Surname		Other Names	
Centre Number			Candidate Number					
Candidate Signature									

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General Certificate of Secondary Education
November 2005

ASSESSMENT and QUALIFICATIONS ALLIANCE

MATHEMATICS (SPECIFICATION A) 3301/1H
Higher Tier
Paper 1 Non-Calculator

Tuesday 8 November 2005 9.00 am to 11.00 am

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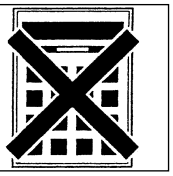
In addition to this paper you will require:
mathematical instruments.
You must **not** use a calculator.



Time allowed: 2 hours

Instructions
- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.

Information
- The maximum mark for this paper is 100.
- Mark allocations are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued on request and must be tagged securely to this answer booklet.
- The use of a calculator is **not** permitted.

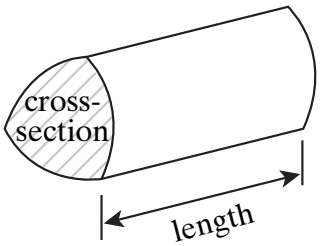
Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	**Mark**
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

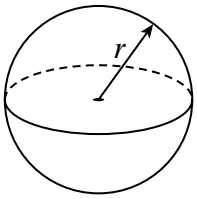
You may need to use the following formulae:

Volume of prism = area of cross-section × length



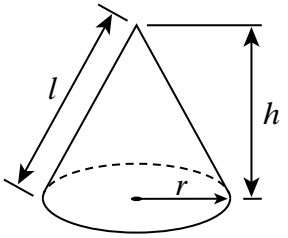
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

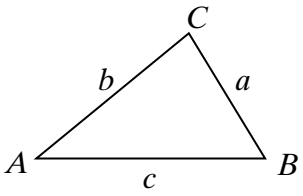


In any triangle ABC

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

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

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



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** questions in the spaces provided.

1 Bag A contains x counters.
Bag B contains 6 more counters than Bag A.
Bag C contains 4 times as many counters as Bag B.
Show that the total number of counters in Bags A, B and C is $6(x + 5)$.

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(4 marks)

2 A cuboid is made from centimetre cubes.
The area of the base of the cuboid is $5\,cm^2$.
The volume of the cuboid is $10\,cm^3$.
Work out the surface area of the cuboid.

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Answer ..... cm^2 *(3 marks)*

7

3 Use approximations to show which of the following calculations gives the bigger answer.

(a) $59.4 \div 0.307$ (b) $80.16 \div 0.481$

You **must** show your working.

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Answer ..... *(3 marks)*

4 Lucy makes some curtains for her living room and her bedroom.
In the living room she uses $3\frac{2}{3}$ metres of material.
In the bedroom she uses $2\frac{4}{5}$ metres of material.
How many metres of material does she use altogether?

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Answer ..... m *(3 marks)*

5 Mr Jones buys a new car for £50 000.
The car decreases in value at the rate of 30% each year.
Find the value of the car after two years.

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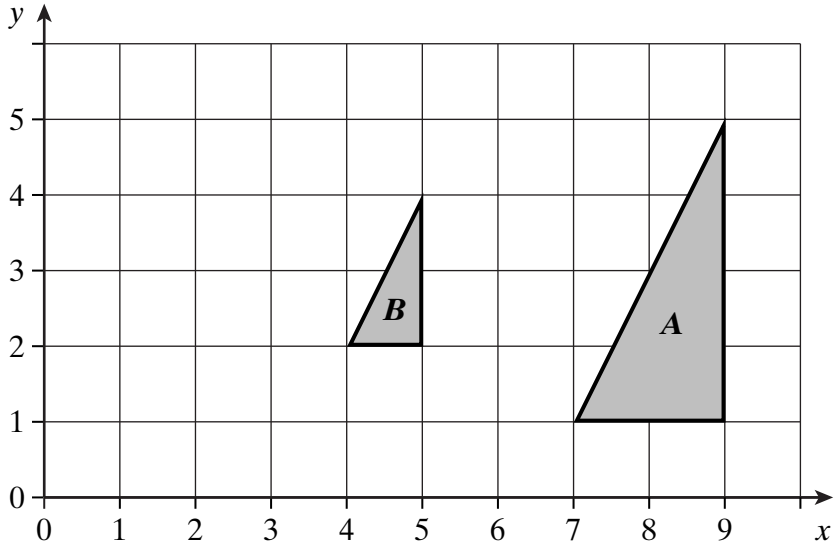
Answer £ ..... *(3 marks)*

6 The diagram shows two triangles ***A*** and ***B***.



(a) Describe fully the single transformation that maps triangle ***A*** onto triangle ***B***.

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(3 marks)

(b) On the diagram draw the image of triangle ***B*** after it is reflected in the line $y = x$
(2 marks)

7 (a) Write these numbers in standard form

(i) 9 170 000

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Answer ..... *(1 mark)*

(ii) 0.000 048

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Answer ..... *(1 mark)*

(b) Find the value of $(1.8 \times 10^{12}) \div (2 \times 10^{8})$

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Answer ..... *(2 marks)*

8 (a) Simplify

(i) $y^7 \times y^2$

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Answer ..... *(1 mark)*

(ii) $y^7 \div y^2$

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Answer ..... *(1 mark)*

(iii) $(y^7)^2$

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Answer ..... *(1 mark)*

(b) (i) If $y = -1$ which answer in part (a) is positive?

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Answer ..... *(1 mark)*

(ii) If $y = 0.5$ which answer in part (a) has the greatest value?

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Answer ..... *(1 mark)*

9 (a) Expand and simplify $4(3k - 2) + 3(4 - k)$

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Answer ..... *(2 marks)*

(b) Factorise $h^2 - 25$

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Answer ..... *(1 mark)*

(c) Make t the subject of the formula $w = \sqrt{t} - v$

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Answer t = ... *(2 marks)*

(d) Solve the equation $4x^2 = 25$

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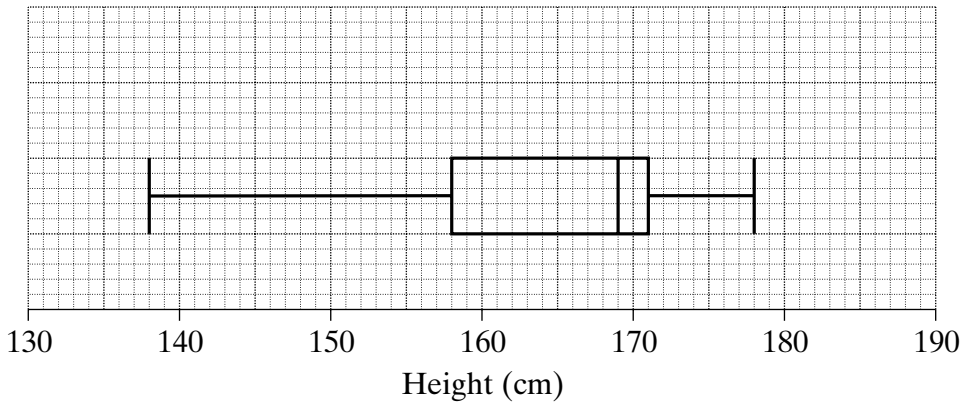
Answer ..... *(2 marks)*

10 (a) The box plot shows the heights of a group of boys in a school.



(i) Write down the median height of these boys.

Answer ..... cm *(1 mark)*

(ii) Find the interquartile range of the heights of these boys.

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Answer ..... cm *(2 marks)*

(b) 15 girls in the school are chosen at random.
Their heights, in centimetres, are shown below.

142, 147, 152, 156, 156, 159, 164, 166, 166, 166, 167, 170, 171, 171, 175

There are a total of 450 girls in the school.
Use this sample to estimate how many girls in the school are less than 148 cm tall.

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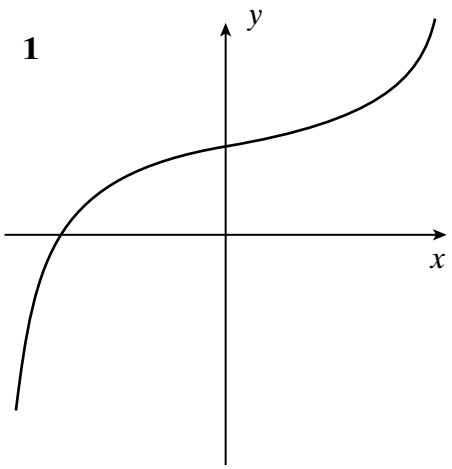
Answer ..... *(2 marks)*

11 Match each of the sketch graphs to one of these equations.

A $y = 2 - 2x$ **B** $y = 2x + 2$ **C** $y = 3 - x^2$ **D** $y = x^3 + 4$ **E** $y = \frac{2}{x}$

1



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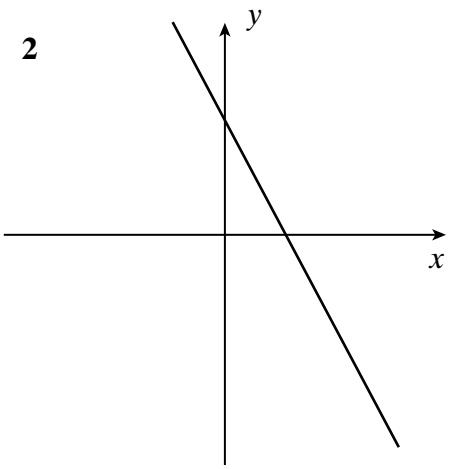

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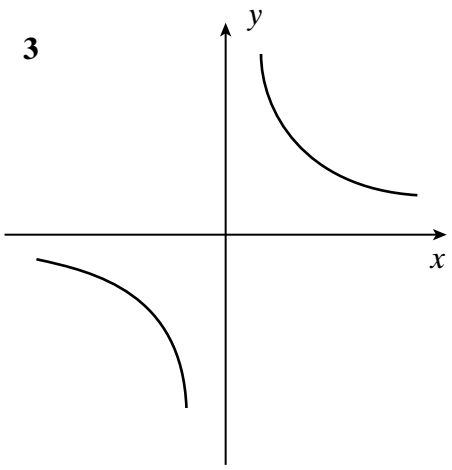

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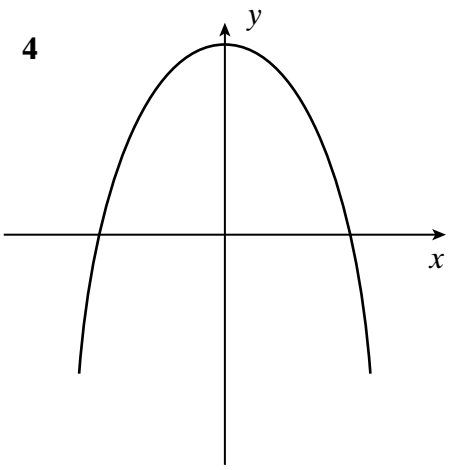


Graph **1** represents equation .....

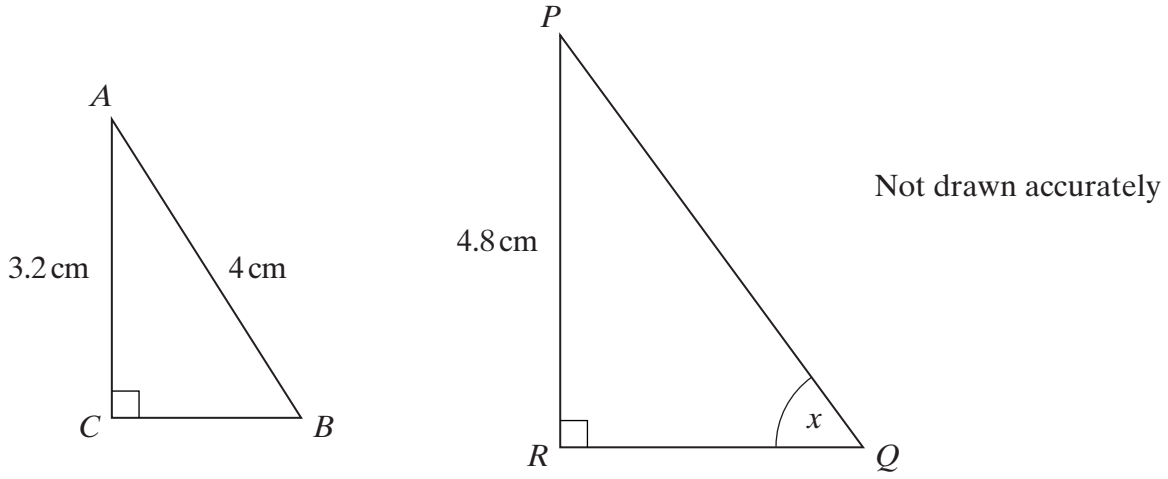
Graph **2** represents equation .....

Graph **3** represents equation .....

Graph **4** represents equation .....

(4 marks)

12 Triangles ABC and PQR are similar.
$AC = 3.2\,\text{cm}$, $AB = 4\,\text{cm}$ and $PR = 4.8\,\text{cm}$.



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(a) Explain why $\sin x = 0.8$

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(1 mark)

(b) Calculate the length of PQ.

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Answer ..... cm *(3 marks)*

8

13 Solve the equation $x^2 - 6x - 3 = 0$

Give your answers in the form $p \pm q\sqrt{3}$ where p and q are integers.

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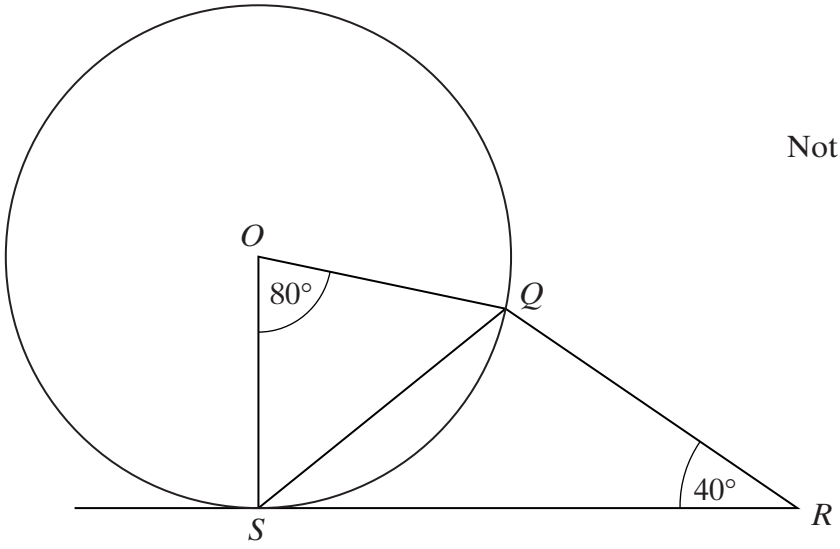
Answer ..... *(4 marks)*

14 In the diagram below points Q and S lie on a circle centre O.
SR is a tangent to the circle at S.
Angle $QRS = 40°$ and angle $SOQ = 80°$



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Prove that triangle QSR is isosceles.

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(3 marks)

15 (a) Write down the value of $27^{\frac{1}{3}}$

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Answer ..... *(1 mark)*

(b) Write down the value of $(4xy)^0$

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Answer ..... *(1 mark)*

(c) If $2^x = \frac{1}{32}$ find the value of x.

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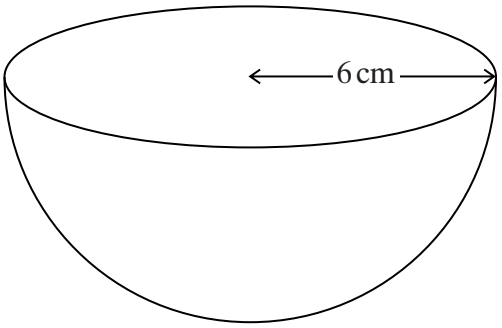
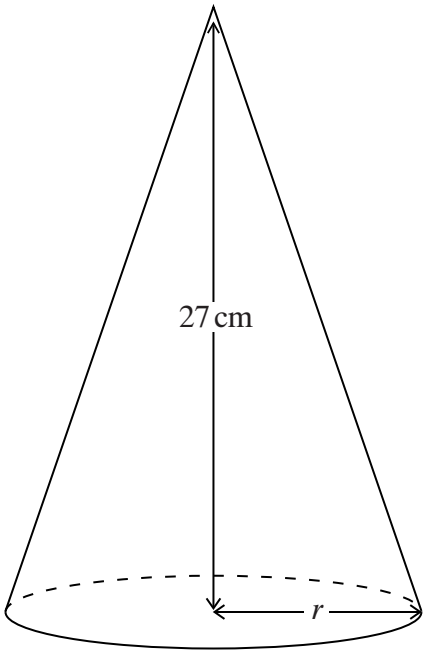
Answer x = ... *(2 marks)*

16 A hemispherical bowl of radius 6 cm has the same volume as a cone of perpendicular height 27 cm.

Not drawn accurately





Calculate the base radius, r, of the cone.

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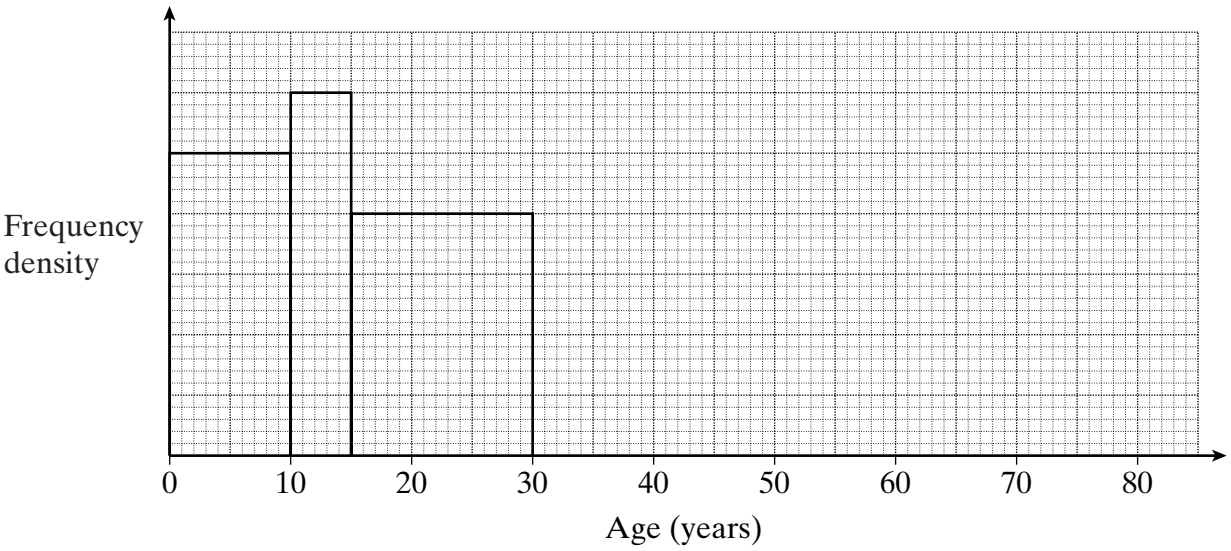
Answer ..... cm *(4 marks)*

17 The histogram and the frequency table are both incomplete.
They represent the same information about the ages of people living in a small village.



Age (years)	Frequency
$0 \leqslant x < 10$	50
$10 \leqslant x < 15$	
$15 \leqslant x < 30$	
$30 \leqslant x < 50$	60
$50 \leqslant x < 75$	25
$75 \leqslant x < 80$	20

(a) Use the information in the histogram to complete the frequency table.

(2 marks)

(b) Complete the histogram. *(2 marks)*

18 The **two-digit** number 37 can be written as $(10 \times 3) + 7$

Similarly the **two-digit** number ab can be written as $10a + b$

(a) def is a **three-digit** number.
Write an expression for the number def in terms of d, e and f.

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Answer ..... *(1 mark)*

(b) Write an expression for the three-digit number fed in terms of f, e and d.

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Answer ..... *(1 mark)*

(c) Using your answers for parts (a) and (b), write down and simplify an expression for

$$def - fed$$

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Answer ..... *(2 marks)*

(d) Hence show that

$$def - fed$$

is divisible by 9.

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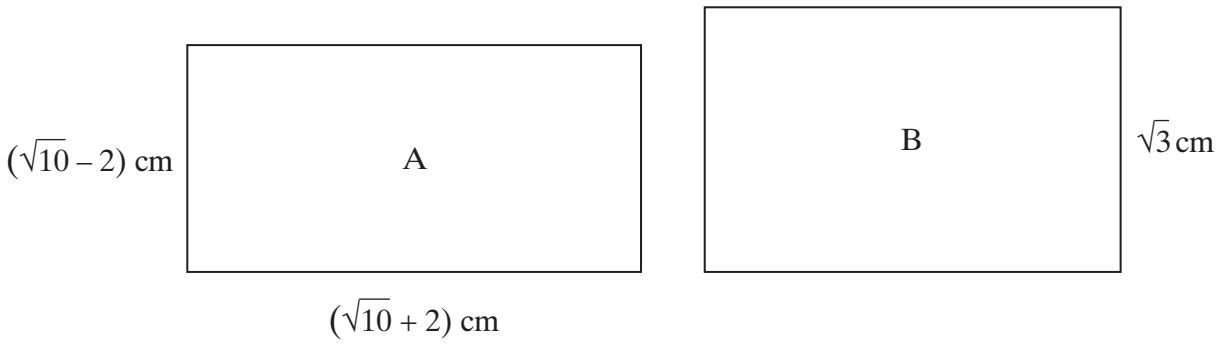
(1 mark)

9

19 Two rectangles, A and B, are equal in area.

Not to scale



Calculate the length of rectangle B.
Give your answer in the form $p\sqrt{3}$.

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Answer ..... cm *(4 marks)*

20 An examiner has to attend a meeting in Manchester.
The probabilities of dry weather (D), rain (R) or snow (S) are

$$\text{Probability (D)} = \frac{1}{2}$$
$$\text{Probability (R)} = \frac{1}{3}$$
$$\text{Probability (S)} = \frac{1}{6}$$

If it is dry the probability that he will arrive in time for the meeting is $\frac{4}{5}$
If it rains the probability that he will arrive in time for the meeting is $\frac{2}{5}$
If it snows the probability that he will arrive in time for the meeting is $\frac{1}{10}$

Calculate the probability that he is **late** for the meeting.

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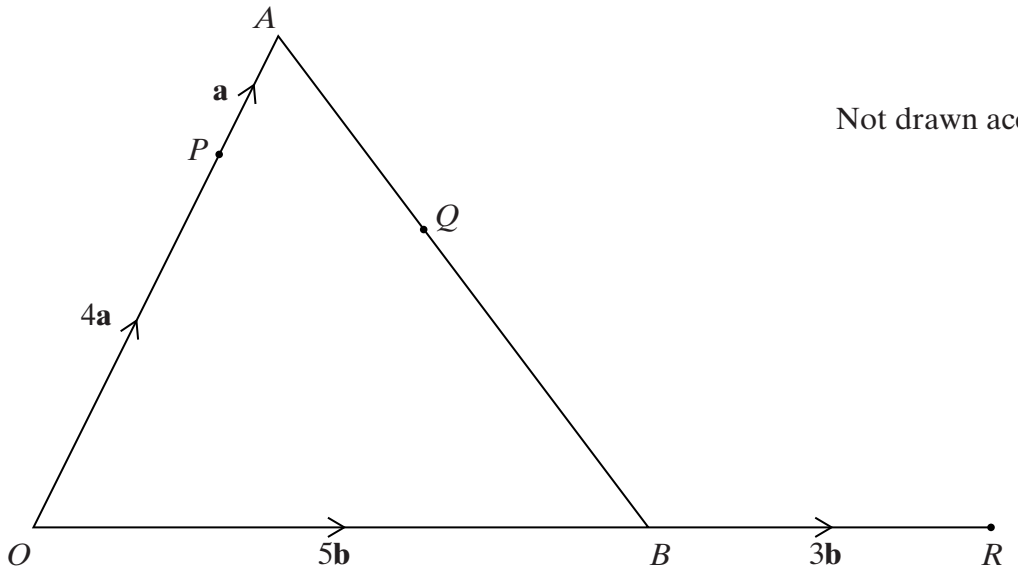
Answer ..... *(4 marks)*

8

21 In the diagram $\overrightarrow{OP} = 4\mathbf{a}$, $\overrightarrow{PA} = \mathbf{a}$, $\overrightarrow{OB} = 5\mathbf{b}$, $\overrightarrow{BR} = 3\mathbf{b}$ and $\overrightarrow{AQ} = \frac{2}{5}\overrightarrow{AB}$



Not drawn accurately

(a) Find, in terms of **a** and **b**, simplifying your answers,

(i) $\overrightarrow{AB}$

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Answer ..... *(1 mark)*

(ii) $\overrightarrow{PQ}$

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Answer ..... *(2 marks)*

(b) Show clearly that points P, Q and R lie on a straight line.

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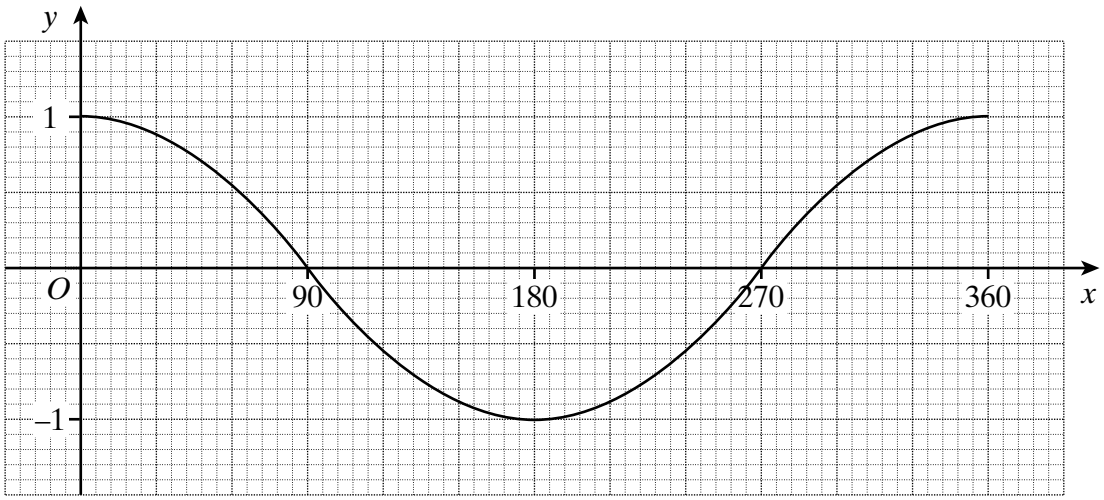
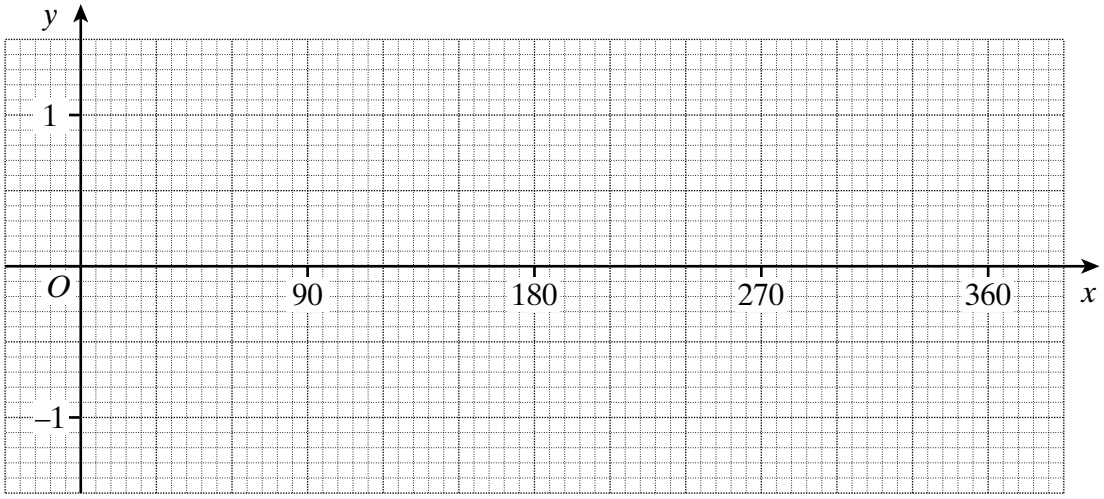
(3 marks)

22 This is the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$

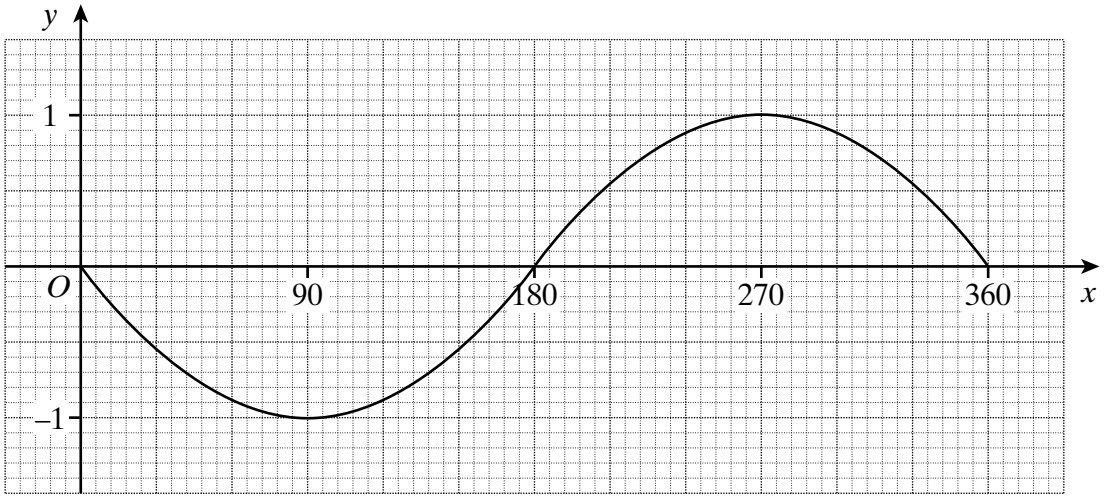


(a) On the axes below draw the graph of $y = \cos(x - 90)$ for $0° \leqslant x \leqslant 360°$



(2 marks)

(b) Write down a possible equation of the following graph.



Answer ..... *(1 mark)*

23 (a) Solve the simultaneous equations

$$y = 2x - 5$$
$$x^2 + y^2 = 25$$

You **must** show your working.
Do **not** use trial and improvement.

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Answer ..... *(6 marks)*

(b) The graph of $y = 2x - 5$ is shown on the opposite page.

(i) On the same axes, draw the graph of $x^2 + y^2 = 25$

(2 marks)

(ii) Explain the connection between the two graphs and the answers you obtained in part (a).

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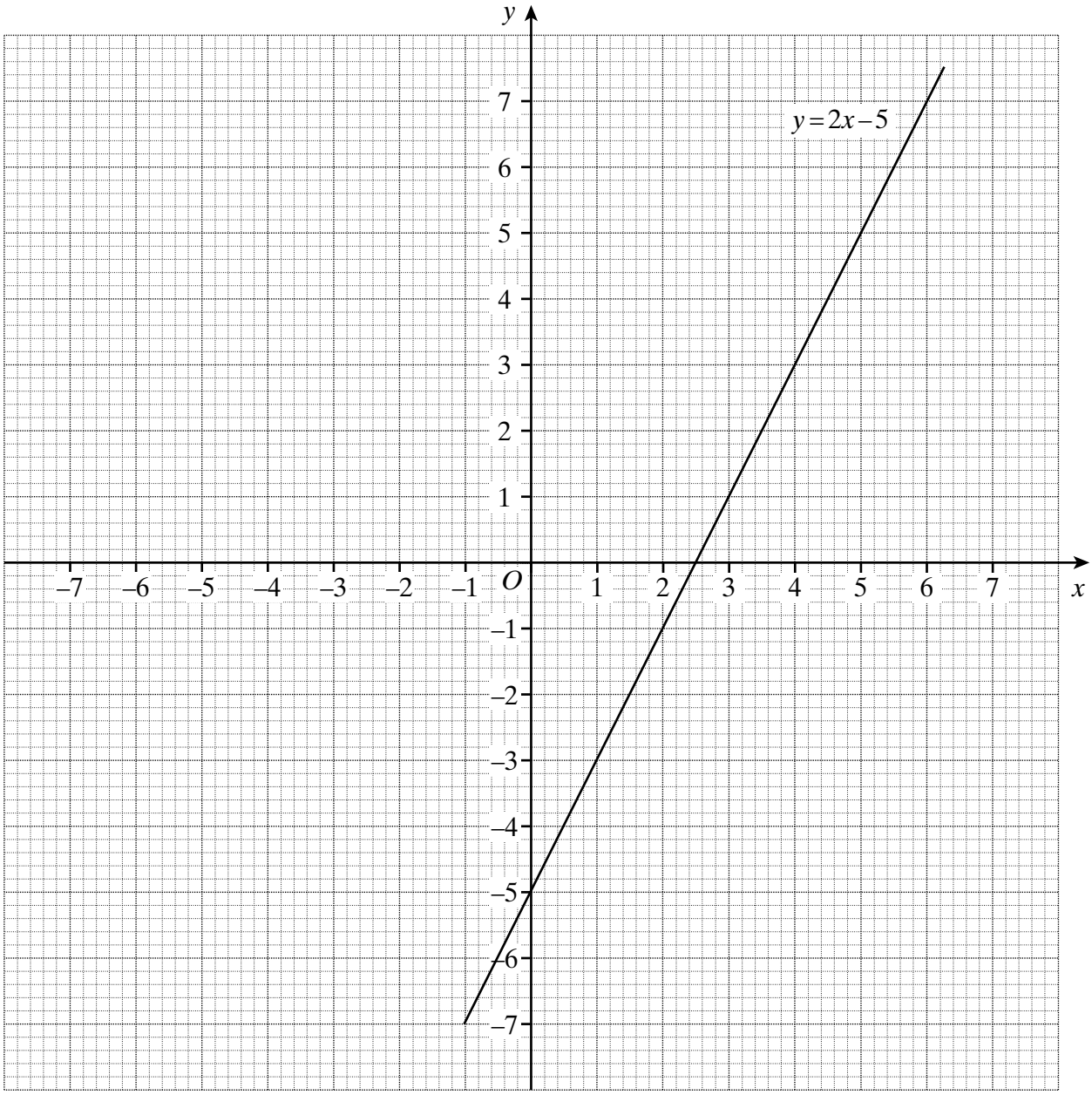
(1 mark)



END OF QUESTIONS

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