Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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	

General Certificate of Secondary Education
Higher Tier
June 2012

Mathematics (Linear) 43652H

Paper 2

H

Wednesday 13 June 2012 9.00 am to 11.00 am

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

Time allowed
- 2 hours

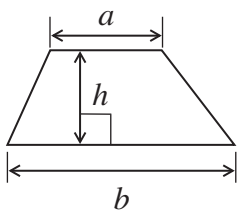
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this 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.

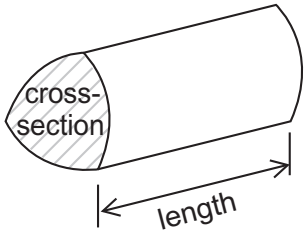
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

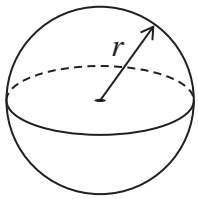


Volume of prism = area of cross-section × length



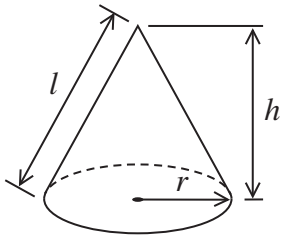
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

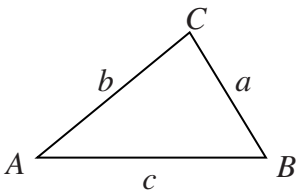
Curved surface area of cone = $\pi r l$



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 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

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

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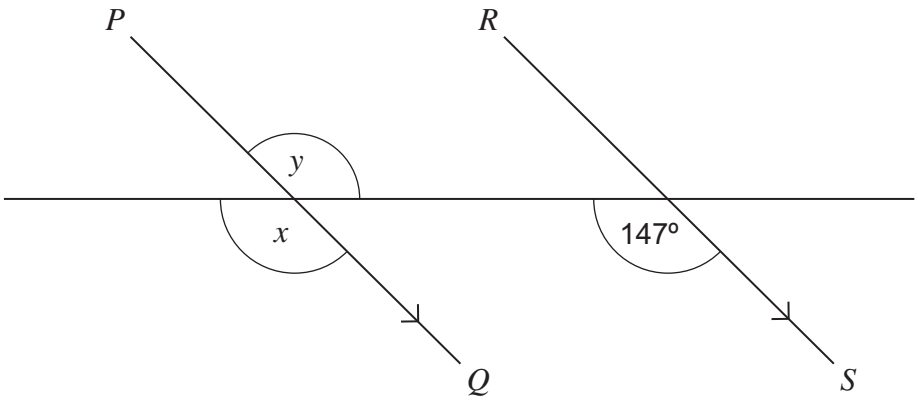

3 (a) Write down the value of x.
Give a reason for your answer.

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	**Best Cars**
No charge for mileage	£36 each day
Normal price £78 each day	15p for each mile
Offer Now $\frac{1}{3}$ off	Prices exclude VAT
Price includes 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

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

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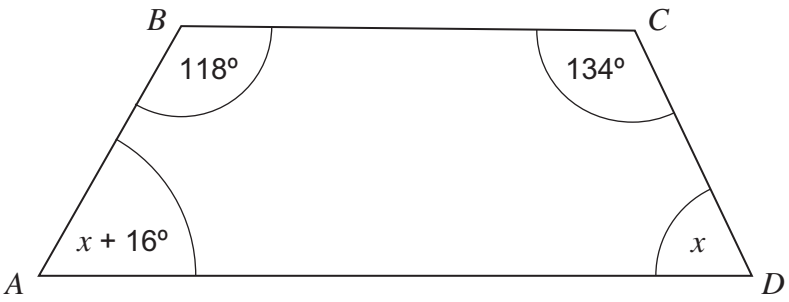
Answer ..... *(2 marks)*

6 $ABCD$ is a quadrilateral.



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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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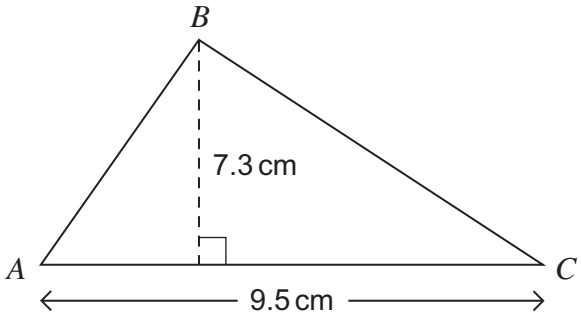
(1 mark)

7 The diagram shows a triangle ABC.



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

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

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

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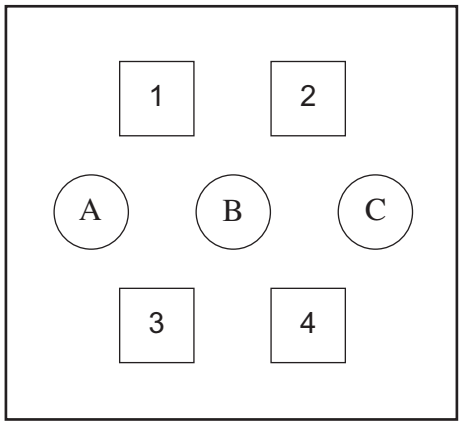
x = ... *(3 marks)*

12

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

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

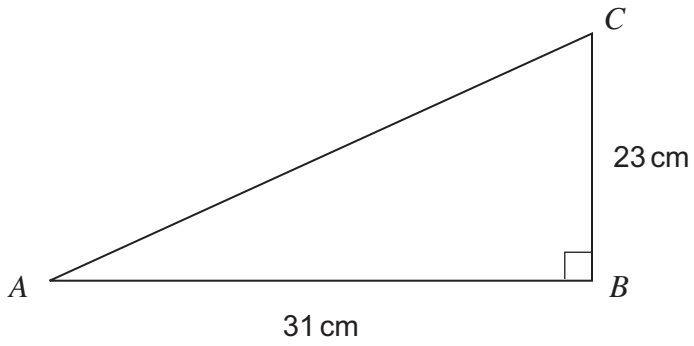
The first step is shown in the table.
Give your solution to 1 decimal place.

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

x = ... *(4 marks)*

7

11 Work out the length AC.



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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 $3x - 5 \geqslant 16$

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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.

$-2 < 2y \leqslant 6$ $-2 \leqslant 2y \leqslant 6$ $-2 \leqslant 2y < 6$

(1 mark)

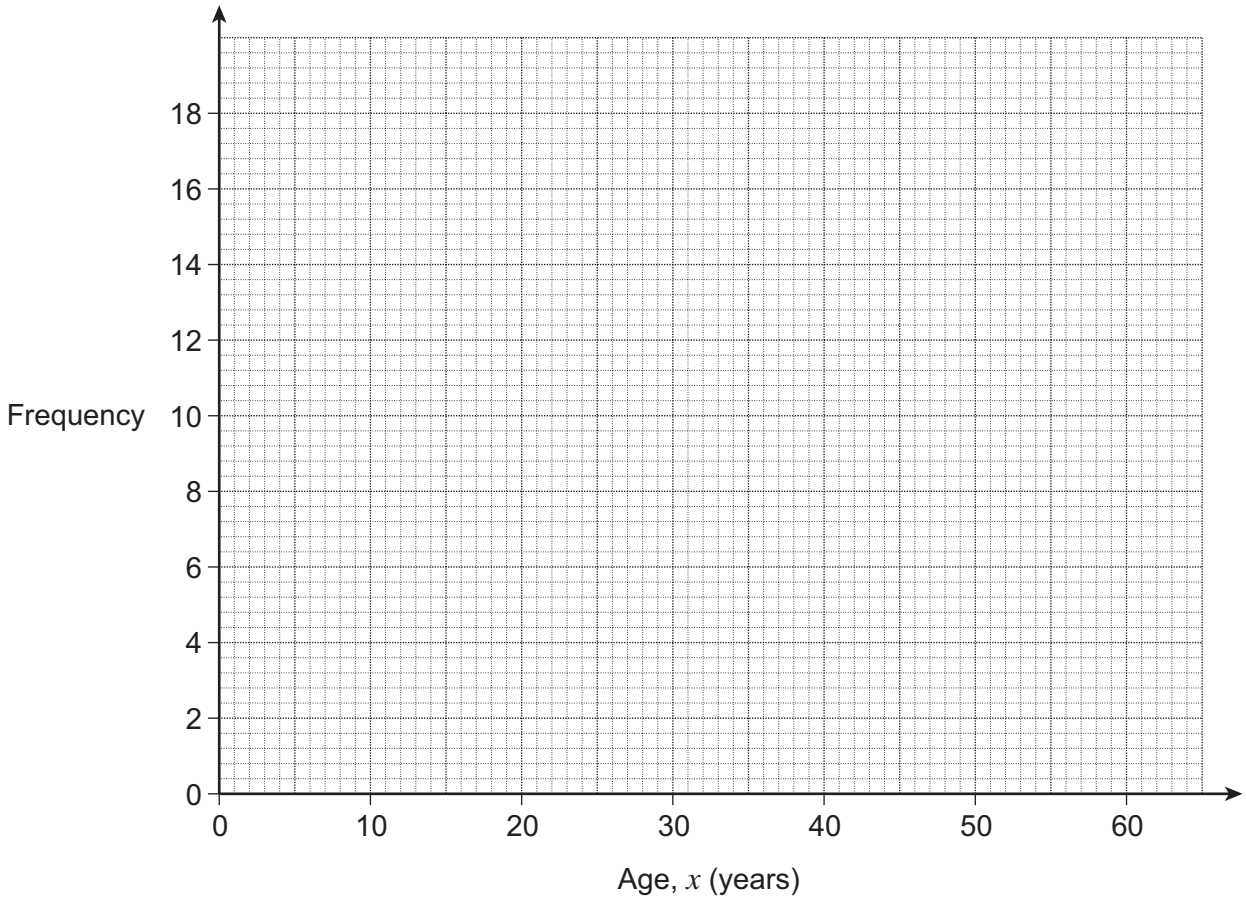
Turn over for the next question

8

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

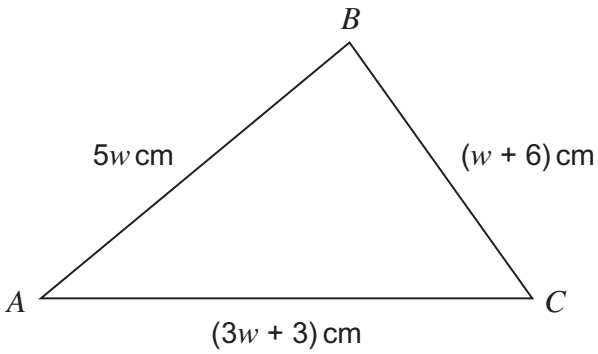
Age, x (years)	$20 < x \leqslant 30$	$30 < x \leqslant 40$	$40 < x \leqslant 50$	$50 < x \leqslant 60$
Frequency	4	8	17	12

Draw a frequency polygon to represent the data.



(2 marks)

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



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Show that the triangle is equilateral.

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(4 marks)

Turn over for the next question

6

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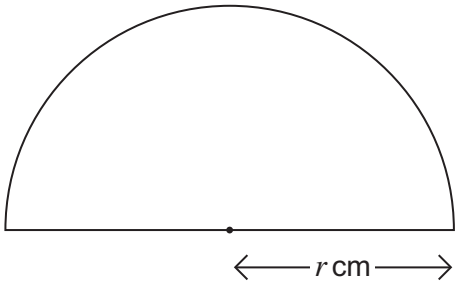
Answer ..... % *(3 marks)*

18 The diagram shows a semi-circular shape.



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

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

(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)*

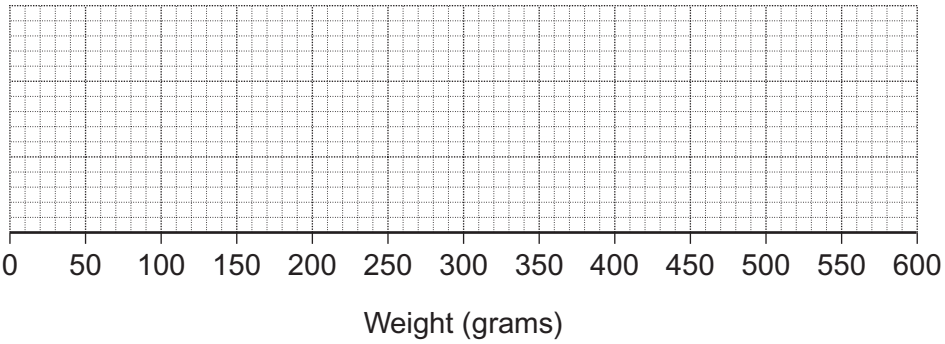
10

Turn over ▶

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	☐	☐	☐
Median	☐	☐	☐
Lower quartile	☐	☐	☐

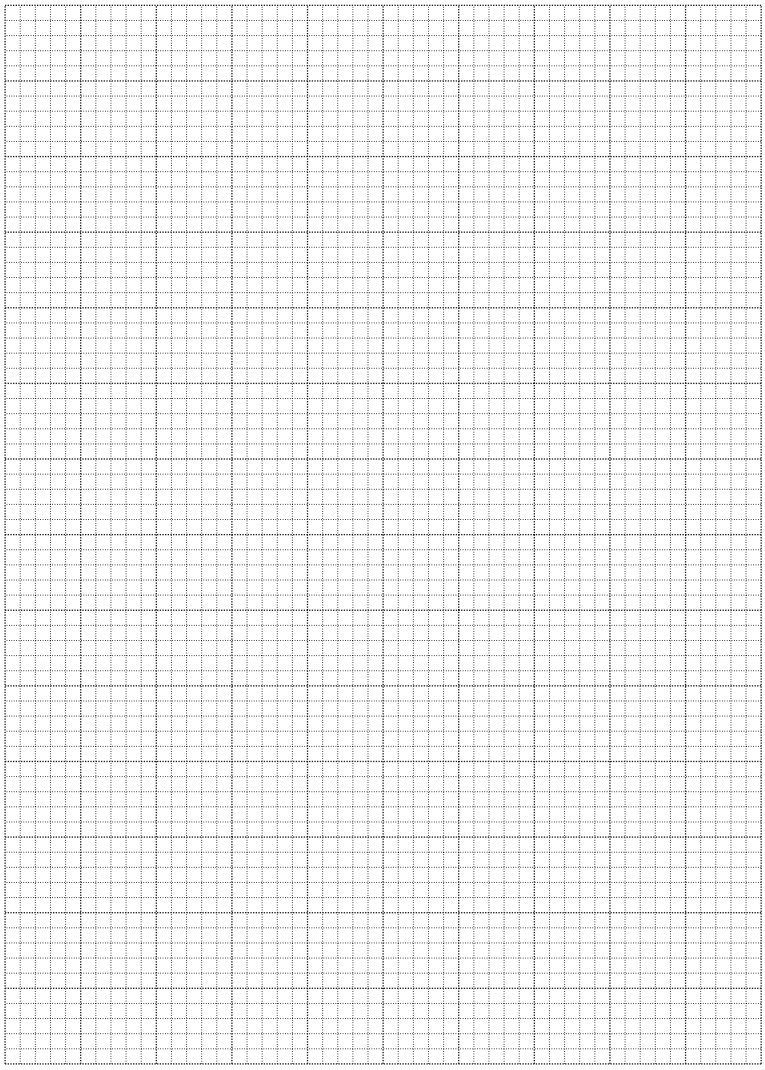
(3 marks)

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)

11

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

Amy	6.8 kg	4.3 kg	5.2 kg
Kate	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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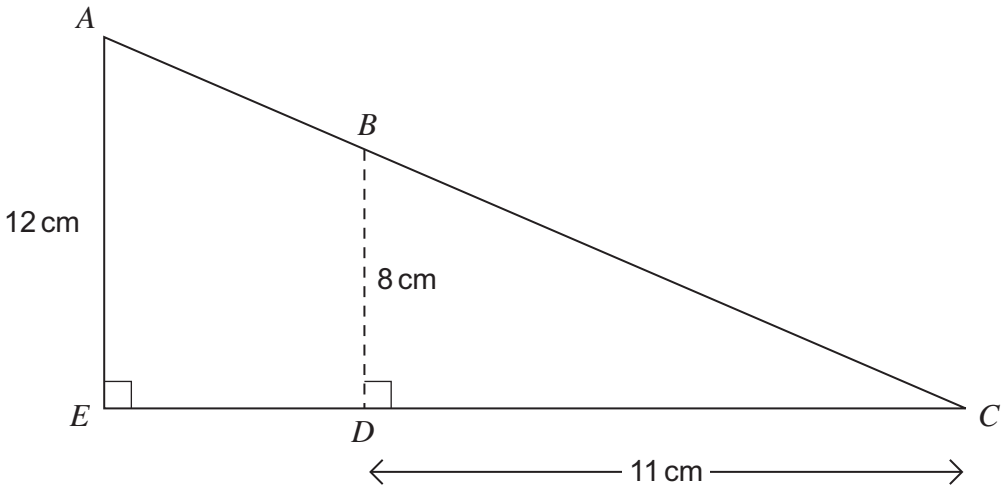
(4 marks)

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



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Work out the area of the trapezium $ABDE$.

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Answer ..... cm^2 *(5 marks)*

9

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

9

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^3 *(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

16

There are no questions printed on this page

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