Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

General Certificate of Secondary Education
June 2009

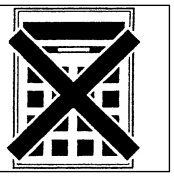
MATHEMATICS (SPECIFICATION A) **4306/1H**
Higher Tier
Paper 1 Non-calculator

H

Monday 18 May 2009 1.30 pm to 3.30 pm

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.



Time allowed: 2 hours

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book.

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You may ask for more answer paper, graph paper and tracing paper. This must be tagged securely to this answer booklet.

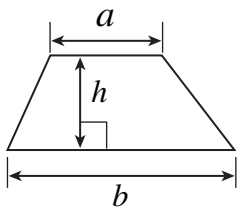
Advice

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

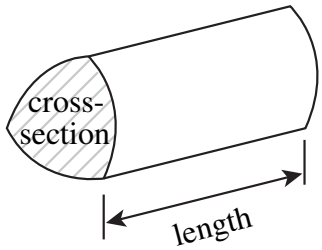
For Examiner's Use	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

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

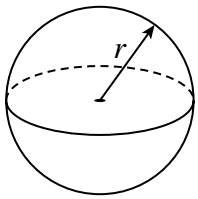


Volume of prism = area of cross-section × length



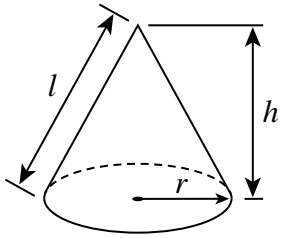
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

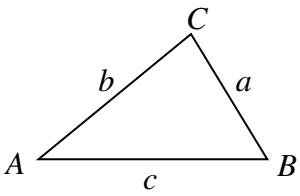
Curved surface area of cone = $\pi r l$



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 Which of the following fractions is nearest to $\frac{1}{2}$?
You **must** show your working.

$$\frac{3}{5} \qquad \frac{7}{10} \qquad \frac{11}{20}$$

.....

.....

.....

.....

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

2 $A = 6$ and $B = -7$

Work out the value of $\dfrac{A(B + 2)}{3}$

.....

.....

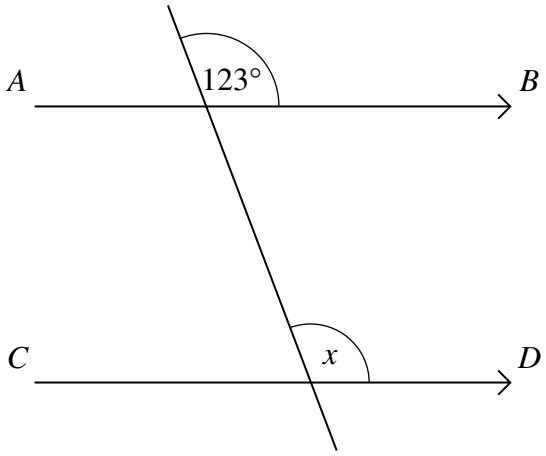
.....

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

Turn over for the next question

5

3 (a) In the diagram, *AB* is parallel to *CD*.



Not drawn accurately

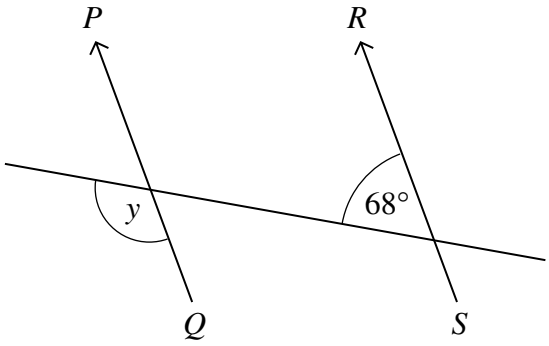
Write down the value of *x*.
Give a reason for your answer.

Answer ..... degrees

Reason .....

(2 marks)

3 (b) In the diagram, *PQ* is parallel to *RS*.



Not drawn accurately

Work out the value of *y*.

.....

.....

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

4 Ann is x years old.
David is 3 years younger than Ann.
Ken is twice as old as Ann.
The total of their ages is 25

4 (a) Write an expression for David's age in terms of x.

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

4 (b) Write an expression for Ken's age in terms of x.

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

4 (c) Form an equation in x and use it to work out Ann's age.

.....

.....

.....

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

5 George wants to buy a new television.
He sees the same television on special offer at two different stores.

Teleworld

40% off 

Normal price £480

SuperSave

$\frac{1}{3}$ off 

Normal price £420

Which store sells the television more cheaply?
You **must** show your working.

.....

.....

.....

.....

.....

Answer ..... *(5 marks)*

13

6 The numbers of driving lessons taken by fifteen people before passing their driving test are shown.

22	15	9	18	29
38	18	19	48	16
13	21	58	23	13

6 (a) Complete an ordered stem-and-leaf diagram to represent this data.
Remember to complete the key.

.....

.....

.....

.....

.....

.....

0	
1	
2	
3	
4	
5	

Key … | …

represents …… lessons

(3 marks)

6 (b) The mean of these numbers is 24

Tony says, 'The average number of lessons needed to pass a driving test is 24'

Is this a reasonable statement to make?
Give a reason for your answer.

.....

.....

.....

(1 mark)

7 The instructions for the time to cook a turkey are

45 minutes per kilogram plus 20 minutes

7 (a) Write down a formula for the time T, minutes, to cook a turkey weighing w kilograms.

.....

.....

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

7 (b) The total time to cook a turkey is 4 hours and 5 minutes.

How much does the turkey weigh?

.....

.....

.....

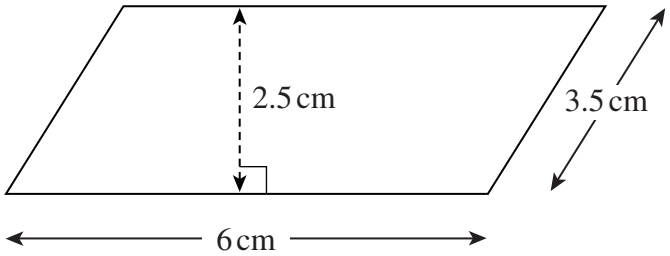
.....

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

Turn over for the next question

9

8 The diagram shows a parallelogram.



Not drawn accurately

Calculate the area of the parallelogram.
State the units of your answer.

.....

.....

.....

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

9 Leah, Chloe and Maya share £400 between them.
Leah receives the smallest amount of £90
The ratio of Leah's share to Chloe's share is 2 : 3

Work out how much Maya receives.

.....

.....

.....

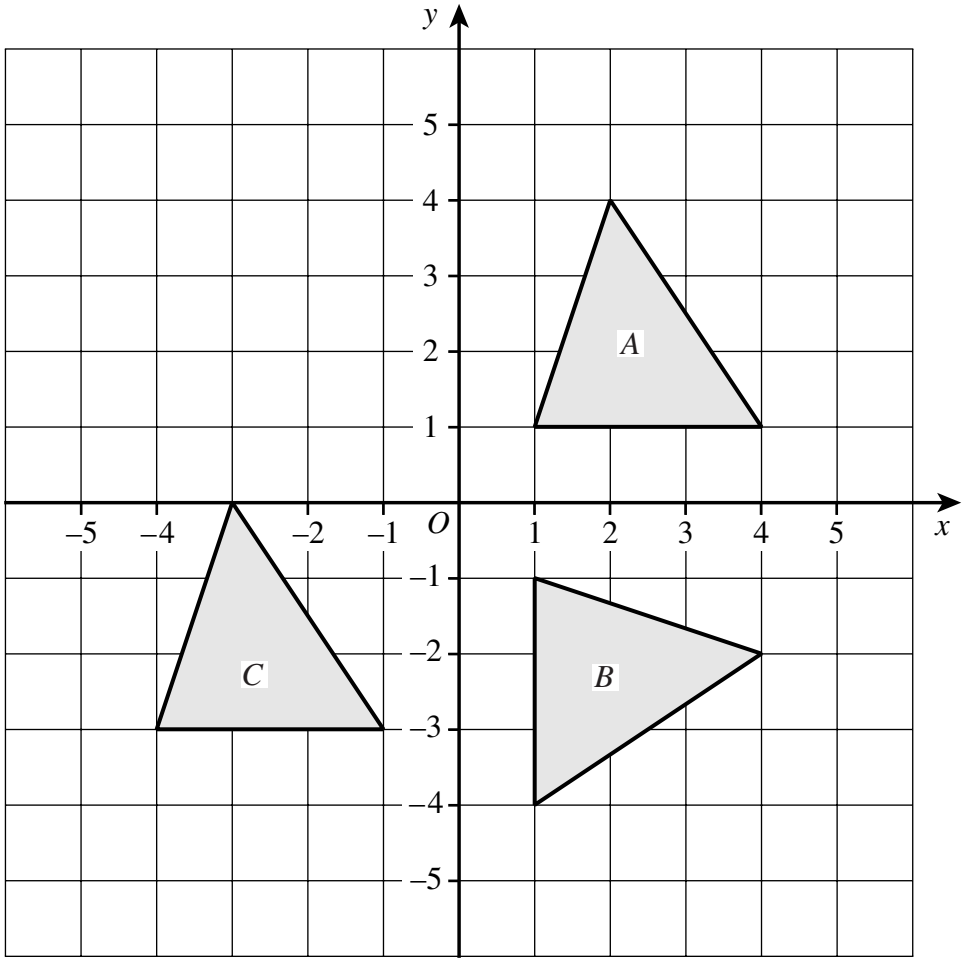
.....

.....

.....

Answer £ ..... *(3 marks)*

10 Triangles *A*, *B* and *C* are shown on the grid.



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

.....

.....

.....

(3 marks)

10 (b) Write down the vector which describes the translation of triangle *A* onto triangle *C*.

Answer $\begin{pmatrix} \ldots\ldots \\ \\ \ldots\ldots \end{pmatrix}$ *(1 mark)*

10

Turn over ▶

11 (a) Solve the inequality $3x + 2 \leqslant 8$

.....

.....

.....

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

11 (b) Write down all the integer values of x satisfying this inequality $-4 \leqslant 2x < 4$

.....

.....

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

12 The table shows the distances that 100 people travel to work each day.

Distance, d, km	Frequency	Midpoint	
$0 < d \leqslant 4$	11		
$4 < d \leqslant 8$	23		
$8 < d \leqslant 12$	36		
$12 < d \leqslant 16$	20		
$16 < d \leqslant 20$	10		

Calculate an estimate of the mean distance travelled.

.....

.....

.....

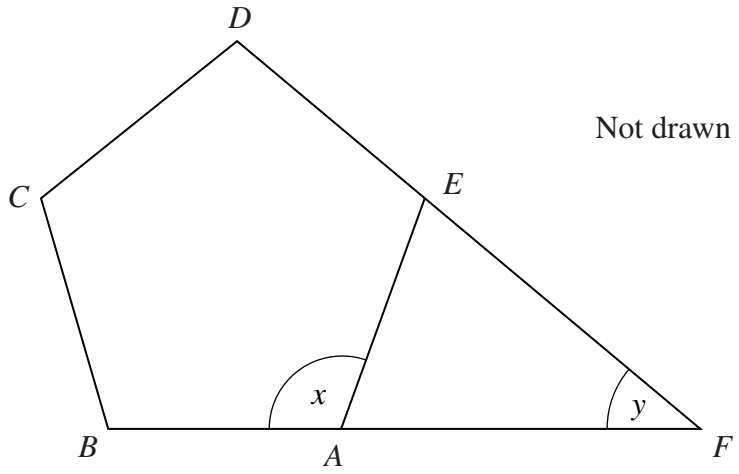
.....

.....

.....

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

13 *ABCDE* is a regular pentagon.
DEF and *BAF* are straight lines.



Not drawn accurately

13 (a) Which **one** of these statements is true?

1 The exterior angle of a regular pentagon is equal to $360° \div 5 = 72°$

2 The interior angle of a regular pentagon is equal to $360° \div 5 = 72°$

3 The exterior angle of a regular pentagon is equal to $360° - 72° = 288°$

4 The interior angle of a regular pentagon is equal to $360° - 72° = 288°$

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

13 (b) (i) Work out the size of the angle marked *x* on the diagram.

.....

.....

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

13 (b) (ii) Work out the size of the angle marked *y* on the diagram.

.....

.....

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

12

14 (a) Expand and simplify $2x^2(x + 6) + 3x(x - 5)$

.....

.....

.....

.....

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

14 (b) Factorise fully $3mh^2 - 15m^2h$

.....

.....

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

15 Sirius is the brightest star in the night sky.
The speed of light is 300 000 km per second.
Light takes 2.7×10^8 seconds to reach Earth from Sirius.

How far is Sirius from Earth?
Give your answer in standard form.

.....

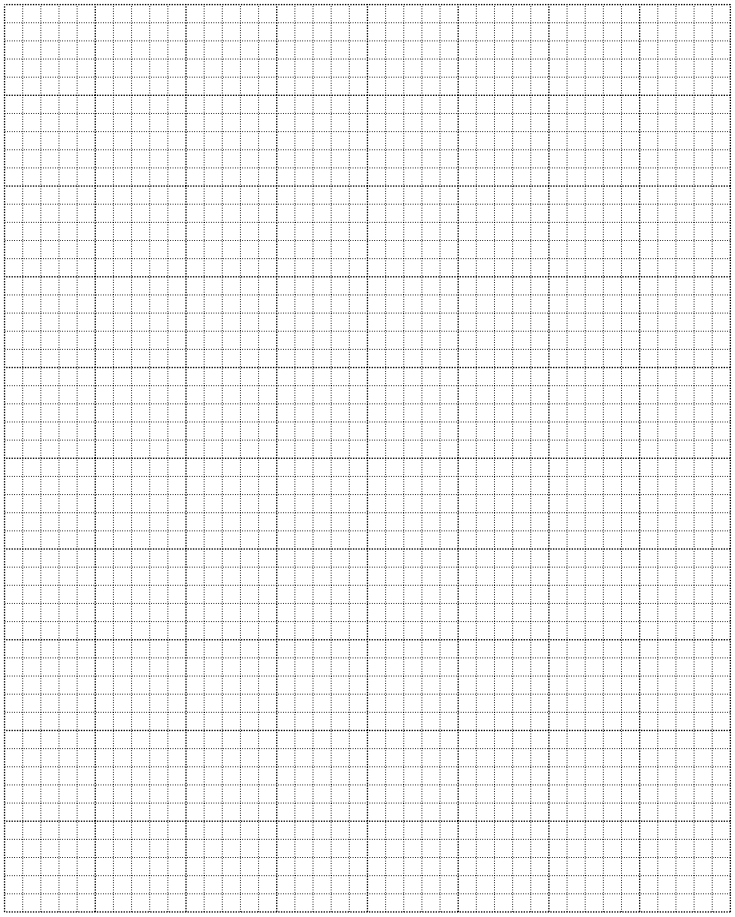
.....

.....

.....

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

16 Find an equation of the straight line which passes through the points (0, –2) and (2, –8).
Show your working.
You may use the graph paper to help you.



.....

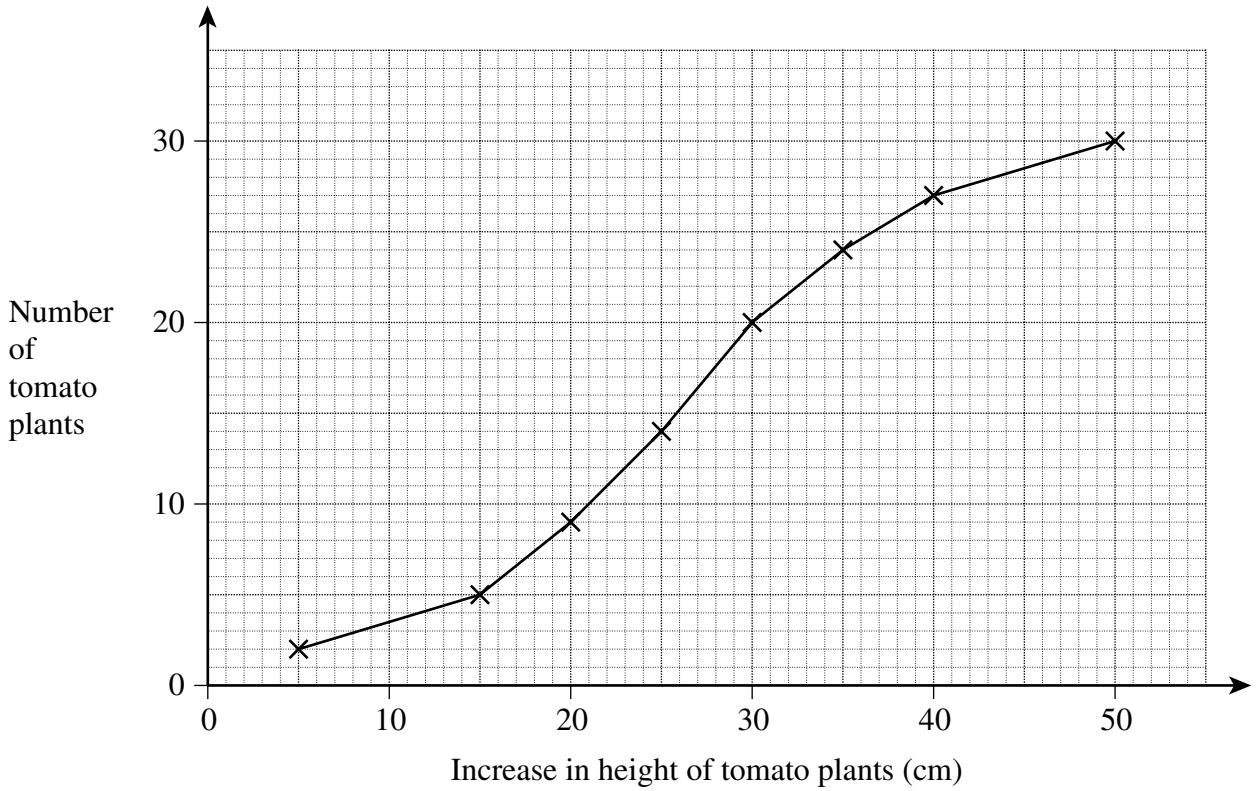
.....

.....

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

11

17 Grace bought 60 tomato plants and split them into two identical batches of 30 plants.
The **first** batch of 30 plants was allowed to grow naturally.
Grace measured the increase in their heights six weeks later.
The results for the **first** batch are shown on this cumulative frequency graph.



17 (a) How many tomato plants from the **first** batch have increased in height by more than 31 cm?

.....

.....

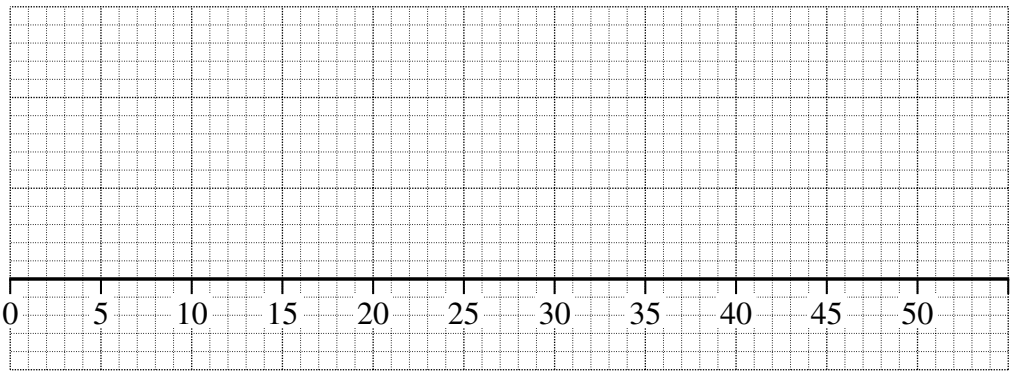
Answer ..... *(2 marks)*

17 (b) The smallest increase in height was 5 cm.
On the graph paper at the top of the next page, draw a box plot from the cumulative frequency diagram for the **first** batch of tomato plants.

.....

.....

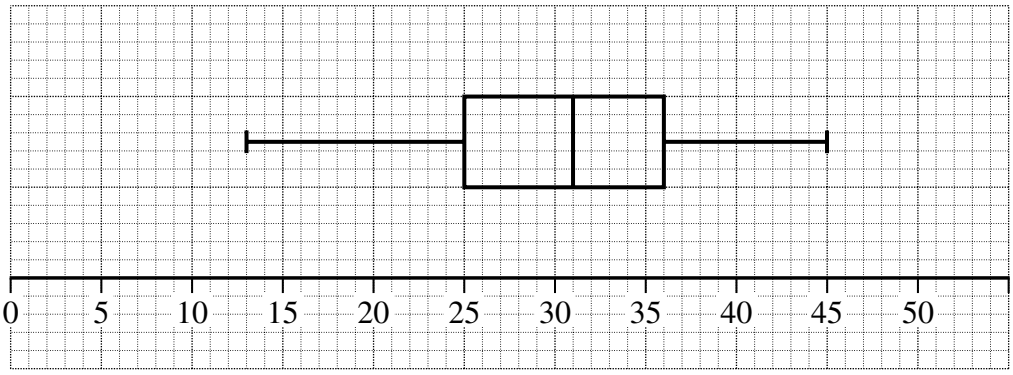
.....



(3 marks)

The **second** batch of 30 tomato plants was treated with *Supergrow*.

This box plot shows the results of the **second** batch when Grace measured the increase in their heights six weeks later.



17 (c) The label on the packet of *Supergrow* says

> Use *Supergrow* for consistent results.
> Make your plants bigger.

Give **two** reasons to support the claims on the packet.

Reason 1 .....

.....

.....

Reason 2 .....

.....

.....

(2 marks)

7

18 Work out $3\frac{3}{4} \div 1\frac{2}{3}$

.....

.....

.....

.....

.....

.....

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

19 Show that $27^{-\frac{2}{3}} = \frac{1}{9}$

.....

.....

.....

.....

.....

(2 marks)

20 Two variables x and y are connected by the relationship

'y is directly proportional to the square root of x'.

20 (a) When $x = 25$, $y = 15$

Express y in terms of x.

.....

.....

.....

.....

.....

.....

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

20 (b) Explain what happens to the value of x when the value of y doubles.

.....

.....

.....

.....

(2 marks)

10

21 A Golf Club has 600 members.
A stratified sample of members is taken, by age group.

The table shows the age grouping of the members.
Some information is given in the table.

Age group	Junior	18 – 39	40 – 59	Senior
Number of members	100			120
Number in sample	20		35	

Complete the table.

.....

.....

.....

.....

.....

.....

.....

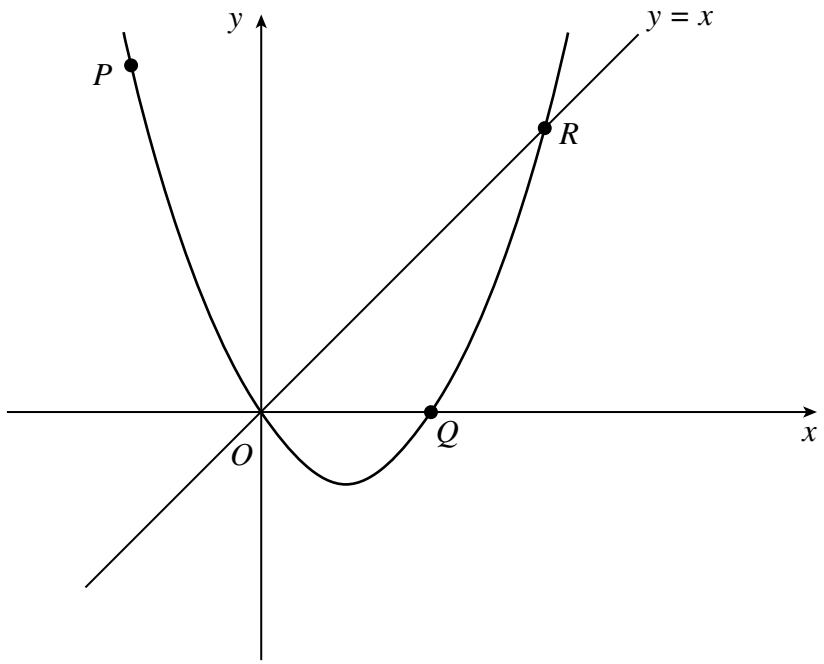
.....

(3 marks)

22 The diagram shows a quadratic graph and a straight line graph.
The two graphs intersect at the origin and at the point marked R.

The quadratic graph has equation $y = ax^2 + bx$, where a and b are integers.
Points P (–1, 10) and Q (4, 0) lie on this graph.

The straight line is $y = x$



Find the coordinates of the point marked R.
You **must** show your working.

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

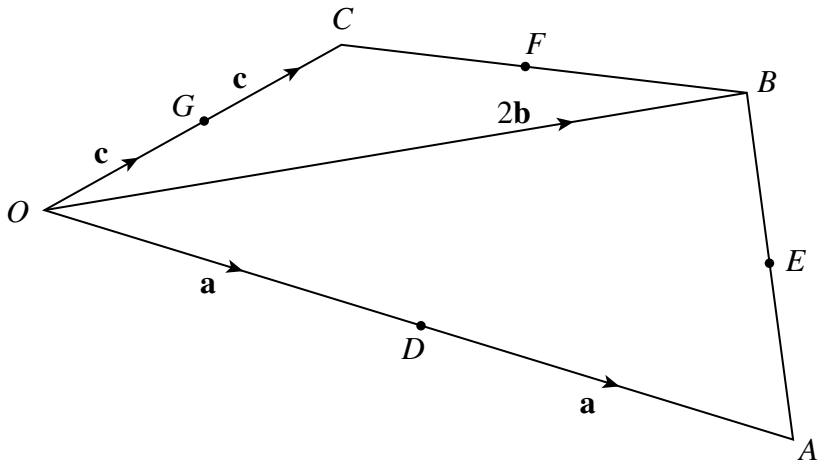
9

Turn over ▶

23 *OABC* is a quadrilateral.
D, *E*, *F* and *G* are the mid-points of *OA*, *AB*, *BC* and *OC* respectively.

$\overrightarrow{OA} = 2\mathbf{a}$, $\overrightarrow{OB} = 2\mathbf{b}$ and $\overrightarrow{OC} = 2\mathbf{c}$

Not drawn accurately



23 (a) Find the following vectors in terms of **a**, **b** and **c**.

23 (a) (i) $\overrightarrow{DG}$

.....

.....

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

23 (a) (ii) $\overrightarrow{AB}$

.....

.....

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

23 (a) (iii) $\overrightarrow{BC}$

.....

.....

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

23 (b) Show that $\overrightarrow{EF} = \mathbf{c} - \mathbf{a}$

.....

.....

.....

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

23 (c) Explain how you can tell that *DEFG* is a parallelogram.

.....

.....

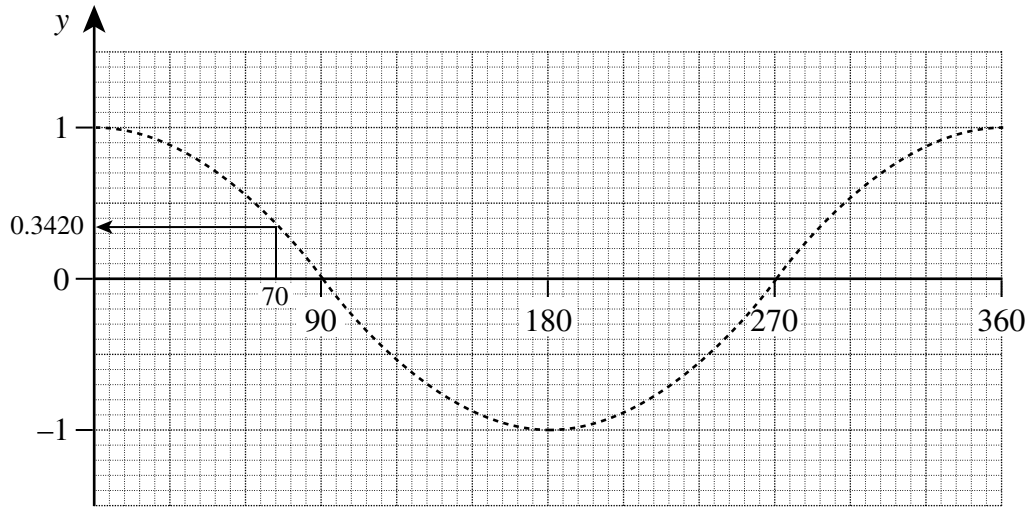
.....

(1 mark)

Turn over for the next question

5

24 The sketch shows the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$



You are given that $\cos 70° = 0.3420$

24 (a) State another value of x, where $0° \leqslant x \leqslant 360°$, for which $\cos x = 0.3420$

.....

.....

Answer x = ... *(1 mark)*

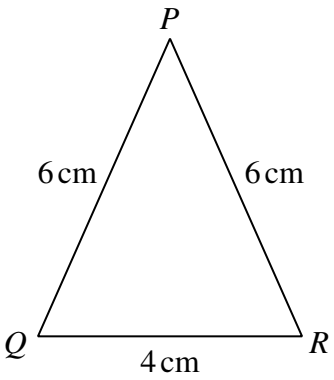
24 (b) State a value of x, where $0° \leqslant x \leqslant 360°$, for which $\cos x = -0.3420$

.....

.....

Answer x = ... *(1 mark)*

25 (a) Triangle PQR is isosceles.
$PQ = PR = 6\,\text{cm}$ and $QR = 4\,\text{cm}$.



Not drawn accurately

Show that the area of the triangle is $8\sqrt{2}\,\text{cm}^2$.

.....

.....

.....

.....

.....

.....

(4 marks)

25 (b) A rectangle has a width of $2\sqrt{6}\,\text{cm}$ and an area equal to **three times** the area of triangle PQR.

Calculate the exact length of the rectangle.
Give your answer in the form $p\sqrt{3}$, where p is an integer.
You **must** show your working.

.....

.....

.....

.....

.....

.....

.....

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

END OF QUESTIONS

9

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED