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Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Higher Tier
June 2011

Mathematics (Specification A)

4306/2H

Paper 2 Calculator

H

Friday 10 June 2011 9.00 am to 11.00 am

For this paper you must have:

- mathematical instruments
- 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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

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

Advice

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

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



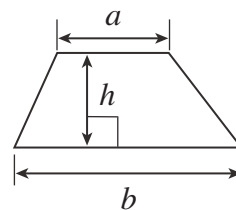
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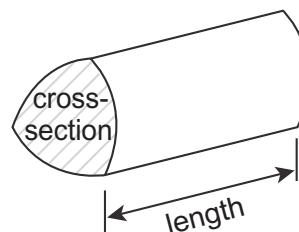
4306/2H

Formulae Sheet: Higher Tier

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

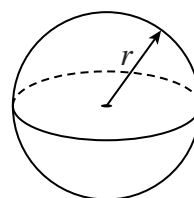


Volume of prism = area of cross-section \times length



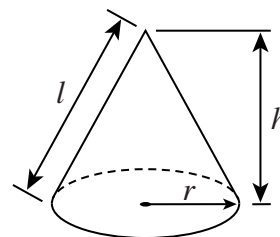
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

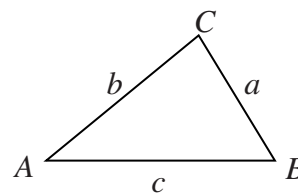


In any triangle ABC

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

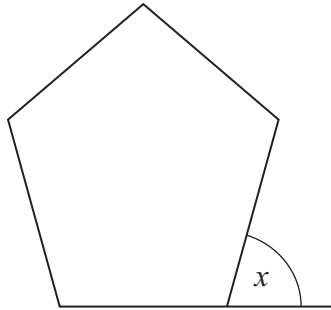
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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



Answer **all** questions in the spaces provided.

- 1** This is a regular pentagon.



Not drawn accurately

Work out the value of the exterior angle, marked x on the diagram.

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Answer degrees (2 marks)

- 2** The cost of a taxi journey is made up of two parts.

£3.50 for any distance up to 1 kilometre.
30p for every 100 metres after the first kilometre.

How much will a taxi journey of 3 kilometres cost?

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Answer £ (3 marks)



3 (a) Here is a sequence.

1 8 22

To find the next term the rule is

add 3 and then multiply by 2

Work out the next term in the sequence.

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Answer (1 mark)

3 (b) Here is a different sequence.

1 15

To find the next term the rule is

add a , where a is an integer, and then multiply by 3

Work out the third term in the sequence.

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Answer (3 marks)

4 (a) Use your calculator to work out $\frac{5.39}{8.34 - 2.17}$

4 (a) (i) Write down your full calculator display.

Answer (1 mark)

4 (a) (ii) Give your answer to 3 significant figures.

Answer (1 mark)

4 (b) Calculate the reciprocal of 0.8

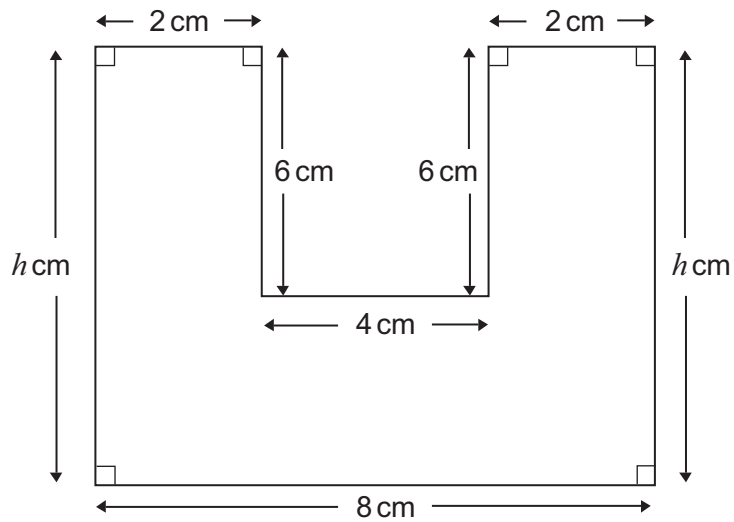
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Answer (1 mark)



5

This shape has measurements as given in the diagram.



Not drawn
accurately

The area of the shape is 56 cm^2 .

Work out the length marked $h \text{ cm}$ in the diagram.

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Answer cm (3 marks)

Turn over for the next question



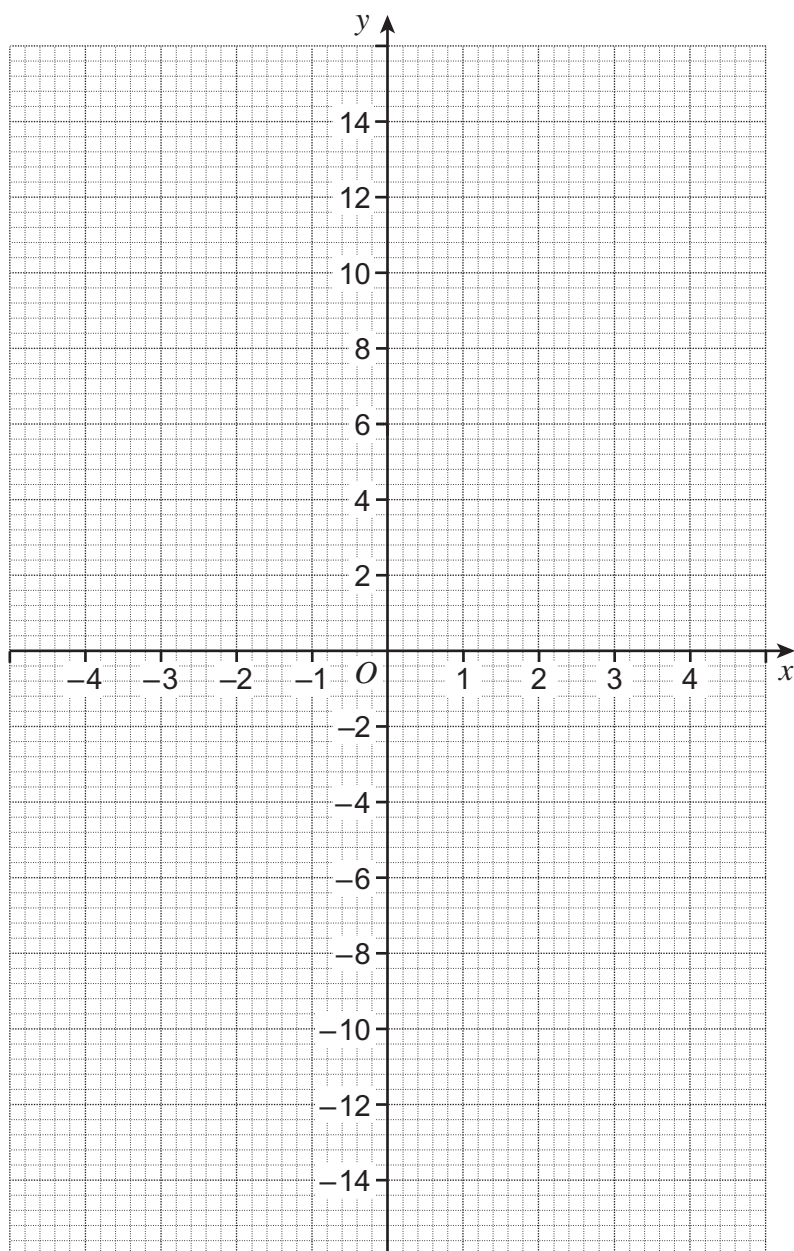
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Draw the graph of $y = 3x - 1$ for $-4 \leq x \leq 4$

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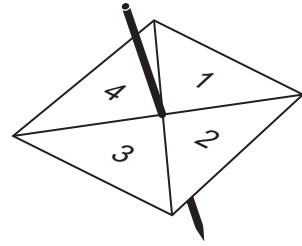
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(3 marks)



- 7 (a) A four-sided spinner is spun 1000 times.



The results are shown in the table.

Number	1	2	3	4
Frequency	126	241	389	244

- 7 (a) (i) What is the relative frequency of a 1?

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Answer (1 mark)

- 7 (a) (ii) How can you tell that the spinner is biased?

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(1 mark)

- 7 (b) A regular fair six-sided dice is thrown 600 times.

How many times would you expect the dice to land on 6?

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Answer (1 mark)



- 8 (a) Write the fraction $\frac{16}{5}$ as a mixed number.

Answer (1 mark)

- 8 (b) Use your calculator to work out $\frac{2}{5} + \frac{2}{9}$
Give your answer as a fraction.

Answer (1 mark)

- 8 (c) Use your calculator to work out $2\frac{1}{2} \div 1\frac{7}{8}$
Give your answer as a mixed number.

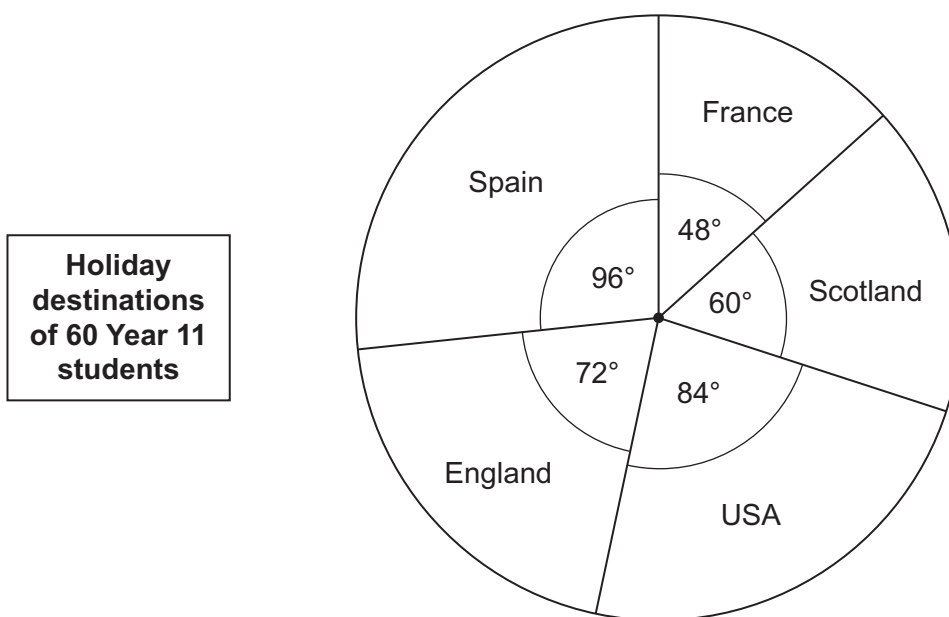
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Answer (1 mark)

- 8 (d) Write the fraction $\frac{2}{11}$ as a recurring decimal.

Answer (1 mark)

- 9 The pie chart shows the holiday destinations of 60 Year 11 students.



90 Year 10 students went to the same five destinations as the 60 Year 11 students.

- Only 8 Year 10 students had a holiday in Scotland.
- The same **number** of Year 10 students as Year 11 students had a holiday in the USA.
- Half the Year 10 students had a holiday in either Spain or the USA.
- The same **proportion** of Year 10 students had a holiday in England as Year 11 students.
- The remainder of the Year 10 students had a holiday in France.

Complete a fully labelled, accurate pie chart to show the holiday destinations of the 90 Year 10 students.

The sector for Scotland has been drawn accurately for you.

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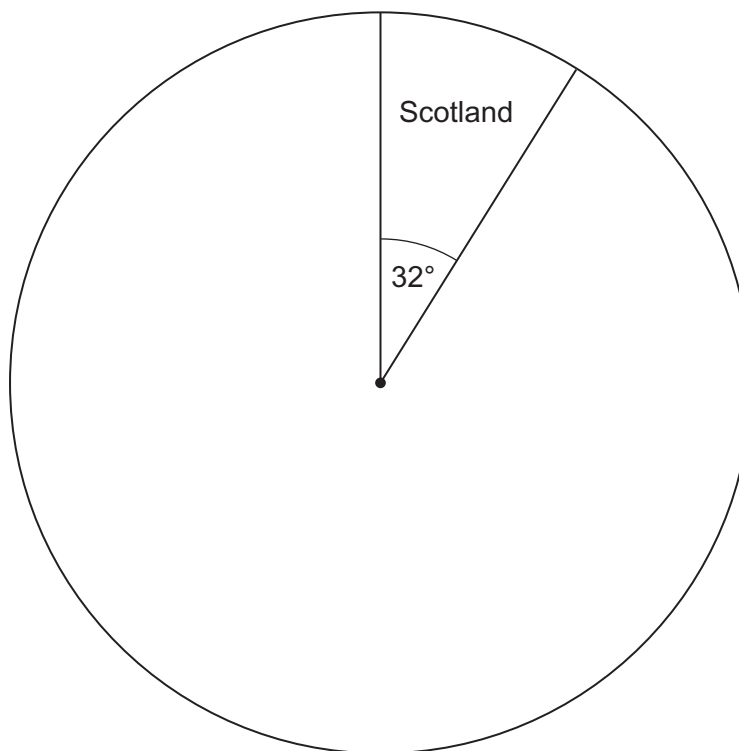
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**Holiday
destinations
of 90 Year 10
students**



(4 marks)

8

Turn over ►



10 A packet of breakfast cereal has the following information on it.

Protein: 10.3 g per 100 g of cereal

The recommended daily amount of protein for an adult male is 50 g.

What percentage of the recommended daily amount of protein does 40 g of cereal provide?

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Answer % (3 marks)

11 Two lanes of a motorway are being resurfaced.
Each lane is 4 metres wide.
The speed limit through the road works is 80 km/h.
It takes 15 minutes to drive through the road works at this speed.

Calculate the area being resurfaced.
Give your answer in square kilometres.

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Answer km² (4 marks)



12 Use trial and improvement to find a solution to the equation

$$x^3 + 6x = 29$$

Continue the table of results.
Give your solution to 1 decimal place.

x	$x^3 + 6x$	Comment
2	20	Too small

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Answer $x =$ (4 marks)



13

This table shows the heights, h , in centimetres, of 30 girls in Year 10.

Height, h (cm)	Frequency	Midpoint	
$120 < h \leq 130$	3		
$130 < h \leq 140$	6		
$140 < h \leq 150$	7		
$150 < h \leq 160$	8		
$160 < h \leq 170$	6		

Use the midpoint of each height group to calculate an estimate of the mean height of the girls.

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Answer cm (3 marks)



14 Solve the equations

14 (a) $\frac{8}{x} = 24$

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Answer $x =$ (1 mark)

14 (b) $5y + 2 = 3y - 1$

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Answer $y =$ (3 marks)

14 (c) $\frac{2w - 3}{2} - \frac{3w + 1}{5} = 1$

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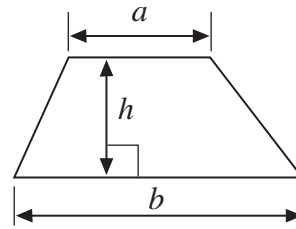
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Answer $w =$ (4 marks)



- 15** The formula for the area, A , of a trapezium is

$$A = \frac{1}{2}(a + b)h$$



Not drawn
accurately

- 15 (a)** A trapezium has an area of 30 cm^2 .

Work out a possible set of values for a , b and h for this trapezium.

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Answer $a =$ cm

$b =$ cm

$h =$ cm

(2 marks)

- 15 (b)** Rearrange the formula $A = \frac{1}{2}(a + b)h$ to make b the subject.

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Answer

(3 marks)



16

The table shows the quarterly fuel bill and the four-point moving average for a small factory.

Date of bill	Bill (£)	4-point moving average (£)
Spring 2008	645.00	
Summer 2008	380.00	
Autumn 2008	763.00	702
Winter 2008	1020.00	724
Spring 2009	733.00	
Summer 2009	452.00	759
Autumn 2009	831.00	781
Winter 2009	1108.00	800
Spring 2010	809.00	817
Summer 2010		825
Autumn 2010	863.00	851
Winter 2010	1212.00	862
Spring 2011	853.00	

Fill in the **two** missing values in the table.

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(4 marks)



17

Frank invests £3000 in a savings account that pays 6.5% interest per annum.

How many years will it take to double the investment?

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Answer (4 marks)



- 18 Solve the equation $x^2 + 4x - 5 = 0$

Do **not** use trial and improvement.

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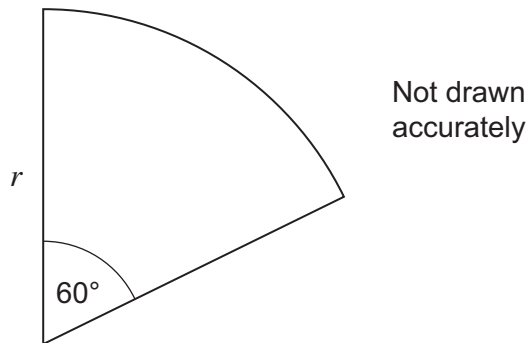
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Answer (3 marks)

- 19 A sector of a circle, radius r , is shown.
The area of this sector is $24\pi \text{ cm}^2$.



Work out the value of r .

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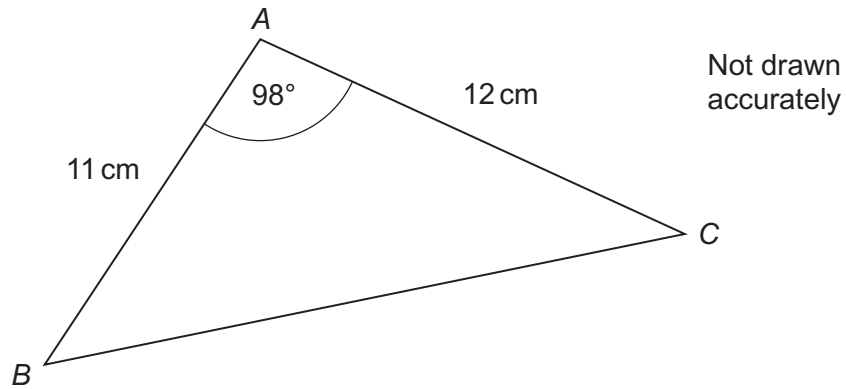
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Answer cm (3 marks)



- 20 (a)** Work out the length of BC in the triangle below.



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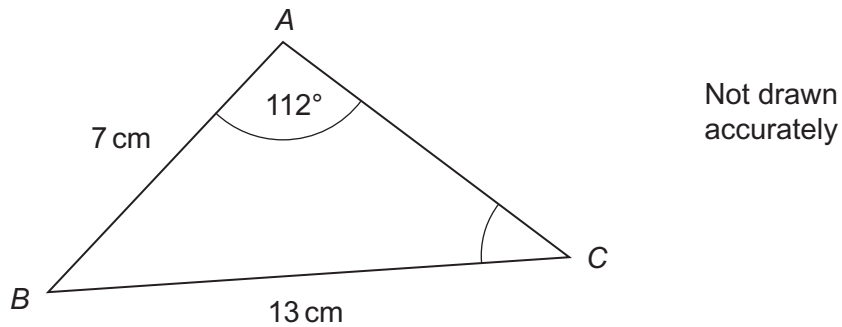
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Answer cm (3 marks)

- 20 (b)** Work out the size of angle ACB in the triangle below.



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Answer degrees (3 marks)



21

Nine cards with the digits from 1 to 9 on them are placed in a bag.

1	2	3	4	5	6	7	8	9
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Two cards are taken from the bag at random.

What is the probability that the total of the two cards is at least 16?

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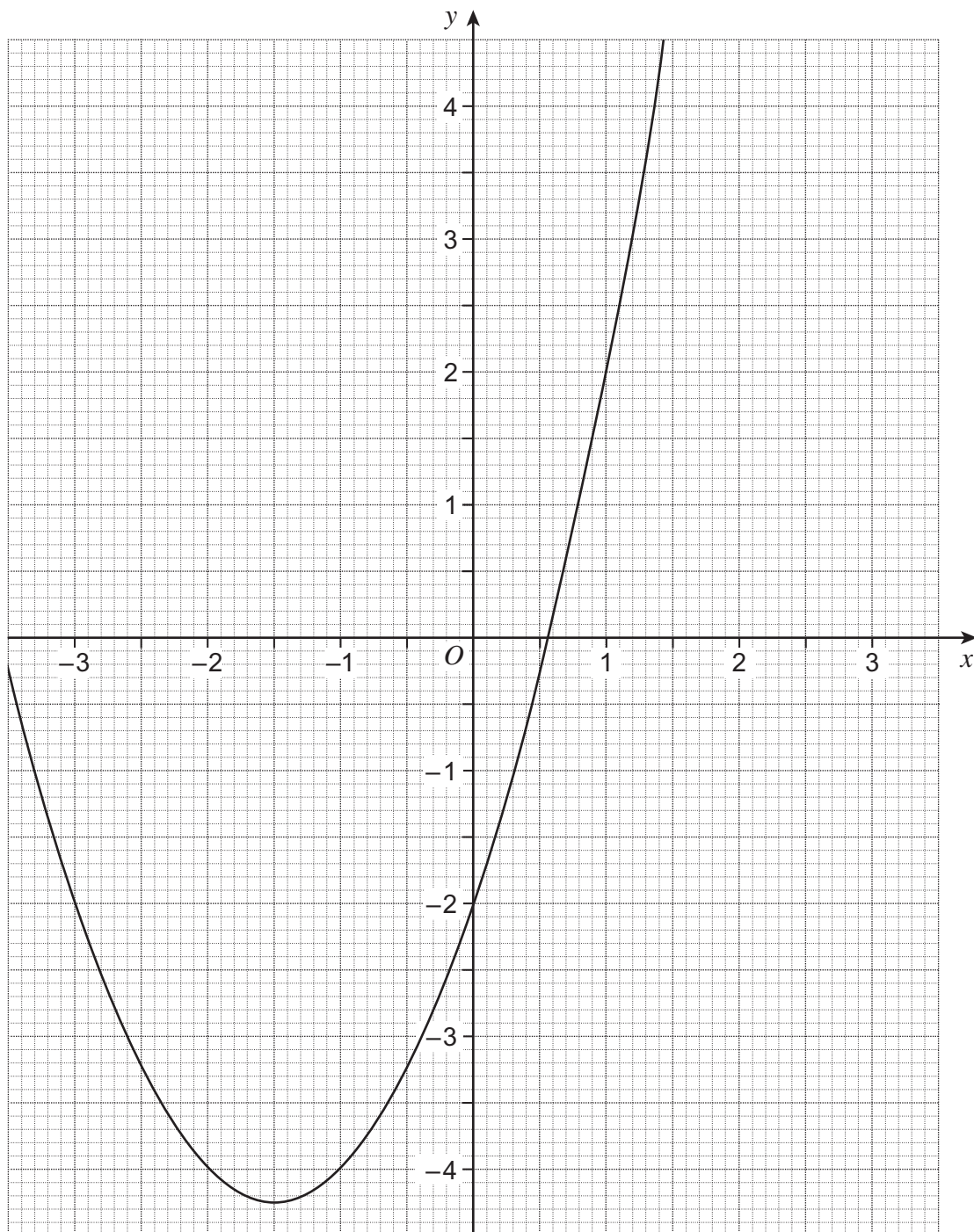
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Answer (4 marks)



22

The graph of $y = x^2 + 3x - 2$ is shown on the grid.



22 (a)

Write down the positive solution of $x^2 + 3x - 2 = 0$

Answer $x = \dots\dots\dots$

(1 mark)



- 22 (b)** By drawing an appropriate straight line find the approximate solutions of

$$x^2 + 2x - 4 = 0$$

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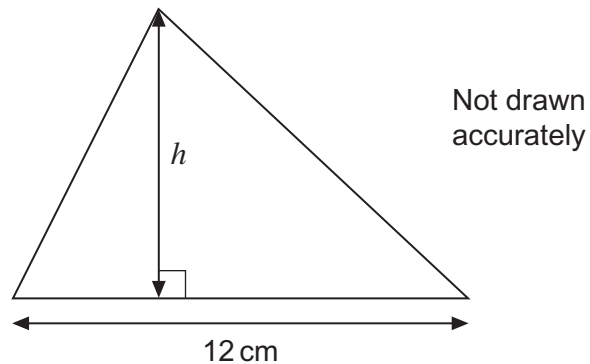
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Answer (3 marks)

- 23** This triangle has a base of 12 cm, to the nearest centimetre.
The area of the triangle is 30 cm^2 , to the nearest square centimetre.



Calculate the greatest possible value of the height, h .

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Answer cm (4 marks)



- 24 (a)** Show that $x = -1$ is a solution of the equation

$$\frac{5x + 9}{6x^2 - 7x - 3} = \frac{2}{5}$$

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(2 marks)

- 24 (b)** Show that the equation $\frac{5x + 9}{6x^2 - 7x - 3} = \frac{2}{5}$

can be written as $4x^2 - 13x - 17 = 0$

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(2 marks)

- 24 (c)** Hence, or otherwise, find a complete solution to the equation

$$\frac{5x + 9}{6x^2 - 7x - 3} = \frac{2}{5}$$

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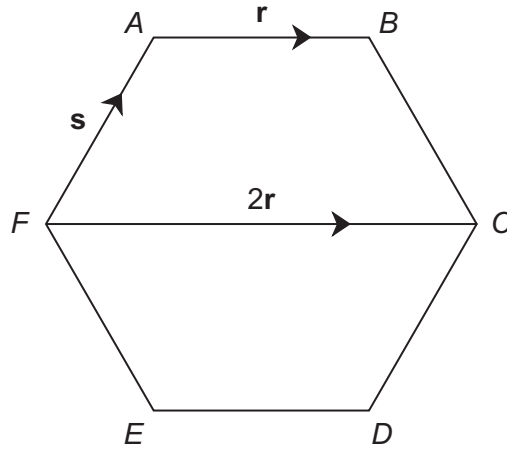
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Answer (2 marks)



25

 $ABCDEF$ is a regular hexagon. $\vec{AB} = \mathbf{r}$, $\vec{FA} = \mathbf{s}$ and $\vec{FC} = 2\mathbf{r}$ 

25 (a)

Work out the vector \vec{BC} .
Give your answer in its simplest form.

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Answer (2 marks)

25 (b)

The line ED is extended to G so that $\vec{EG} = 3\mathbf{r}$

Prove that ACG is a straight line.

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(4 marks)

END OF QUESTIONS



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