Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

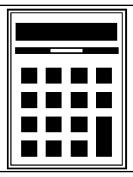
General Certificate of Secondary Education
June 2008

MATHEMATICS (SPECIFICATION A) **4301/2H**
Higher Tier
Paper 2 Calculator

H

Monday 2 June 2008 1.30 pm to 3.30 pm

For this paper you must have:
- a calculator
- mathematical instruments.



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.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information

- The maximum mark for this paper is 100.
- The marks for questions 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.
- You are expected to use a calculator where appropriate.

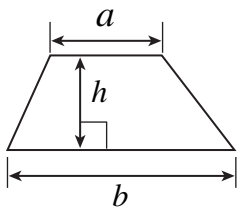
Advice

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

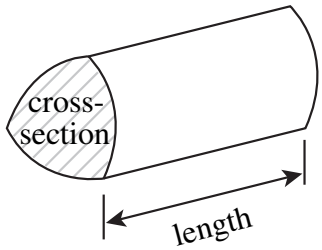
For Examiner's Use	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

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

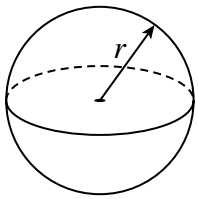


Volume of prism = area of cross-section × length



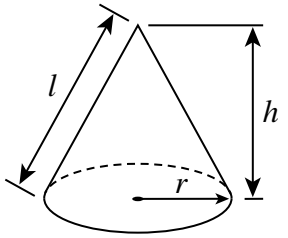
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

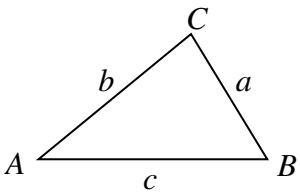


In any triangle ABC

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



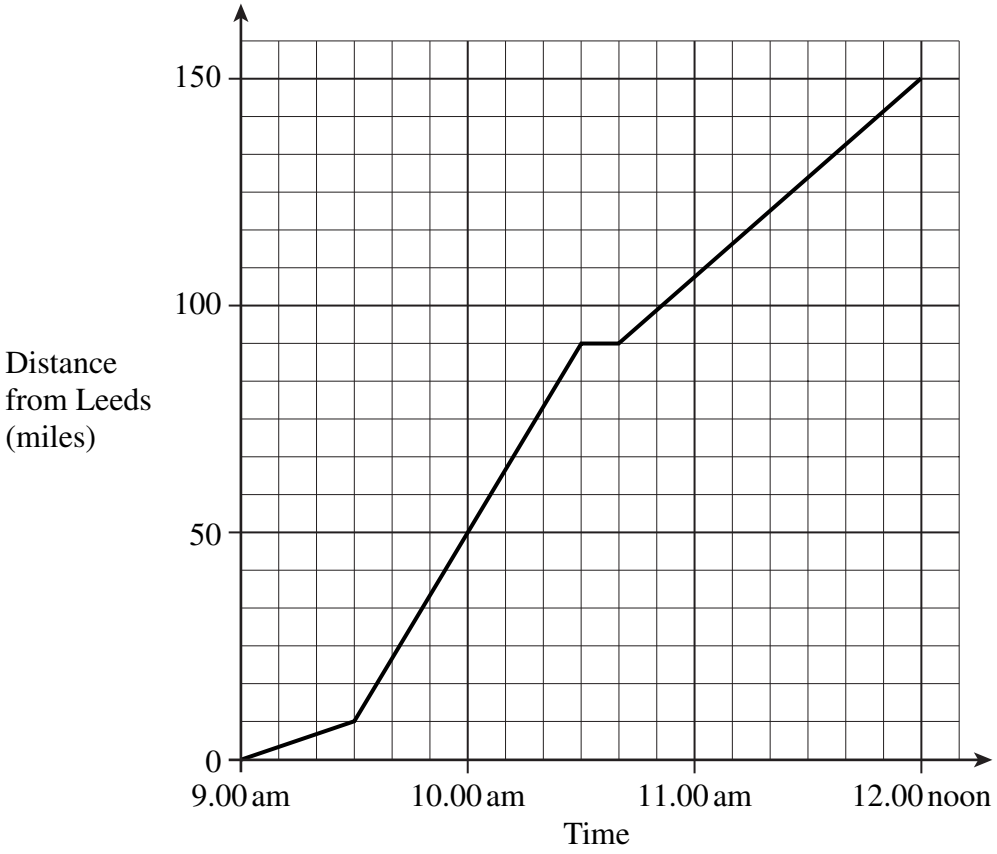
The Quadratic Equation

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 Kevin drove from Leeds to Luton.
The distance – time graph shows his journey.



1 (a) How far is it from Leeds to Luton?

.....

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

1 (b) Kevin stopped at a service station for petrol.

How long did he stop for?

.....

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

1 (c) What was Kevin's average speed for the whole journey?

.....

Answer ..... miles per hour *(2 marks)*

4

Turn over ▶

2 Two drivers measure the petrol consumption of their cars.

Alice's car travels 580 kilometres on a full tank of 51 litres.
Beryl's car travels 370 kilometres on a full tank of 32 litres.

Whose car travels more kilometres to the litre?
You **must** show your working.

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

3 Use your calculator to work out

$$\frac{5.6 + 3.8}{4.3 - 2.6}$$

3 (a) Write down your full calculator display.
Give your answer as a decimal.

.....

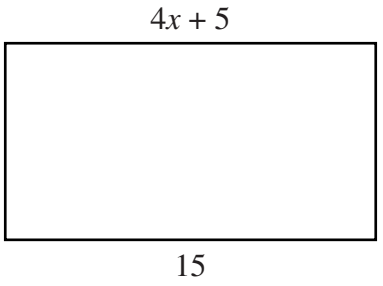
Answer ..... *(1 mark)*

3 (b) Give your answer to a suitable degree of accuracy.

.....

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

4 The diagram shows a rectangle.
All measurements are in centimetres.



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4 (a) What is the value of x?

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

4 (b) The perimeter of the rectangle is 50 cm.

What is the value of y?

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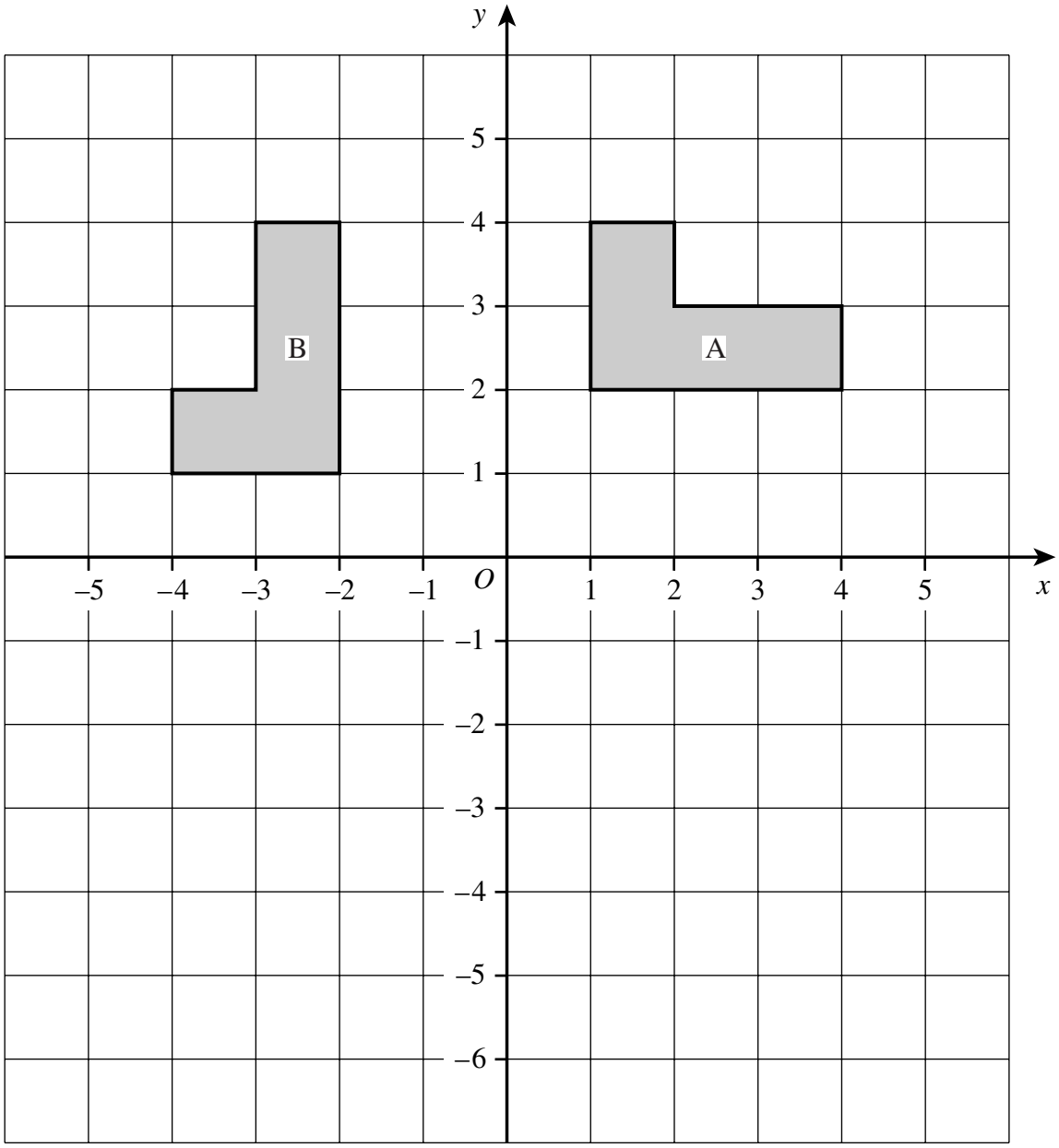
.....

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

9

5



5 (a) Describe the **single** transformation that takes shape A to shape B.

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

5 (b) Reflect shape B in the line $y = -1$.

(2 marks)

6 (a) There are 200 pupils in year 10.
All pupils study at least one language.
No pupil studies all three languages.
The table shows how many pupils study each language.

	French	**Spanish**	**German**
Number of pupils	97	116	45

How many pupils study two languages?

.....

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

6 (b) There are also 200 pupils in year 11.
The table shows the mathematics GCSE paper they are taking.

	Foundation	**Higher**
Boys	32	76
Girls	28	64

6 (b) (i) What percentage of the pupils are taking the Foundation paper?

.....

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

6 (b) (ii) One of the pupils is absent for the examination.

What is the probability that it is a girl taking the Higher paper?

.....

.....

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

8

7 (a) Factorise $x^2 + 3x$

.....

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

7 (b) Factorise fully $4a^2b - 6a^3b^2$

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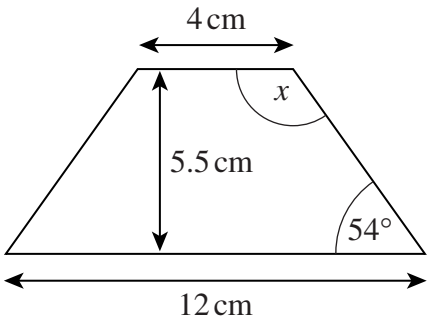
Answer ..... *(2 marks)*

8 The diagram shows an **isosceles** trapezium.



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8 (a) Work out the value of x.

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

8 (b) Work out the area of the trapezium.

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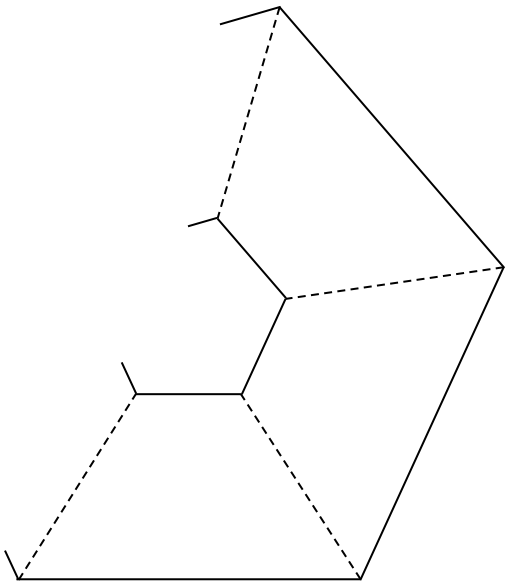
Answer ..... cm^2 *(2 marks)*

8 (c) Some trapezia of this size are put together to form a regular shape.
The diagram below is incomplete.



Not drawn accurately

How many exterior sides does the shape have?
Explain your answer fully.

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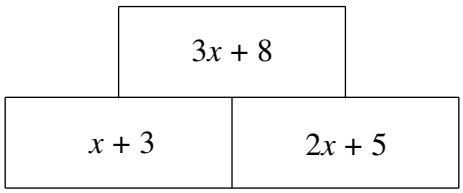
Answer ..... *(3 marks)*

9

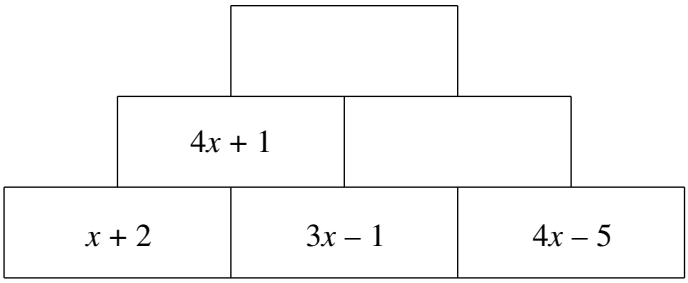
9 Each expression in this wall is formed by adding the two supporting expressions from the row below.

For example



$x + 3 + 2x + 5 = 3x + 8$

9 (a) Find the missing expressions in this wall.



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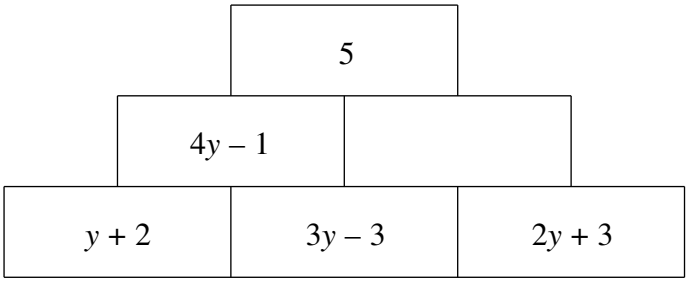
(2 marks)

9 (b) Use the wall below to find the value of y.



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Answer $y =$ ..... *(3 marks)*

10 A bag contains 6 blue balls and 8 red balls.
Some more red balls are added.
The ratio of blue balls to red balls can now be written in the form 1:n, where n is an integer.

What is the smallest number of red balls that can be added?

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

11 Expand and simplify $(x - 3)(x + 4)$

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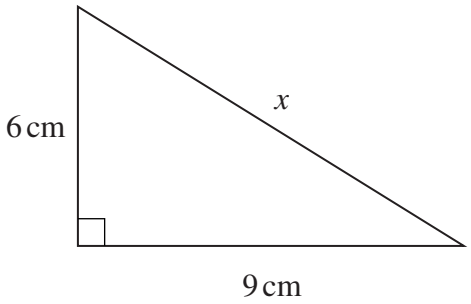
Answer ..... *(2 marks)*

12 Calculate the length, x cm, in the triangle below.



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

12

Turn over ▶

13 (a) The table shows the frequency of the variable, x, for various values.

x	Frequency
25	16
35	38
45	26
55	14
65	6
Total	100

Show that the mean of x is 40.6

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(3 marks)

13 (b) The table shows the heights, h (in centimetres), of 100 girls in year 10.

Height, h (cm)	Frequency
$120 < h \leqslant 130$	16
$130 < h \leqslant 140$	38
$140 < h \leqslant 150$	26
$150 < h \leqslant 160$	14
$160 < h \leqslant 170$	6
Total	100

13 (b) (i) What is the mid-point of the group $120 < h \leqslant 130$?

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

13 (b) (ii) Using the mean value of x from part (a), write down an estimate for the mean height of the 100 girls.

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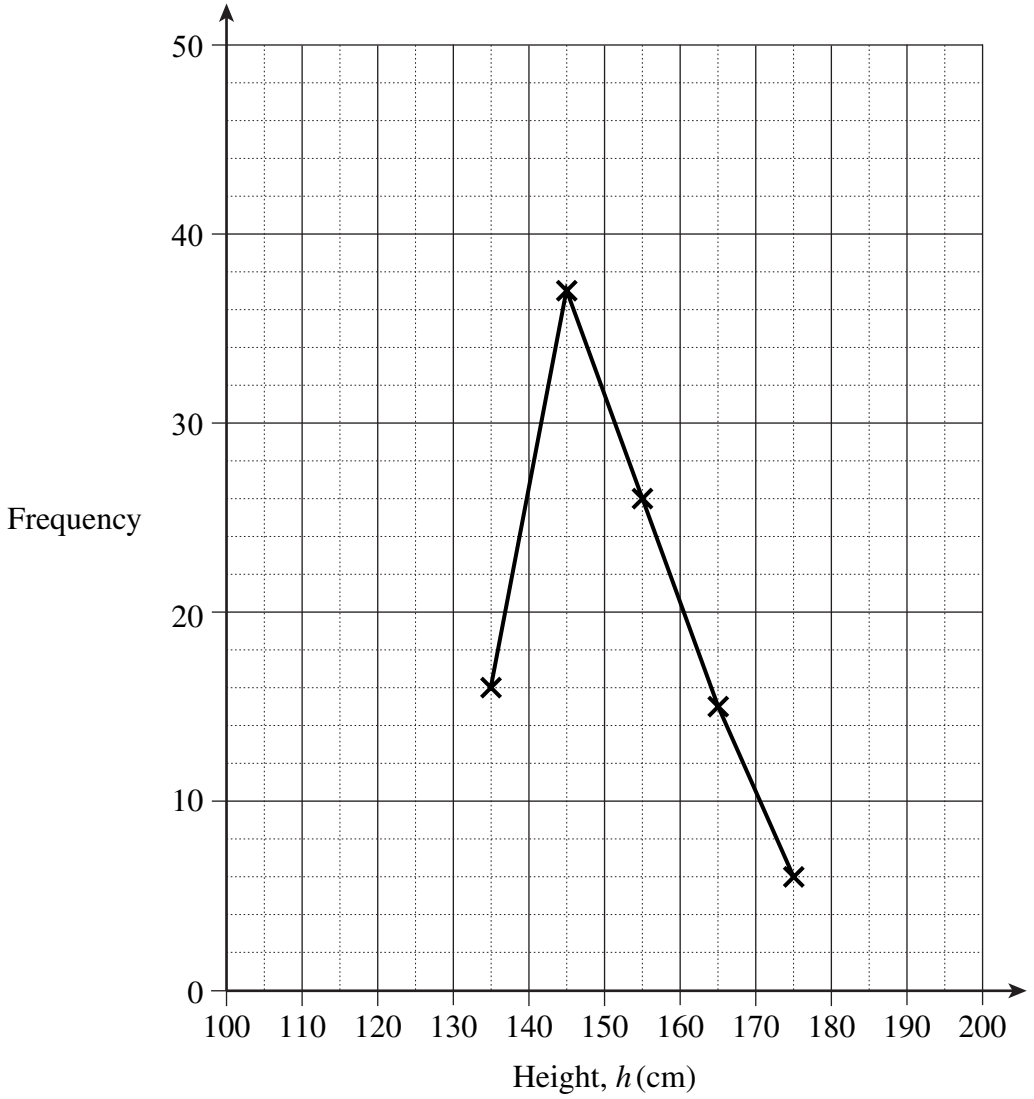
Answer ..... cm *(1 mark)*

13 (c) The frequency diagram shows the distribution of the heights of 100 boys in year 10.



13 (c) (i) On the same grid, draw a frequency diagram for the heights of the girls in year 10.
(2 marks)

13 (c) (ii) Make two comments to compare the heights of the boys and the girls.

Comment 1 .....

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Comment 2 .....

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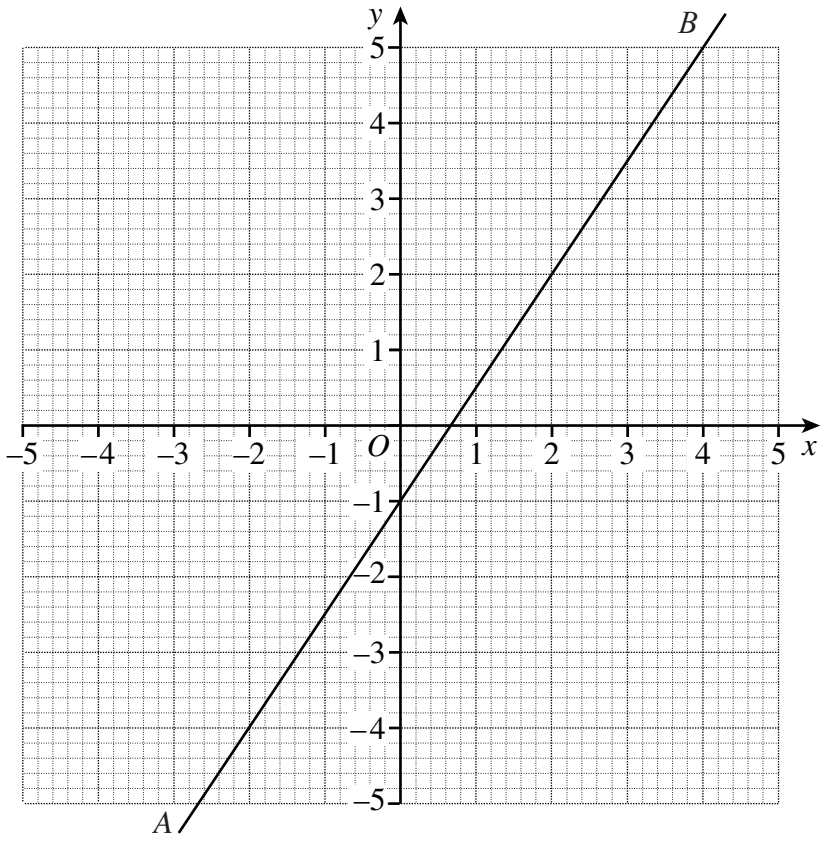
(2 marks)

9

14 The graph shows a line *AB*.



14 (a) Work out the gradient of the line *AB*.

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

14 (b) Write down the equation of the line *AB*.

.....

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

14 (c) Write down the gradient of a line perpendicular to *AB*.

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

14 (d) Write down the equation of the line perpendicular to *AB* passing through (0, 8)

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

15 (a) Solve the inequality $2x + 3 \geqslant 4x + 5$

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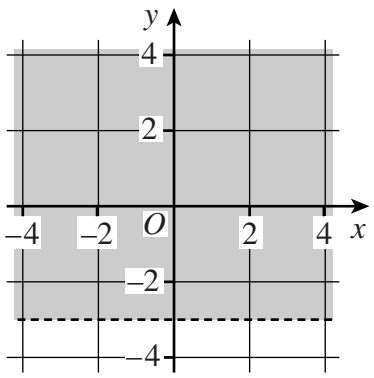
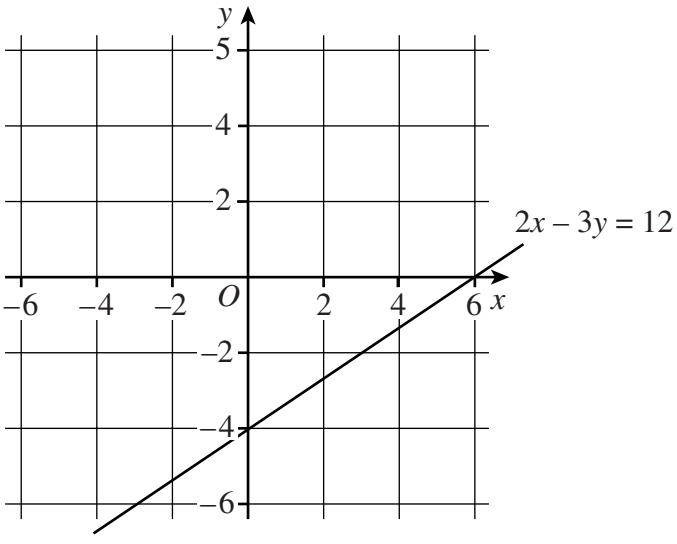
Answer ..... *(2 marks)*

15 (b) Which inequality is represented by the shaded region?



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

15 (c) The line $2x - 3y = 12$ is drawn on the grid.



Shade the side of the line that represents $2x - 3y \leqslant 12$
Explain how you know which side to shade.

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(1 mark)

9

16 The size of the North Sea Cod Stock in 2008 is estimated at 250 000 tonnes.
Because of over-fishing it is decreasing at the rate of 11% per annum.

How many years will it be before the North Sea Cod Stock falls below the critical level of 70 000 tonnes?
You **must** show your working and justify your answer fully.

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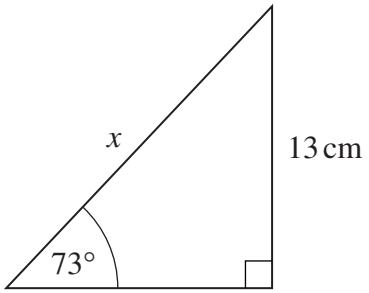
Answer ..... *(4 marks)*

17 Calculate the length, x cm, in the triangle below.



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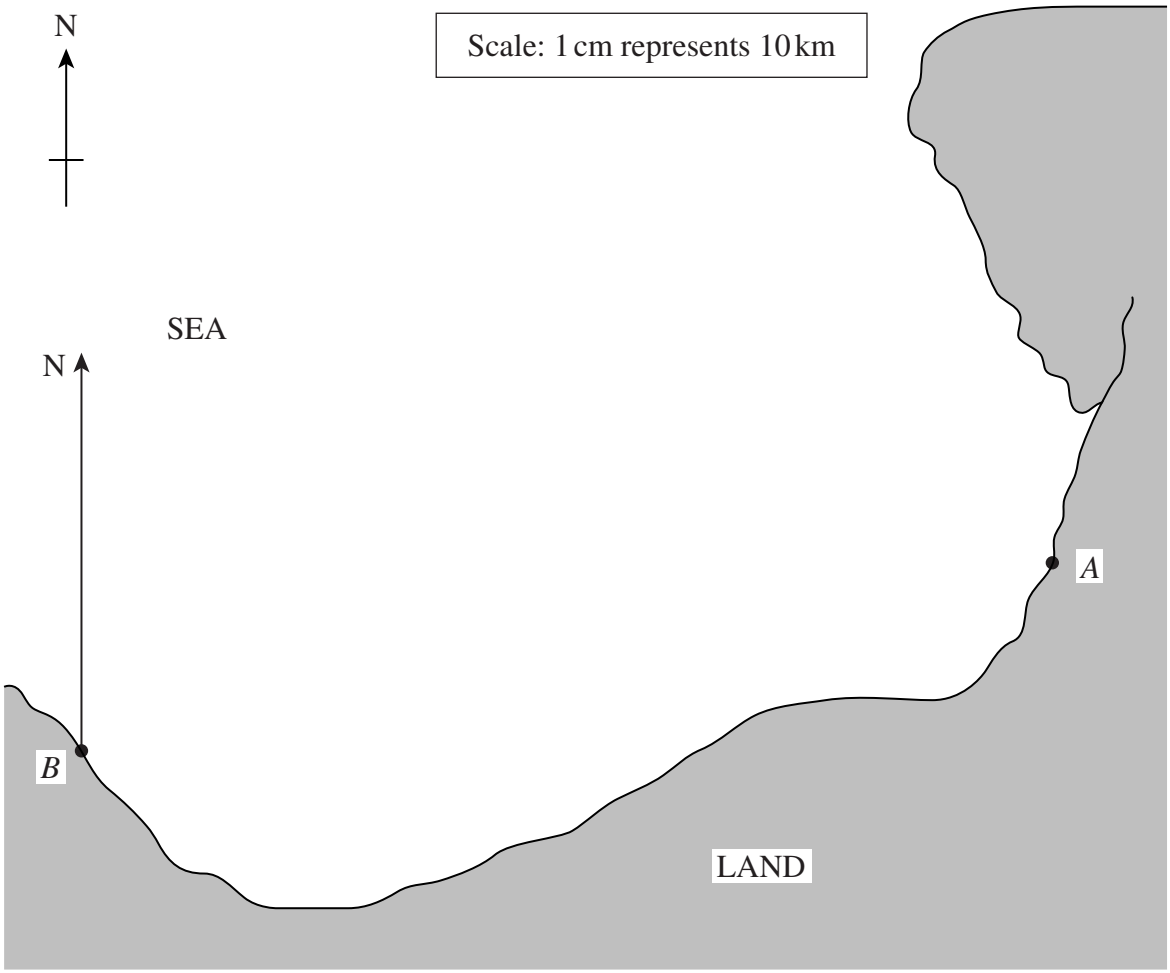
Answer ..... cm *(3 marks)*

18 Two radio stations at *A* and *B* pick up a distress call from a boat at sea.
The station at *A* can tell that the boat is between 50 km and 70 km from *A*.
The station at *B* can tell that the boat is between a bearing of 060° and 070° from *B*.

Show clearly, using compasses and a protractor, the region where the boat will be found.



(3 marks)

10

Turn over ▶

19 Express the recurring decimal $0.0\dot{7}\dot{2}$ as a fraction.

Give your answer in its simplest form.
You **must** show your working.

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

20 Solve the equation $2x^2 + 3x - 7 = 0$

Give your answers correct to 2 decimal places.
You **must** show your working.

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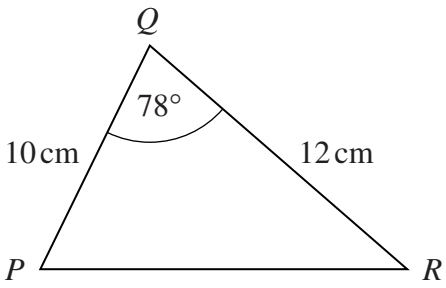
Answer ..... *(3 marks)*

21 *PQR* is a triangle.
PQ = 10 cm, *QR* = 12 cm and angle *PQR* = 78°



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Calculate the length *PR*.

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

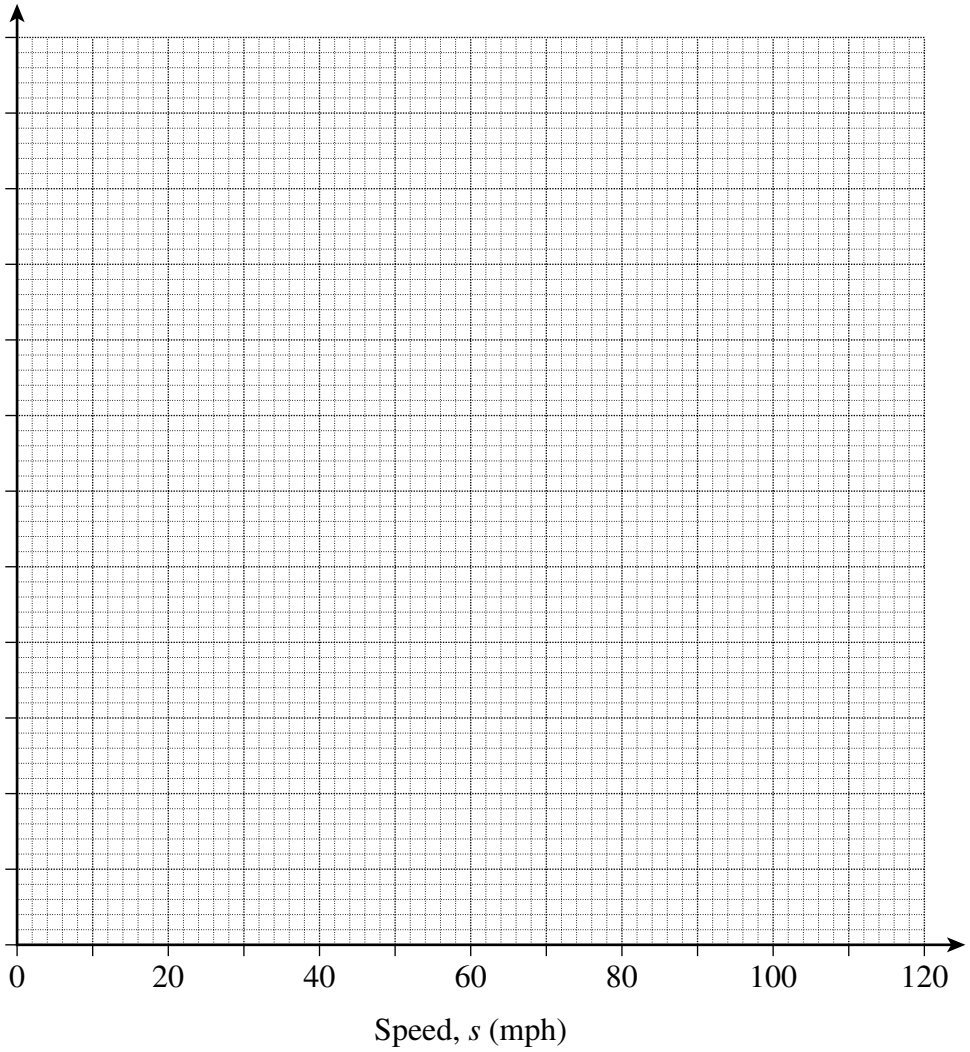
Turn over for the next question

9

22 A mobile speed camera recorded the speed of some vehicles on a motorway. The table shows the results.

Speed, *s* (mph)	**Frequency**
$0 < s \leqslant 30$	42
$30 < s \leqslant 50$	54
$50 < s \leqslant 60$	82
$60 < s \leqslant 70$	116
$70 < s \leqslant 80$	70
$80 < s \leqslant 120$	36
Total	400

22 (a) Draw a histogram to illustrate the data.



(3 marks)

22 (b) Drivers of vehicles doing more than 77 miles per hour were given a speeding ticket.

Estimate the number of drivers who receive a ticket.

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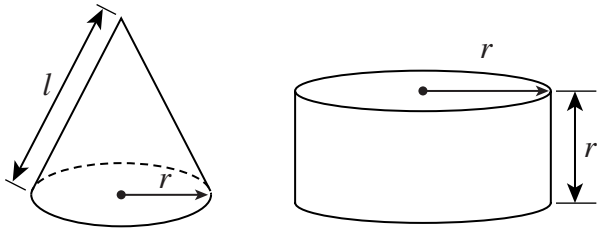
Answer ..... *(1 mark)*

23 A cone has radius r and slant height l.
A cylinder has radius r and height r.



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The **total** surface area of the cone is equal to the **total** surface area of the cylinder.

Find an expression for l in terms of r.

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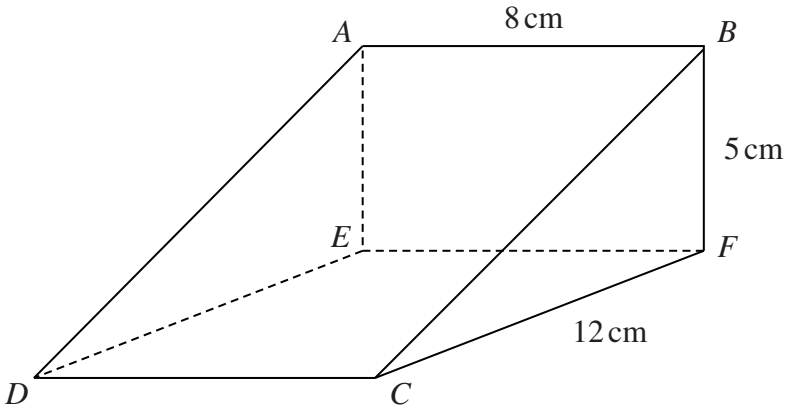
Answer ..... *(3 marks)*

7

24 A prism *ABCDEF* with a right-angled triangular cross section has dimensions as shown.



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24 (a) Calculate the length *BD*.

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

24 (b) Hence, or otherwise, calculate the angle *BDF*.

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

25 A formula used in science is $s = ut + \frac{1}{2}at^2$

During an experiment the following values were recorded.
u = 2.4 m/s correct to 2 significant figures.
t = 10 sec correct to nearest second.
a = 0.5 m/s^2 correct to 1 significant figure.

25 (a) What is the greatest possible value of t?

.....

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

25 (b) Calculate the greatest possible value of s.

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

Turn over for the next question

10

26 A sequence of fractions is

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \ldots\ldots$$

26 (a) The nth fraction of this sequence is $\frac{n}{n+1}$

Write down an expression for the $(n + 1)$th fraction in the sequence.

.....

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

26 (b) Subtracting the first fraction from the second gives $\frac{2}{3} - \frac{1}{2} = \frac{1}{6}$

Subtracting the second fraction from the third gives $\frac{3}{4} - \frac{2}{3} = \frac{1}{12}$

Prove algebraically that the difference between any two consecutive fractions in this sequence is the reciprocal of the product of the denominators.

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(3 marks)

END OF QUESTIONS