

Centre Number						Candidate Number				
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Candidate Signature										



General Certificate of Secondary Education  
Higher Tier  
June 2012

## Mathematics (Linear)

## 43652H

### Paper 2

Wednesday 13 June 2012 9.00 am to 11.00 am

# H

#### 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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.

#### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- The quality of your written communication is specifically assessed in Questions 3 and 10. These questions are indicated with an asterisk (\*).
- You may ask for more answer paper, tracing paper and graph paper. These must be tagged securely to this answer book.

#### Advice

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

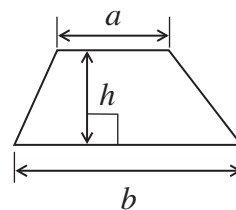
For Examiner's Use	
Examiner's Initials	
Pages	Mark
2 – 3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
TOTAL	



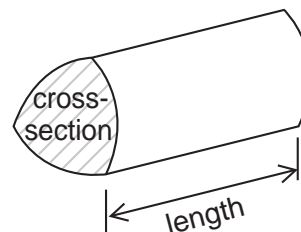
J U N 1 2 4 3 6 5 2 H 0 1

### Formulae Sheet: Higher Tier

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

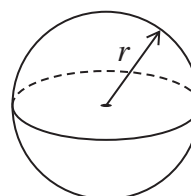


**Volume of prism** = area of cross-section  $\times$  length



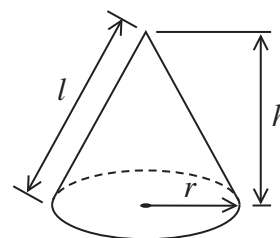
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

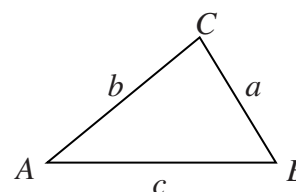


**In any triangle ABC**

**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** Andy thinks of a number.

He multiplies it by 4  
He then subtracts 6  
His answer is 7.2

What number did he think of?

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Answer ..... (3 marks)

**2** Ellie drives 169 miles from Sheffield to London.

She drives at an average speed of 65 miles per hour.  
She leaves Sheffield at 6:30 am.

Does she arrive in London before 9:00 am?  
You **must** show your working.

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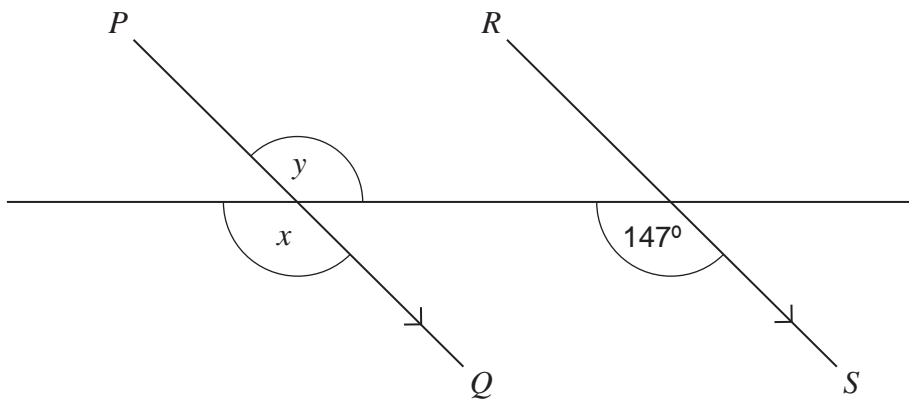
(4 marks)

7

Turn over ►



\*3  $PQ$  and  $RS$  are parallel.



Not drawn accurately

3 (a) Write down the value of  $x$ .  
Give a reason for your answer.

Answer .....degrees

Reason .....  
(2 marks)

3 (b) Write down the value of  $y$ .  
Give a reason for your answer.

Answer .....degrees

Reason .....  
(2 marks)



4 Ben sees these adverts to hire the same car.

**Hire Deal**

No charge for mileage

Normal price £78 each day

**Offer** Now  $\frac{1}{3}$  off

Price includes VAT

**Best Cars**

£36 each day

15p for each mile

Prices exclude VAT

VAT is 20%

Ben wants to hire the car for 10 days.  
He expects to drive 600 miles.

Should he choose Hire Deal or Best Cars to get the cheaper deal?  
You **must** show your working.

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Answer ..... (6 marks)

10

Turn over ►

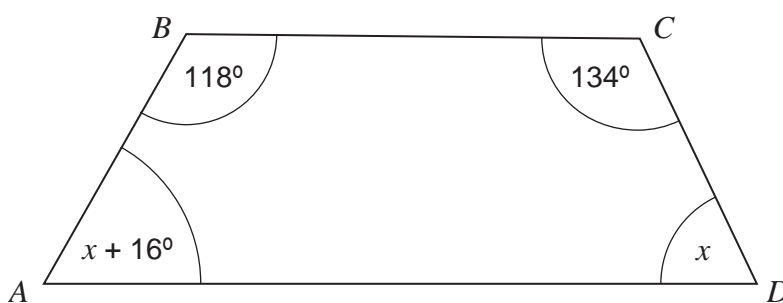


5 Work out the value of  $15(3n + 8)$  when  $n = 13$

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Answer ..... (2 marks)

6  $ABCD$  is a quadrilateral.



Not drawn accurately

6 (a) Work out the value of  $x$ .

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Answer ..... degrees (3 marks)

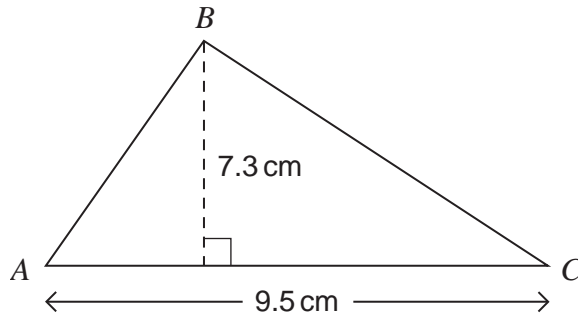
6 (b) Is  $BC$  parallel to  $AD$ ?  
Give a reason for your answer.

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(1 mark)



7 The diagram shows a triangle  $ABC$ .



Not drawn accurately

Work out the area of the triangle.  
Give your answer to 1 decimal place.

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Answer .....  $\text{cm}^2$  (3 marks)

8 Solve  $4(3x - 7) = 20$

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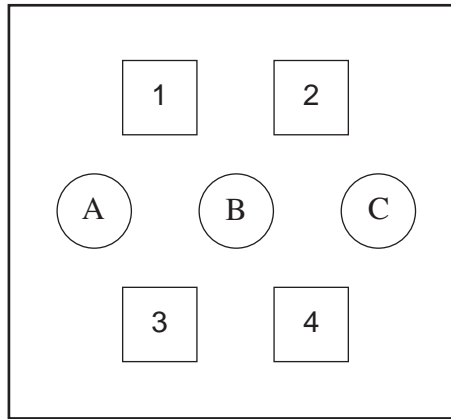
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$x =$  ..... (3 marks)



9 The diagram shows a door lock.



The code (number, letter, number) is entered by pressing a button from each row in turn (top row, middle row, bottom row).

Sarah knows that the code begins with 1.  
She presses 1 and then enters the rest of the code at random.

Work out the probability that she enters the correct code.

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Answer ..... (3 marks)





**\*10** Use trial and improvement to find a solution to the equation

$$x^3 - 3x = 45$$

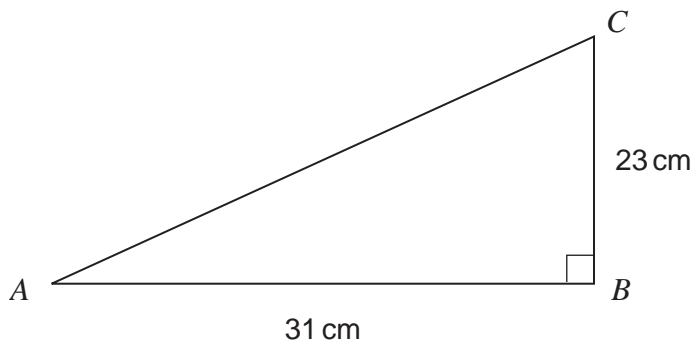
The first step is shown in the table.  
Give your solution to 1 decimal place.

$x$	$x^3 - 3x$	Comment
3	18	Too small

$x = \dots\dots\dots$  (4 marks)



11 Work out the length  $AC$ .



Not drawn accurately

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Answer ..... cm (3 marks)

12 A gym owner wants to know the number of hours that people exercise.

Write a question that he can use in his survey.  
Include a response section.

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(2 marks)



**13 (a)** Solve the inequality  $3x - 5 \geq 16$

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Answer ..... (2 marks)

**13 (b)** The values  $-1, 0, 1, 2$  and  $3$  satisfy **one** of the inequalities below.

Circle the correct inequality.

$$-2 < 2y \leq 6$$

$$-2 \leq 2y \leq 6$$

$$-2 \leq 2y < 6$$

(1 mark)

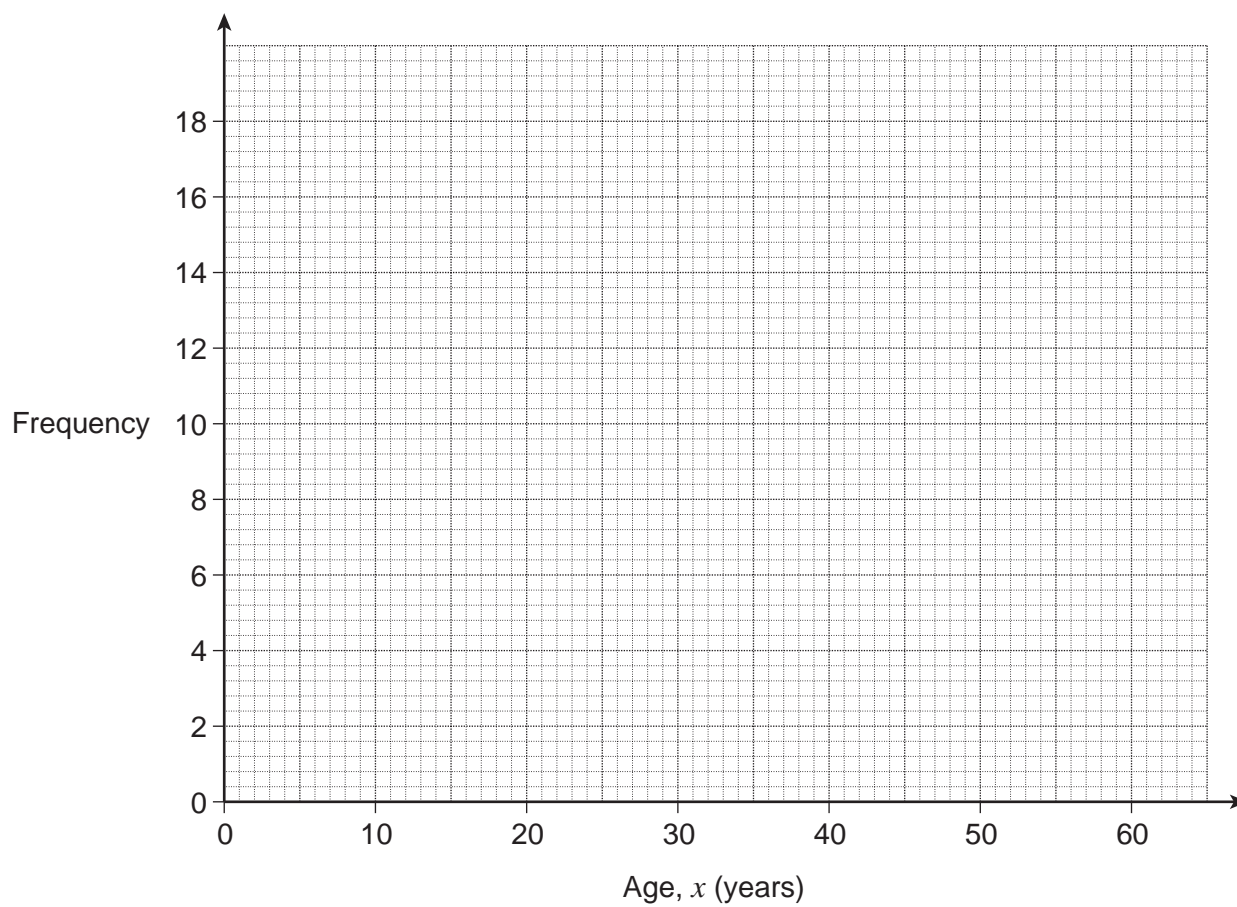
**Turn over for the next question**



- 14 The table shows information about the ages of people in a club.

Age, $x$ (years)	$20 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 50$	$50 < x \leq 60$
Frequency	4	8	17	12

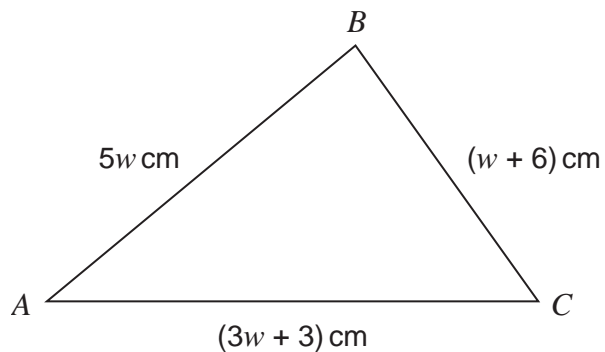
Draw a frequency polygon to represent the data.



(2 marks)



15 The diagram shows a triangle  $ABC$ .  
 $AB = AC$



Not drawn  
accurately

Show that the triangle is equilateral.

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(4 marks)

Turn over for the next question



**16** Here is a pattern for the numbers 1, 8 and 17.

$1^3 = 1$	and	$1 = 1$
$8^3 = 512$	and	$5 + 1 + 2 = 8$
$17^3 = 4913$	and	$4 + 9 + 1 + 3 = 17$

Find a number between 25 and 30 that follows this pattern.

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Answer ..... (2 marks)

**17** A car is advertised for £3000.  
The car will be in a sale next month.  
Tom can afford to pay £2500.

By what percentage will the price have to be reduced so that he can afford the car?

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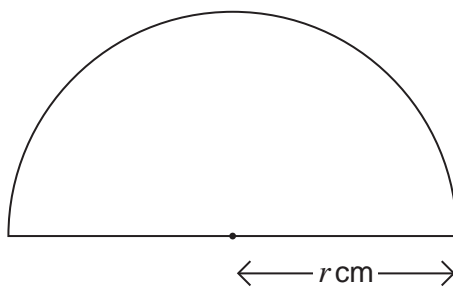
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Answer ..... % (3 marks)



18 The diagram shows a semi-circular shape.



Not drawn accurately

18 (a) Circle the correct expression for the perimeter of the shape.

$2\pi r$

$\pi r + 2r$

$\frac{1}{2} \pi r^2$

$\pi r$

(1 mark)

18 (b) The perimeter of the shape is 11.6 cm.

Calculate  $r$ .  
Give your answer to a suitable degree of accuracy.

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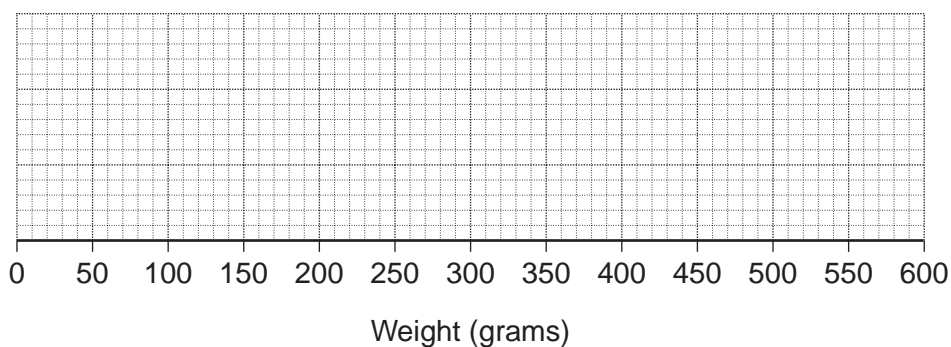
Answer ..... cm (4 marks)



- 19** Bags of sugar are weighed.  
The results are summarised in the table.  
All measurements are in grams.

Minimum	Lower Quartile	Median	Upper Quartile	Maximum
210	250	310	390	470

- 19 (a)** Draw a box plot to show this information.



(2 marks)

- 19 (b)** An extra 10 grams of sugar is added to each of the bags.

Tick the correct box to show how each of the following will change.

	Decrease	No Change	Increase
Range	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Median	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower quartile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(3 marks)



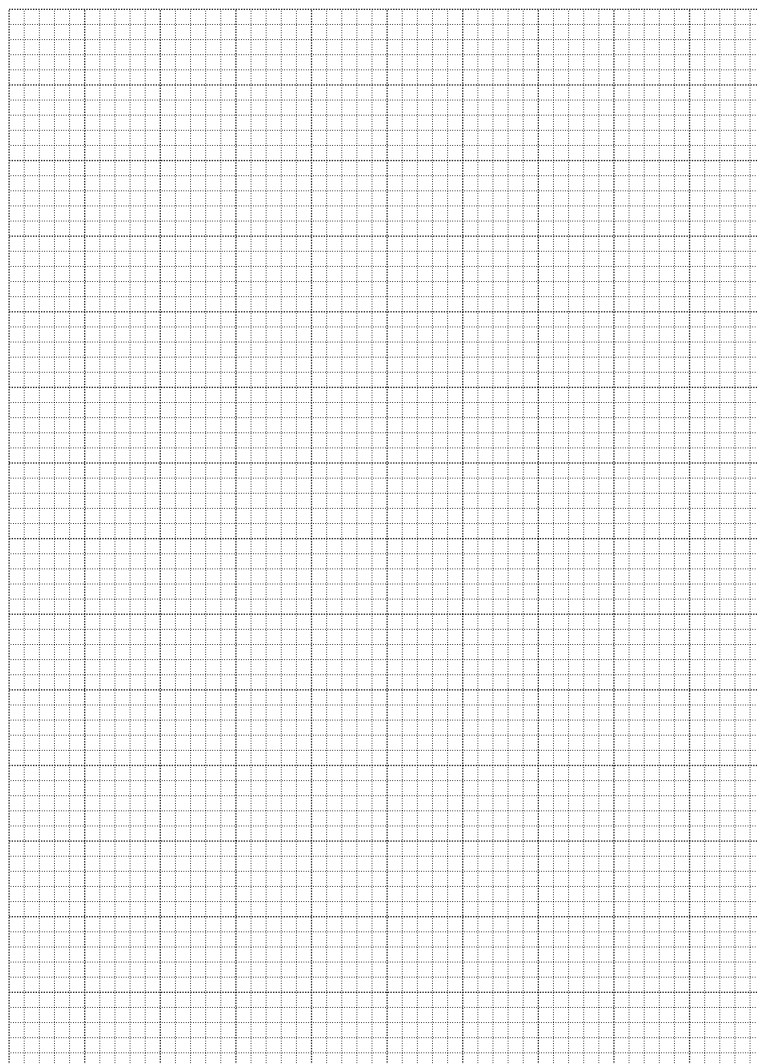


**20 (a)** Complete the table of values for  $y = 2x^2 - 3$

$x$	-2	-1	0	1	2
$y$	5			-1	

(2 marks)

**20 (b)** Draw the graph of  $y = 2x^2 - 3$  for values of  $x$  from -2 to 2.



(4 marks)



**21** Amy and Kate each catch three fish.  
The weight of each fish, to the nearest tenth of a kilogram, is shown.

<b>Amy</b>	6.8 kg	4.3 kg	5.2 kg
<b>Kate</b>	8.2 kg	3.4 kg	4.5 kg

Kate says that the total weight of her fish is more than the total weight of Amy's fish.

Show that this could be true.

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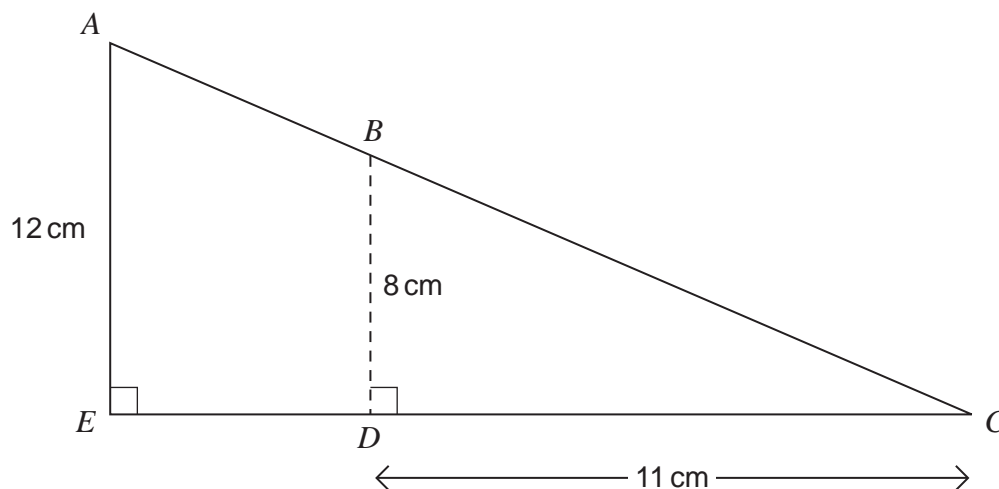
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(4 marks)



22

The diagram shows a triangle cut into a smaller triangle and a trapezium.



Not drawn accurately

Work out the area of the trapezium *ABDE*.

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Answer .....  $\text{cm}^2$  (5 marks)

9

Turn over ►



23

Two ordinary fair dice are thrown.  
One dice shows a number greater than 3.  
The other dice shows a number less than 3.

Put these statements in order, starting with the least likely.

- A Both dice show an even number.
- B Both dice show an odd number.
- C One dice shows an odd number and one dice shows an even number.

You **must** show your working.

Answer ..... , ..... , ..... (3 marks)



24 Expand and simplify  $(3x + y)(2x - 5y)$

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Answer ..... (3 marks)

25 Solve the quadratic equation

$$6x^2 + 2x - 5 = 0$$

Give your answers to 2 decimal places.

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Answer ..... (3 marks)

**Turn over for the next question**



**26** Jack is making spheres out of clay.

A box of clay contains 25 packs.  
Each pack is a cuboid measuring 10 cm by 10 cm by 4 cm.

**26 (a)** How many spheres of radius 6 cm can Jack make from a **box** of clay?

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Answer ..... (6 marks)

**26 (b)** A **pack** of clay has a mass of 500 grams.

Work out the density of the clay.

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Answer ..... grams/cm<sup>3</sup> (2 marks)



27 Prove that  $\frac{3n - 1}{n} - \frac{3n + 1}{n - 2} \equiv \frac{2 - 8n}{n(n - 2)}$

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(4 marks)

28 A bag contains 4 blue, 4 red and 4 white counters.  
Two counters are chosen at random without replacement.  
What is the probability that the counters are different colours?

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Answer ..... (4 marks)

END OF QUESTIONS



**There are no questions printed on this page**

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ANSWER IN THE SPACES PROVIDED**

