Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics A

Paper 4H

Higher Tier

Monday 16 January 2012 – Morning
Time: 2 hours

Paper Reference
4MA0/4H

You must have:
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – there may be more space than you need.
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ▶

P40613A

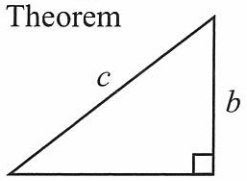
6/6/6/6/3

P 4 0 6 1 3 A 0 1 2 4

PEARSON

International GCSE MATHEMATICS
FORMULAE SHEET – HIGHER TIER

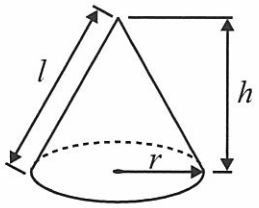
Pythagoras' Theorem



$a^2 + b^2 = c^2$

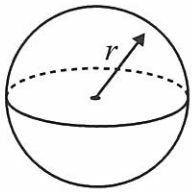
Volume of cone $= \frac{1}{3}\pi r^2 h$

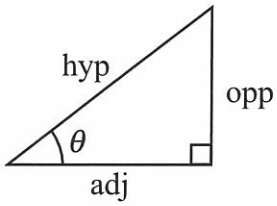
Curved surface area of cone $= \pi r l$



Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$





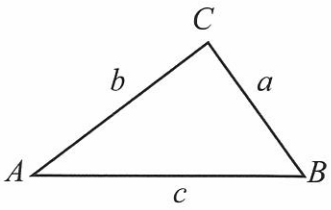
adj = hyp × cos θ
opp = hyp × sin θ
opp = adj × tan θ

or $\sin\theta = \frac{\text{opp}}{\text{hyp}}$

$\cos\theta = \frac{\text{adj}}{\text{hyp}}$

$\tan\theta = \frac{\text{opp}}{\text{adj}}$

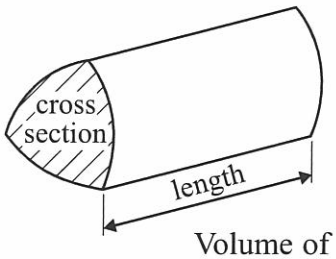
In any triangle ABC



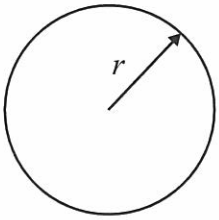
Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$



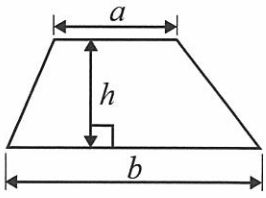
Volume of prism = area of cross section × length

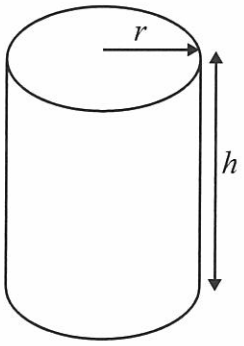


Circumference of circle $= 2\pi r$

Area of circle $= \pi r^2$

Area of a trapezium $= \frac{1}{2}(a + b)h$





Volume of cylinder $= \pi r^2 h$

Curved surface area of cylinder $= 2\pi r h$

The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

Answer ALL TWENTY TWO questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out the value of $\dfrac{6.7-2.5}{2.8\times 0.4}$

Give your answer as a decimal.

3.75

(Total for Question 1 is 2 marks)

2 An aeroplane flew from Qatar to Bahrain.
The distance flown was 135 km.
The average speed was 180 km/h.

Work out the time taken.
Give your answer in minutes.

$S = \dfrac{d}{t}$

$\Rightarrow t = \dfrac{d}{S} = \dfrac{135}{180} = 0.75 \text{ hrs}$ or 45 minutes

45 minutes

(Total for Question 2 is 3 marks)

Do NOT write in this space.

3 Solve $7x - 5 = 3x + 2$
Show your working clearly.

$4x - 5 = 2$

$\Rightarrow x = \frac{2+5}{4} = \frac{7}{4} = 1\frac{3}{4}$ or 1.75

$x =$ 1.75

(Total for Question 3 is 3 marks)

4 Three positive whole numbers have a median of 7 and a mean of 5

Find the range of these three numbers.

$\text{Mean} = \frac{\Sigma x}{f} = \frac{x_1 + 7 + x_3}{3} = 5$

$\Rightarrow x_1 + 7 + x_3 = 15$

and $x_1 + x_3 = 8$

where $x_1 \leq 7 \leq x_3$ and x_1, x_3 are +ve integers.

Since $x_3 < 8$, x_3 must be 7.

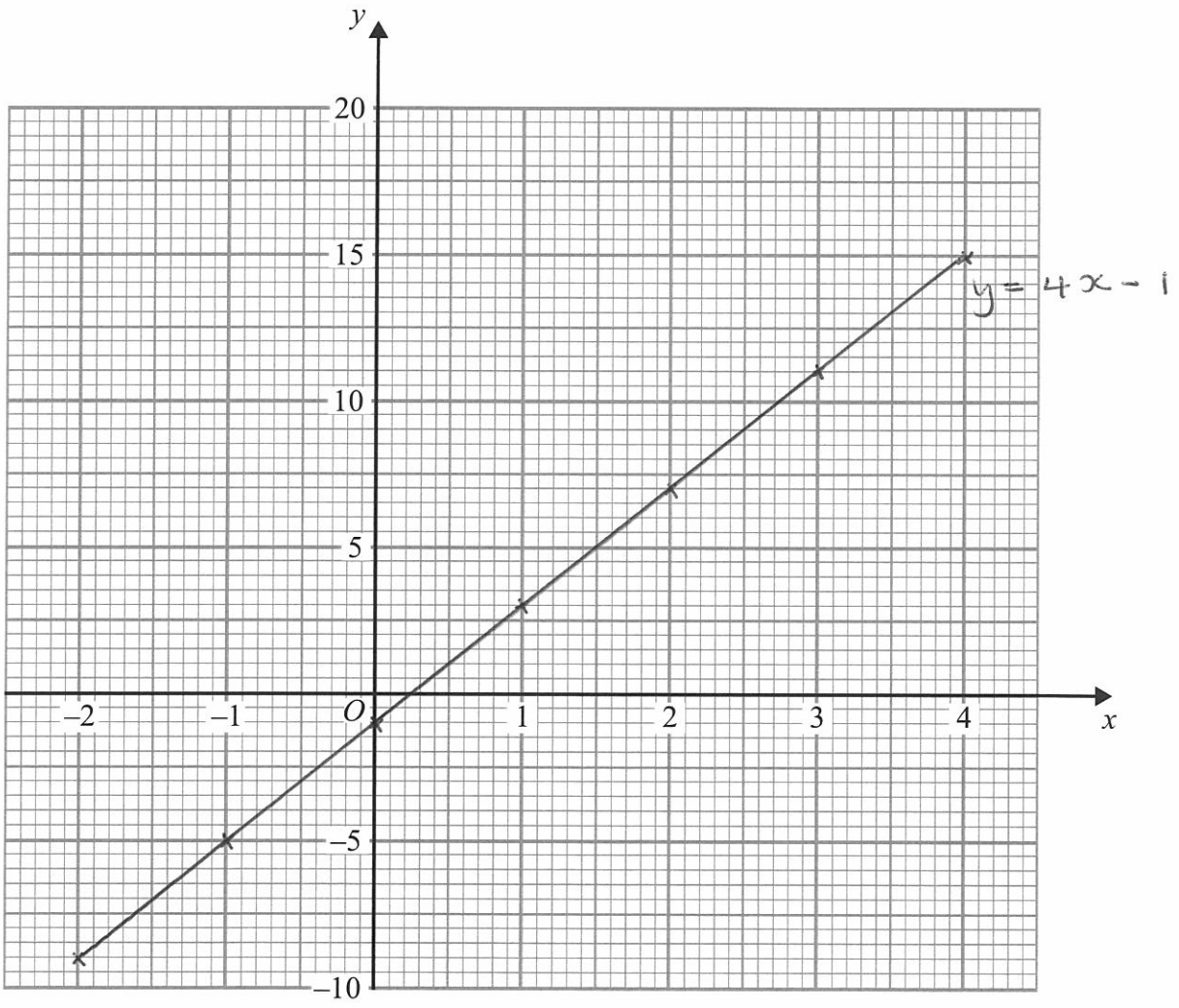
$\therefore x_1 = 1$ and $x_3 = 7$

Range $= 7 - 1 = 6$

(Total for Question 4 is 3 marks)

Do NOT write in this space.

5 On the grid, draw the graph of $y = 4x - 1$ from $x = -2$ to $x = 4$



(Total for Question 5 is 4 marks)

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6 (a) There are 32 students in a class.
All the students are either left-handed or right-handed.
The ratio of the number of left-handed students to the number of right-handed students is 1 : 7

Work out the number of right-handed students.

$\frac{32}{1+7} \times 7$ or simply $\frac{7}{8}$ of 32.

$\frac{7}{8} \times 32 = \frac{32}{8} \times 7 = 4 \times 7 = 28$

28

(2)

(b) Sajid makes a scale model of a lorry.
He uses a scale of 1 : 32
The length of Sajid's model lorry is 45 cm.
Chitra makes a scale model of the same lorry.
She uses a scale of 1 : 72

Work out the length of Chitra's model lorry.

$\frac{45 \times 32}{72} = 20$ cm

20 cm

(3)

(Total for Question 6 is 5 marks)

Do NOT write in this space.

7 Express 200 as a product of powers of its prime factors.

$200 = 2 \times 100$

$= 2 \times 2 \times 50$

$= 2 \times 2 \times 2 \times 25$

$= 2 \times 2 \times 2 \times 5 \times 5$

$2^3 \times 5^2$

(Total for Question 7 is 3 marks)

8 $\frac{y^3 \times y^n}{y} = y^6$

Find the value of n.

$\frac{y^{(3+n)}}{y} = y^6$

$\Rightarrow y^{(3+n-1)} = y^6$

$\Rightarrow y^{(2+n)} = y^6$

$\Rightarrow 2+n = 6 \quad \therefore n = 4$

$n =$ 4

(Total for Question 8 is 2 marks)

Do NOT write in this space.

9

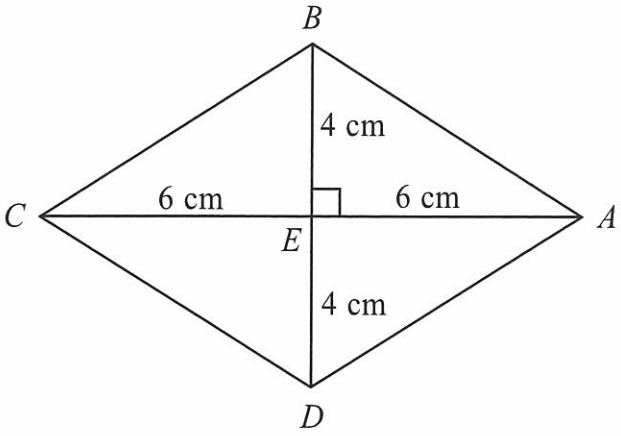

Diagram **NOT** accurately drawn

ABCD is a rhombus.
The diagonals *AC* and *BD* cross at the point *E*.
AE = *CE* = 6 cm.
BE = *DE* = 4 cm.
Angle *AEB* = 90°

(a) Work out the area of the rhombus.

Area of rhombus = $\frac{1}{2}$ x the product of the diagonals

$= \frac{1}{2} \times AC \times BD$

$= \frac{1}{2} \times 12 \times 8$

$= 48\ cm^2$

48 cm^2

(3)

(b) Work out the length of *AB*.
Give your answer correct to 3 significant figures.

$AB = \sqrt{6^2 + 4^2} = \sqrt{52}$

$= 7.21$ cm (3 s.f.).

7.21 cm

(3)

(Total for Question 9 is 6 marks)

10 (i) Solve the inequalities $-6 < 4x \leqslant 8$

$-\frac{6}{4} < x \leqslant \frac{8}{4}$

$\Rightarrow -1.5 < x \leqslant 2$

$-1.5 < x \leqslant 2$

(ii) n is an integer.

Write down all the values of n which satisfy $-6 < 4n \leqslant 8$

$n = -1, 0, 1, 2$

$-1, 0, 1, 2$

(Total for Question 10 is 4 marks)

11 (a) Find the Highest Common Factor (HCF) of 75 and 90

$90 = 2 \times 3 \times 3 \times 5$

$75 = 3 \times 5 \times 5$

$HCF = 3 \times 5 = 15$

15

(2)

(b) Find the Lowest Common Multiple (LCM) of 75 and 90

$90 = 2 \times 3 \times 3 \times 5$

$75 = 3 \times 5 \times 5$

$LCM = 5 \times 90 = 450$

450

(2)

(Total for Question 11 is 4 marks)

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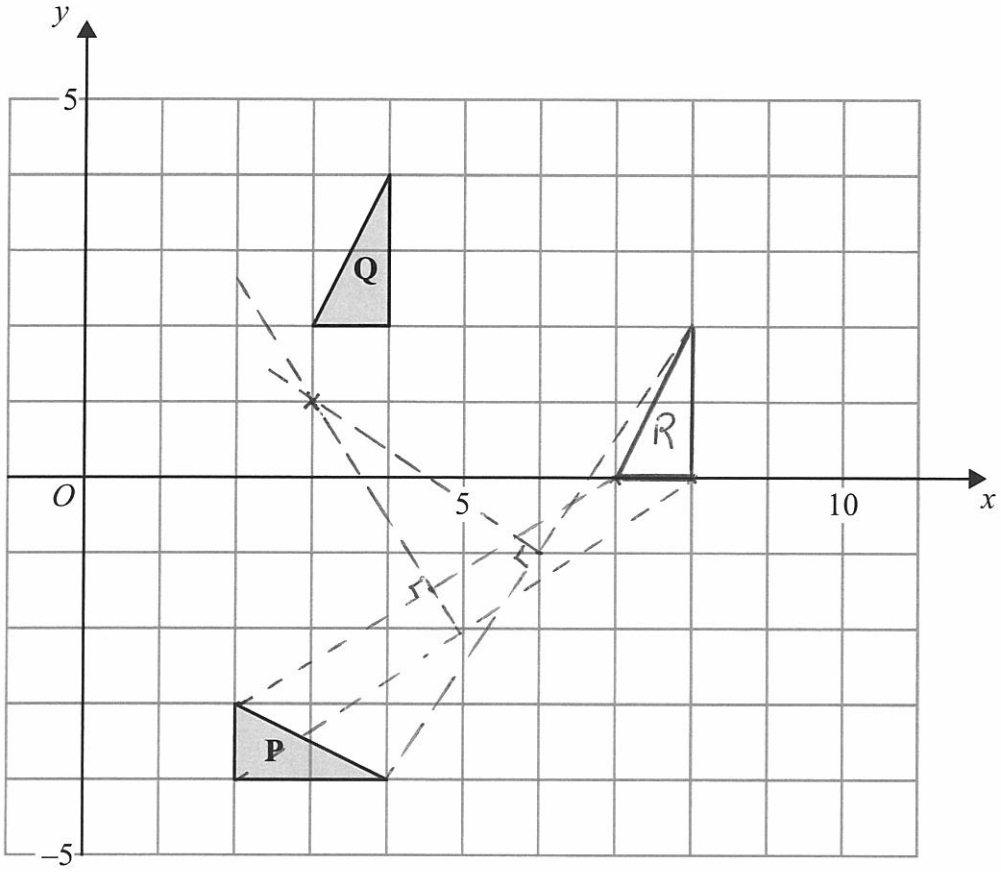
12



(a) Describe fully the single transformation which maps triangle **P** onto triangle **Q**.

A rotation of 90° anti-clockwise about the point (0, 0)

(3)

(b) On the grid, translate triangle **Q** by the vector $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$

Label the new triangle **R**.

(1)

(c) Describe fully the single transformation which maps triangle **P** onto triangle **R**.

A rotation of 90° anti-clockwise about the point (3, 1)

(2)

(Total for Question 12 is 6 marks)

Do NOT write in this space.

13 (a) Find the gradient of the line with equation $3x + 4y = 10$

$3x + 4y = 10$

$\Rightarrow 4y = -3x + 10$

and $y = -\frac{3}{4}x + 2.5$

$\therefore$ Gradient $= -\frac{3}{4}$

$-\frac{3}{4}$

(3)

(b) Find the coordinates of the point of intersection of the line with equation $3x + 4y = 10$ and the line with equation $5x - 6y = 23$
Show your working clearly.

$3x + 4y = 10 \quad \cdots \quad (1)$

$5x - 6y = 23 \quad \cdots \quad (2)$

Substitute $y = -\frac{3}{4}x + \frac{5}{2}$ from part a into equation 2.

Then $5x - 6\left(-\frac{3}{4}x + \frac{5}{2}\right) = 23$

$\Rightarrow 5x + \frac{18}{4}x - 15 = 23$

$\Rightarrow \frac{19}{2}x = 38$

$x = \frac{38 \times 2}{19} = 4$

$\therefore y = -\frac{3}{4}(4) + \frac{5}{2} = -3 + 2.5 = -0.5$

(4 , -0.5)

(5)

(Total for Question 13 is 8 marks)

14 The grouped frequency table gives information about the ages of 200 elephants.

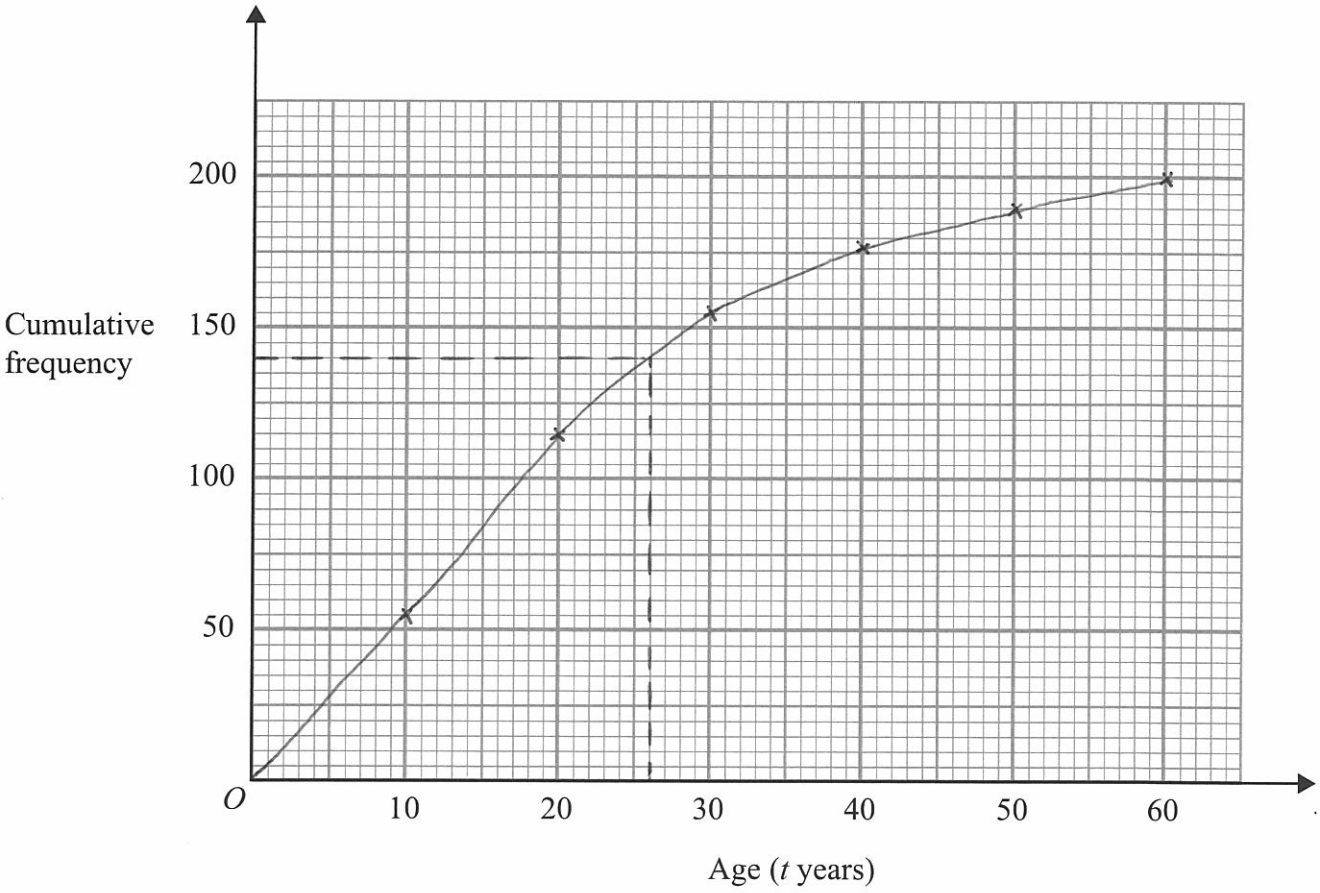
Age (t years)	Frequency
$0 < t \leqslant 10$	55
$10 < t \leqslant 20$	60
$20 < t \leqslant 30$	40
$30 < t \leqslant 40$	22
$40 < t \leqslant 50$	13
$50 < t \leqslant 60$	10

(a) Complete the cumulative frequency table.

Age (t years)	Cumulative frequency
$0 < t \leqslant 10$	55
$0 < t \leqslant 20$	115
$0 < t \leqslant 30$	155
$0 < t \leqslant 40$	177
$0 < t \leqslant 50$	190
$0 < t \leqslant 60$	200

(1)

(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use the graph to find an estimate for the number of elephants with ages of more than 26 years.

200 - 140 = 60

60

(2)

(Total for Question 14 is 5 marks)

Do NOT write in this space.

15 Solve the inequality $x^2 < 16$

$x < \sqrt{16}$ or $x > -\sqrt{16}$

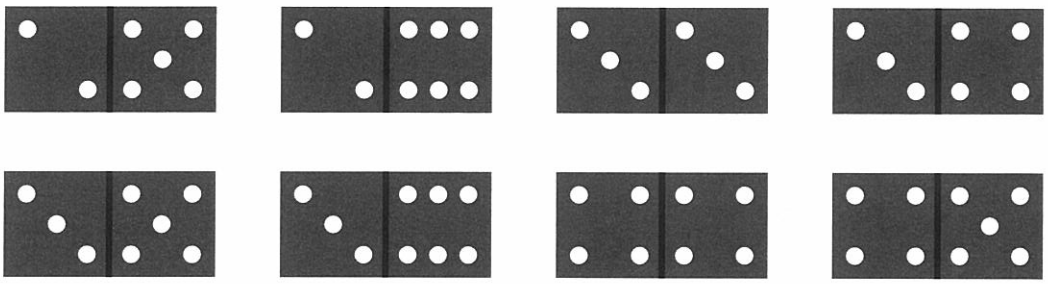
$\Rightarrow x < 4$ or $x > -4$

i.e. $-4 < x < 4$

$-4 < x < 4$

(Total for Question 15 is 2 marks)

16 Here are 8 dominoes.



The 8 dominoes are put in a bag.

Riaz takes at random a domino from the bag.

(a) Find the probability that he takes a domino with a total of 8 spots or a domino with a total of 9 spots.

$P(8 \text{ OR } 9) = \frac{5}{8}$

$\frac{5}{8}$

(2)

Helima takes at random 2 dominoes from the bag of 8 dominoes without replacement.

(b) Work out the probability that

(i) the total number of spots on the two dominoes is 18

$P(18 \text{ spots}) = P(9 \text{ AND } 9) = \frac{2}{8} \times \frac{1}{7}$

$= \frac{2}{56} = \frac{1}{28}$

$\frac{1}{28}$

(ii) the total number of spots on the two dominoes is 17

$P(17 \text{ spots}) = P(9 \text{ and } 8 \text{ OR } 8 \text{ and } 9)$

$= \left(\frac{2}{8} \times \frac{3}{7}\right) + \left(\frac{3}{8} \times \frac{2}{7}\right)$

$= \frac{6}{56} + \frac{6}{56} = \frac{12}{56} = \frac{3}{14}$

$\frac{3}{14}$

(5)

(Total for Question 16 is 7 marks)

Do NOT write in this space.

17 $f(x) = \sqrt{x-6}$

(a) Find f(10)

$\sqrt{10-6} = \sqrt{4} = 2$

.....

(1)

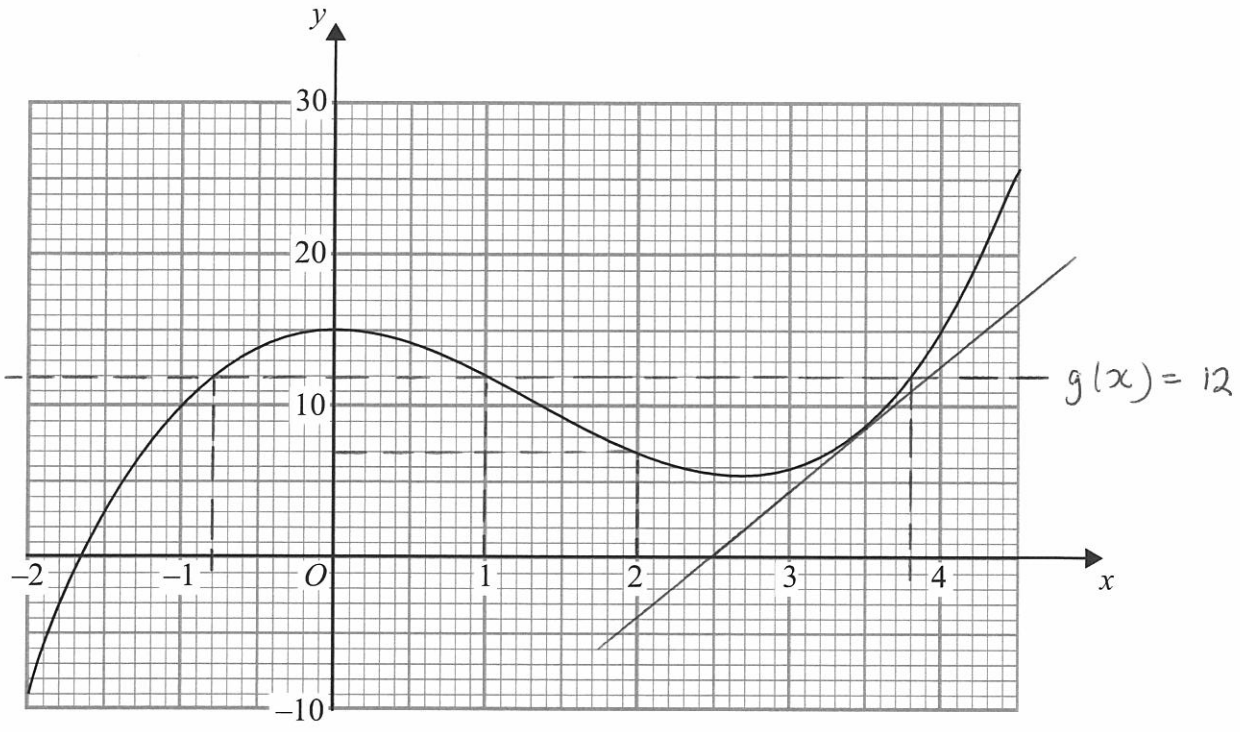
(b) State which values of x must be excluded from a domain of f

$x < 6$

.....

(2)

The diagram shows part of the graph of $y = g(x)$



(c) Find g(2)

$g(2) = 7$

7

.....

(1)

(d) Find fg(0)

$g(0) = 15$

$\Rightarrow fg(0) = f(15) = \sqrt{15-6} = \sqrt{9} = 3$

3

(2)

(e) One of the solutions of $g(x) = k$, where k is a number, is $x = 1$

Find the other solutions.
Give your answers correct to 1 decimal place.

$x = -0.8$ or 3.8

(3)

(f) Find an estimate for the gradient of the curve at the point where $x = 3.5$
Show your working clearly.

Gradient of tangent to curve at $x = 3.5$ is given by $\frac{\Delta y}{\Delta x}$ or $\frac{\delta y}{\delta x}$ or $\frac{y_2 - y_1}{x_2 - x_1} = \frac{17 - 0}{4.5 - 2.5} = \frac{17}{2}$

$= 8.5$

8.5

(3)

(Total for Question 17 is 12 marks)

Do NOT write in this space.

18

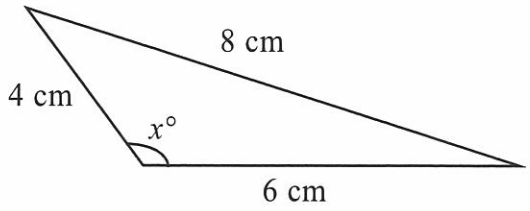


Diagram **NOT** accurately drawn

Calculate the value of x.
Give your answer correct to 1 decimal place.

Use cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$

$8^2 = 6^2 + 4^2 - 2(6)(4)\cos x$

$\Rightarrow 48\cos x = 6^2 + 4^2 - 8^2 = -12$

$\therefore x = \cos^{-1}\left(\frac{-12}{48}\right) = \cos^{-1}\left(-\frac{1}{4}\right) = 104.5^\circ$ (1d.p.)

$x =$ 104.5°

(Total for Question 18 is 3 marks)

Do NOT write in this space.

19 A and B are two sets.

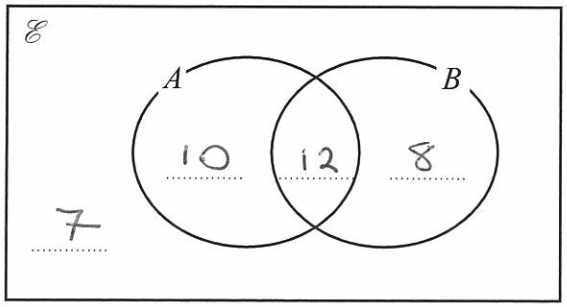
$n(\mathscr{E}) = 37$

$n(A) = 22$

$n(A \cap B) = 12$

$n(A \cup B) = 30$

(a) Complete the Venn Diagram to show the **numbers** of elements.



(2)

(b) Find (i) $n(A \cap B')$

10

(ii) $n(A' \cup B')$

10 + 8 + 7 = 25

25

(2)

(Total for Question 19 is 4 marks)

Do NOT write in this space.

20

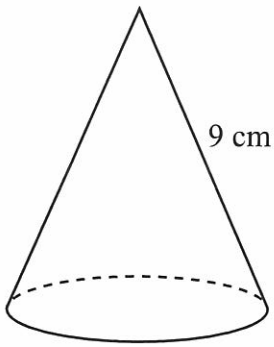


Diagram **NOT** accurately drawn

A solid cone has a slant height of 9 cm.
The **curved** surface area of the cone is 100 cm^2.

Calculate the volume of the cone.
Give your answer correct to 3 significant figures.

Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l = 100$

$\Rightarrow 9\pi r = 100$ and $r = \frac{100}{9\pi}$

Height of cone, h, is given by $\sqrt{9^2 - \left(\frac{100}{9\pi}\right)^2}$

$\therefore$ Volume of cone $= \frac{1}{3}\pi\left(\frac{100}{9\pi}\right)^2\sqrt{9^2 - \left(\frac{100}{9\pi}\right)^2}$

$= 108 \text{ cm}^3$ (3 s.f.).

108 cm^3

(Total for Question 20 is 5 marks)

21 (a) Simplify $(16y^8)^{\frac{3}{4}}$

$16^{\frac{3}{4}} y^{(8 \times \frac{3}{4})} = (\sqrt[4]{16})^3 y^{(24/4)}$

$= 2^3 y^6 = 8y^6$

$8y^6$

(2)

(b) Given that $2^p \times 8^q = 2^n$

express n in terms of p and q.

$2^p \times 8^q = 2^n$

$\Rightarrow 2^p \times 2^{3q} = 2^n$

$\Rightarrow 2^{(p+3q)} = 2^n$

$\therefore n = p + 3q$

$n = p + 3q$

(2)

(Total for Question 21 is 4 marks)

Do NOT write in this space.

22

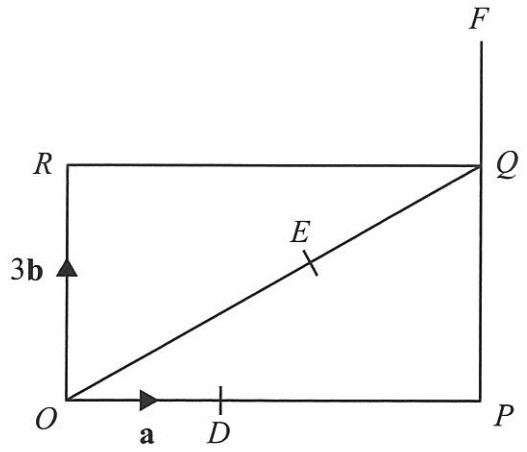


Diagram **NOT** accurately drawn

OPQR is a rectangle.

D is the point on *OP* such that $OD = \frac{1}{3} OP$.

E is the point on *OQ* such that $OE = \frac{2}{3} OQ$.

PQF is the straight line such that $QF = \frac{1}{3} PQ$.

$\overrightarrow{OD} = \mathbf{a}$ $\overrightarrow{OR} = 3\mathbf{b}$

(a) Find, in terms of **a** and **b**,

(i) $\overrightarrow{OQ}$

$\overrightarrow{OQ} = \overrightarrow{OR} + \overrightarrow{RQ} = 3b + 3a$

N.B: $\overrightarrow{RQ} = \overrightarrow{OP} = 3\overrightarrow{OD} = 3a$

$3b + 3a$

(ii) $\overrightarrow{OE}$

$\overrightarrow{OE} = \frac{2}{3}\overrightarrow{OQ} = \frac{2}{3}(3b + 3a)$

$= 2b + 2a$

$2b + 2a$

(iii) $\overrightarrow{DE}$

$\overrightarrow{DE} = \overrightarrow{DO} + \overrightarrow{OE} = -a + 2b + 2a$

$= a + 2b$

$a + 2b$

(3)

(b) Use a vector method to prove that *DEF* is a straight line.

$\overrightarrow{DP} = \frac{2}{3}\overrightarrow{OP} = \frac{2}{3}(3a) = 2a$

$\overrightarrow{QF} = \frac{1}{3}\overrightarrow{PQ} = \frac{1}{3}(3b) = b$

$\Rightarrow \overrightarrow{PF} = \overrightarrow{PQ} + \overrightarrow{QF} = 3b + b = 4b$

$\therefore \overrightarrow{DF} = \overrightarrow{DP} + \overrightarrow{PF} = 2a + 4b$

$= 2(a + 2b)$

i.e. $\overrightarrow{DF} = 2\overrightarrow{DE}$

Since $\overrightarrow{DF}$ is a scalar multiplier of $\overrightarrow{DE}$ (i.e. same direction but just twice the size of $\overrightarrow{DE}$ in this instance) then DEF is a straight line.

(2)

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

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