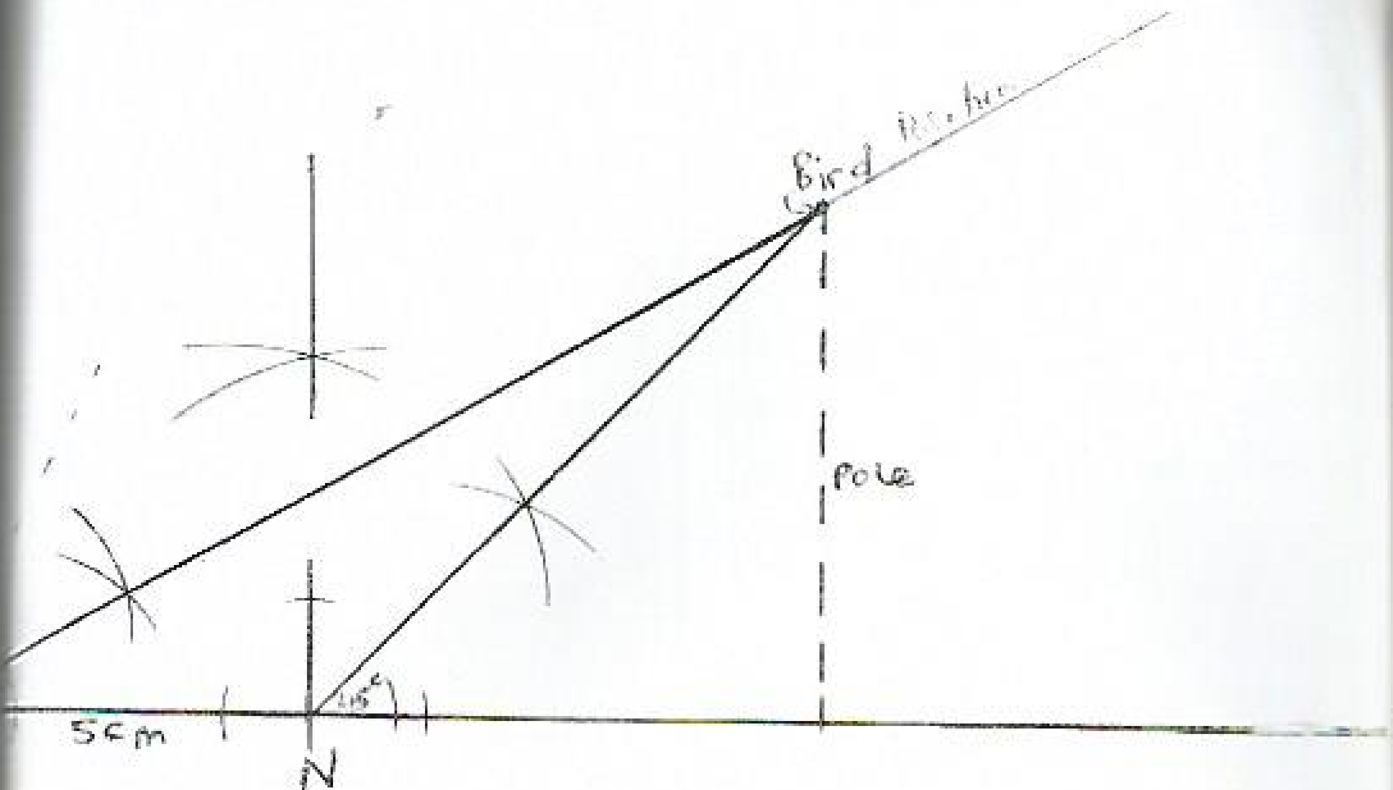
(5) (b) (ii) When $n = 10$; $d = 4$ and $P = 20$

$$a = \frac{p}{n} - \frac{(n-1)\,d}{2}$$

$$= {}^{20}/_{10} - \frac{(10-1)\,4}{2}$$

$$= 2 - (10-1)^2 \qquad = 2 - 18$$

$$a \; \underline{\mathbf{= -16}}$$



) Height of pole is 6,6cm
Since 1cm = 2m
∴ Height is 2 × 6,6 = 13,2m

) Distance of M from pole is 11,6cm
1cm = 2m
∴ Distance is 2 × 11,6 = 23,2m

(7) $M \propto (d-1)^2$

$\underline{\mathbf{M = k(d-1)^2}}$

$12 = k(4-1)^2 \qquad 12 = k(3^2)$

$\frac{12}{9} = \frac{9k}{9}$

$\underline{\mathbf{k = {}^4/_3}}$

So $M = {}^4/_3\,(d-1)^2$

When $d = 7$, $M = {}^4/_3\,(7-1)^2$

$= {}^4/_3\,(6^2) = {}^4/_3\,\left(\frac{36}{1}\right)$

$\underline{\mathbf{M = 48}}$

(b)(i) $h^2 + 4^2 = 5^2$

$h^2 = 5^2 - 4^2$

$h^2 = 25-16$

$h^2 = 9$ $\qquad$ $\underline{\mathbf{h = 3m}}$

(iii) Cross-sectional area $= \Delta BCD + ABDE$

$= \frac{1}{2}bh + LW$

$= \frac{1}{2}\left|\frac{8}{1}\right|\left|\frac{3}{1}\right| + 5(8)$

$= 12 + 40$

$= \underline{\mathbf{52m^2}}$

(iii) Volume of the shade

= Cross – sectional area x distance between

$= 52 \times 20$

$= \underline{\mathbf{1040\ m^3}}$

(iv) Up to BD, Volume

= total volume – volume of triangular prism

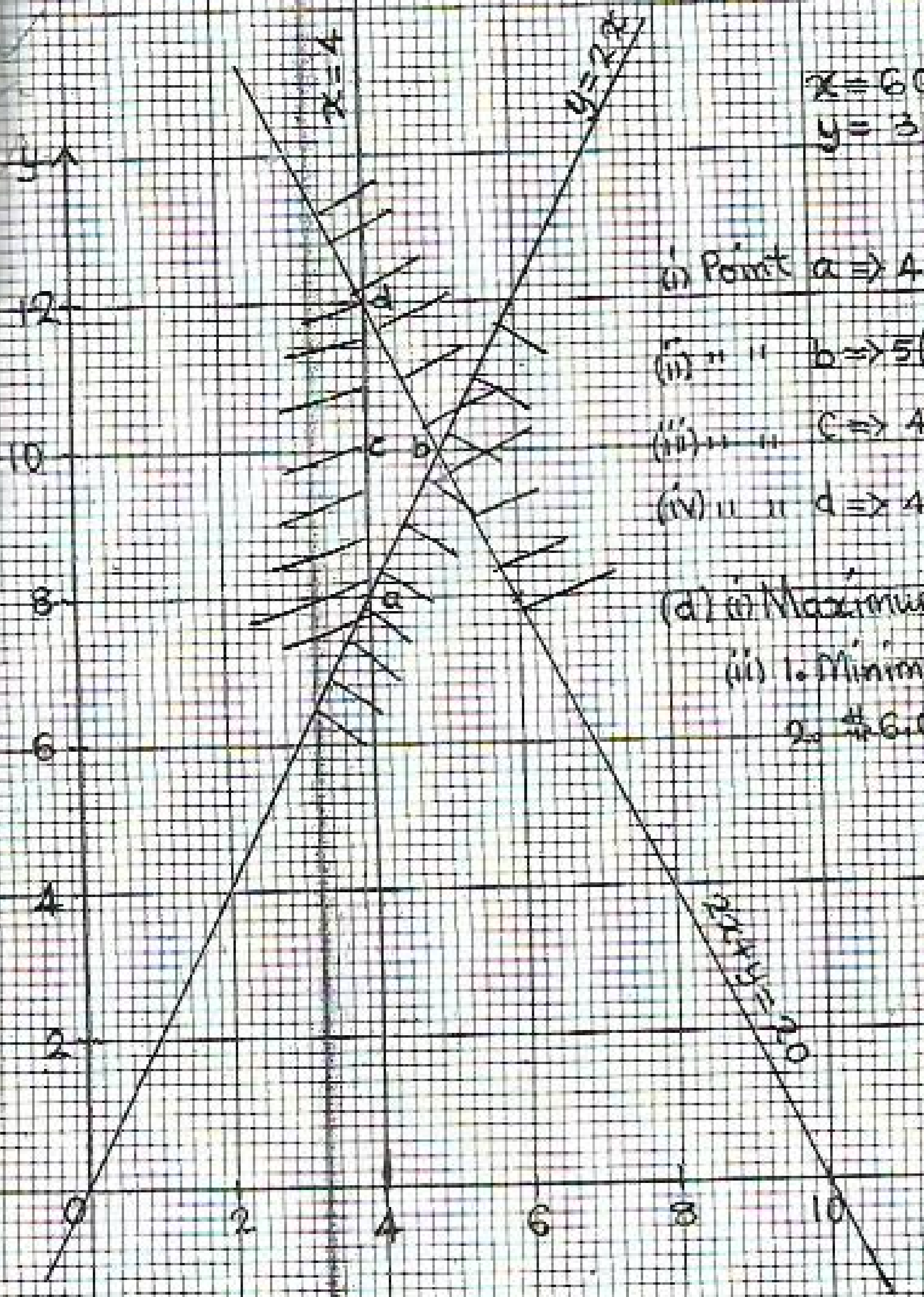
$= 1040 - \frac{1}{2}bh \times \text{distance}$

$= 1040 - \frac{1}{2}\,({}^8/_1)\,({}^3/_1)\,({}^{20}/_1)$

$= 1040 - 240$

$= \underline{\mathbf{800m^3}}$

Thus No. of bales $= \frac{800m^3}{4m^3}$ $\qquad$ $= \underline{\mathbf{200\ bales}}$



$x = 60c$
$y = 30c$

(i) Point a ⇒ 4(60)+8(30) = \$4.80

(ii) " " b ⇒ 5(60)+10(30) = \$6.00

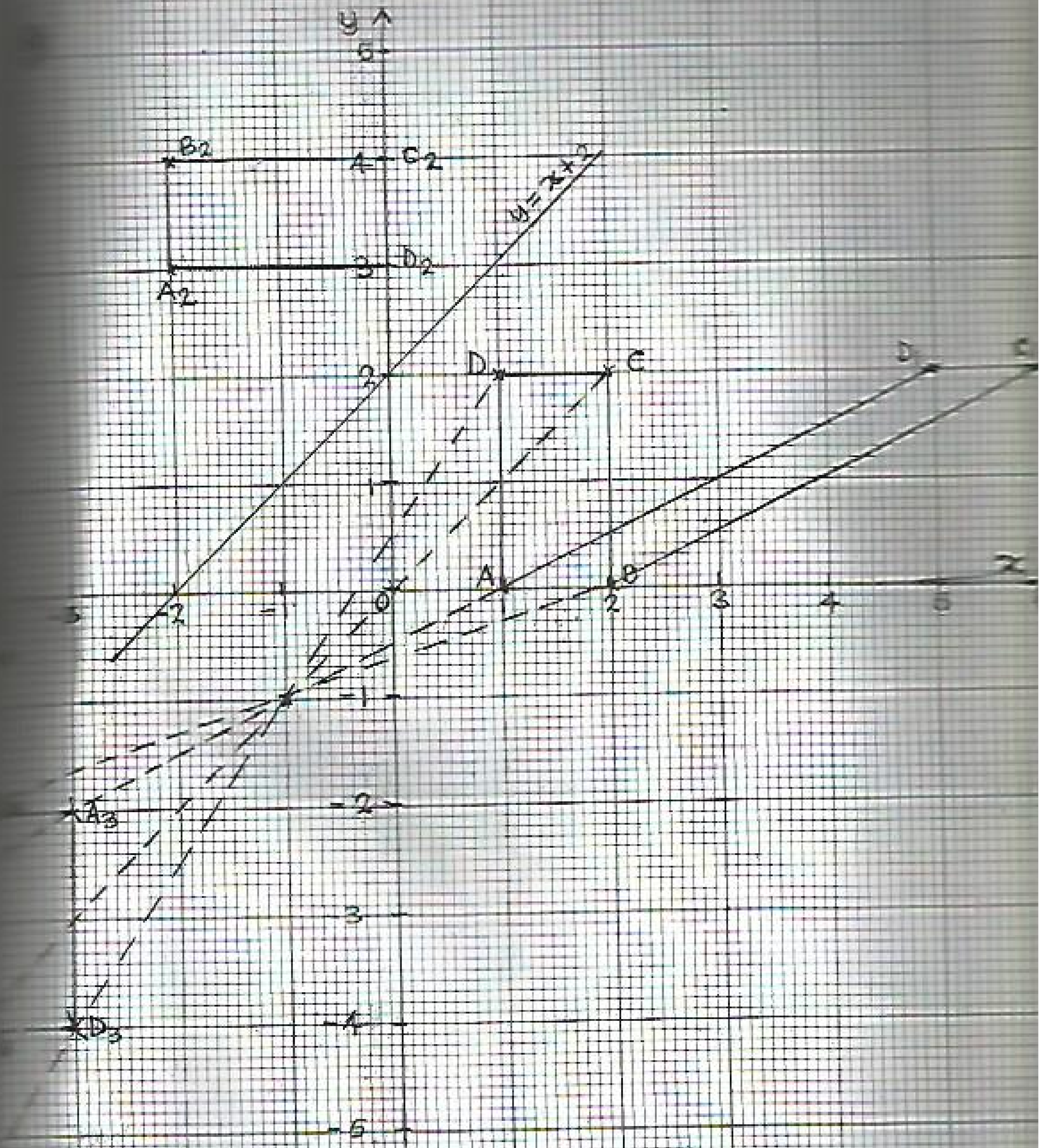
(iii) " " c ⇒ 4(60)+10(30) = \$5.40

(iv) " " d ⇒ 4(60)+12(30) = \$6.00

(d) (i) Maximum = b and d.

(ii) 1. Minimum amount = a = \$8

2. \$6.00 − \$4.80 = \$1.20 (change)



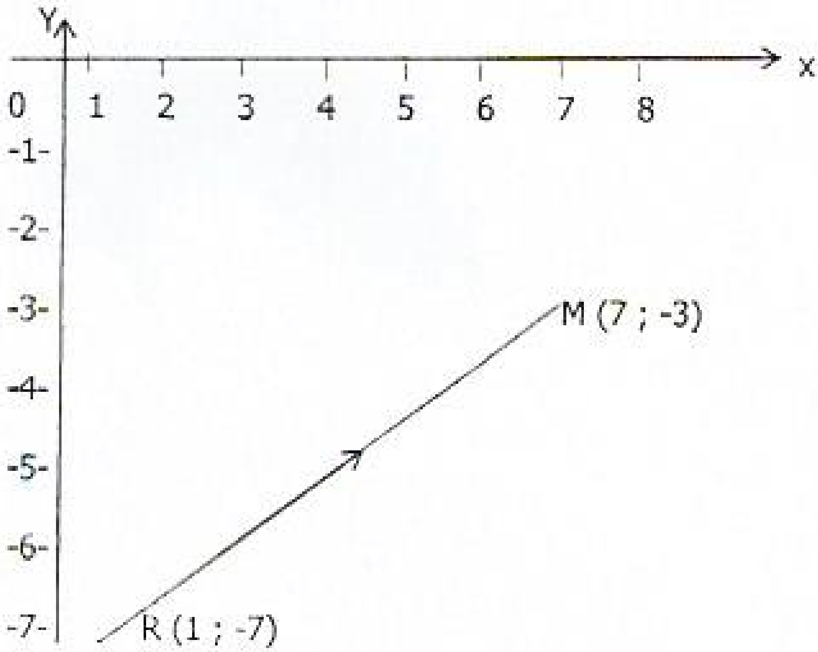
(a)(ii) rectangle

(b)(ii) It's a shear parallel to the x axis.

10 (a) (i) $\begin{pmatrix}7\\-3\end{pmatrix} - \begin{pmatrix}6\\4\end{pmatrix} = \begin{pmatrix}1\\-7\end{pmatrix}$

$\underline{R = (1\ ;\ -7)}$

<u>OR Graphical</u>



(ii) $\overrightarrow{MR} = -\begin{pmatrix}6\\4\end{pmatrix}$

$\overrightarrow{MR} = \underline{\begin{pmatrix}-6\\-4\end{pmatrix}}$

(b) (i) 1. $\overrightarrow{RT} = \overrightarrow{RO} + \overrightarrow{OT}$

$= u + 2V$

$= \mathbf{\underline{2V - U}}$

---

2. $\overrightarrow{OS} = \overrightarrow{OT} + \overrightarrow{TS}$

$= 2V + 2U + V$

$= 2V + V + 2U \qquad = \mathbf{\underline{3V + 2U}}$

(ii) 1. $\overrightarrow{OP} = k\,\overrightarrow{OS}$

$= k\,(3V + 2U)$

$= \mathbf{\underline{3\,Kv + 2ku}}$

2. $\overrightarrow{RP} = \overrightarrow{RO} + \overrightarrow{OP}$

$= -U + 3KV + 2KU$

$= 2KU - U + 3KV$

$= U\,(2k - 1) + 3kv$

$= \mathbf{\underline{(2k - 1)\ u + 3\ kv}}$

(iv) $\overrightarrow{RP} = h\overrightarrow{RT}$

$= h(2v - u)$

$= \underline{\mathbf{2hv - hu}}$

Thus $\overrightarrow{RP} = (2k - 1)\ u + 3kv$

$\overrightarrow{RP} = hu + 2hv$

Compare Coeficients

Thus $2k - 1 = -h$ ----------(i) $\times 2$

$3k = 2h$----------(ii) $\times 1$

$4k - 2 = 2h$

$3k = 2h$

$7k - 2 = 0$

$\underline{\mathbf{k = {}^2/_7}}$ and $\underline{\mathbf{h\ {}^3/_7}}$

(ii)(a) $3x - 2y = 8$ --------(i) $\times 2$

$5x - 4y = 12$ ----------(ii) $\times 1$

$6x - 4y = 16$

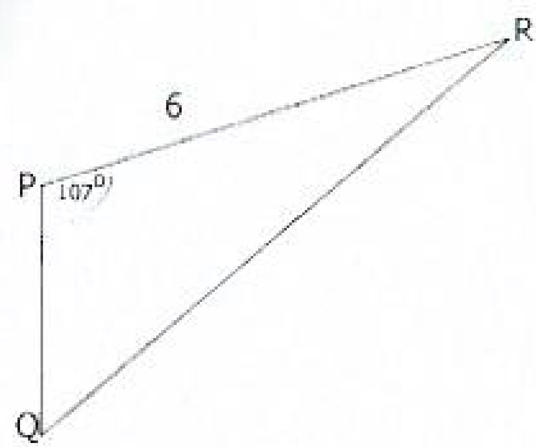
$5x - 4y = 12$

$\underline{\mathbf{X = 4}}$

Sub 4 for x in (i) , $y = 2$

Therefore $x = 4$ and $y = 2$

(b)(i)



$(QR)^2 = 6^2 + 4^2 = (2(6)(4)\ \text{Cos } 107$

$= 36 + 16 - 48\ \text{- Cos } 73$

$QR = \sqrt{52 - 48(-\text{Cos } 73)}$

$\underline{\mathbf{QR = 8{,}13km}}$

(iii) $\dfrac{\text{Sin}\theta}{6} = \dfrac{\text{Sin } 73}{8{,}13}$

$\text{Sin}\theta = \dfrac{6\ \text{Sin } 73}{8{,}13}$

$\text{Sin}\ \theta = 0{,}707238$

$\Theta = 44{,}9$ $\underline{\mathbf{\theta = 45^\circ}}$

(12) (b) Median Mark = 40

(ii) $Q_3 - Q_1$

$= 57 - 27$

$= \underline{\underline{30}}$

$\left\{ \begin{array}{l} Q_3 = \frac{3}{4}(n+1) \\ Q_1 = \frac{1}{4}(n+1) \end{array} \right.$

(c) $\frac{325}{500} \times \frac{324}{499}$

$= \frac{1053}{2495}$