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	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2012

Mathematics (Linear) 43651H

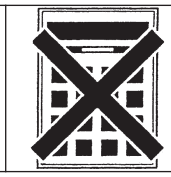
Paper 1

Monday 11 June 2012 1.30 pm to 3.00 pm

H

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.



Time allowed
- 1 hour 30 minutes

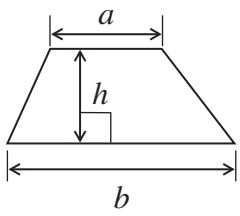
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- The quality of your written communication is specifically assessed in Questions 8 and 15. 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.

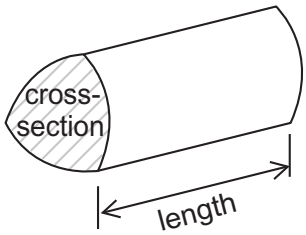
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

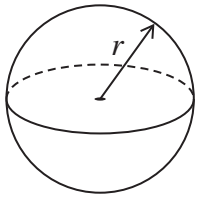


Volume of prism = area of cross-section × length



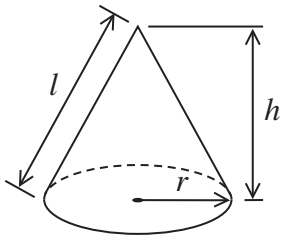
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

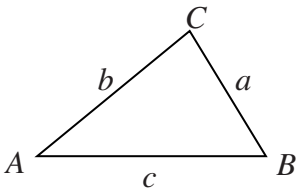
Curved surface area of cone = $\pi r l$



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

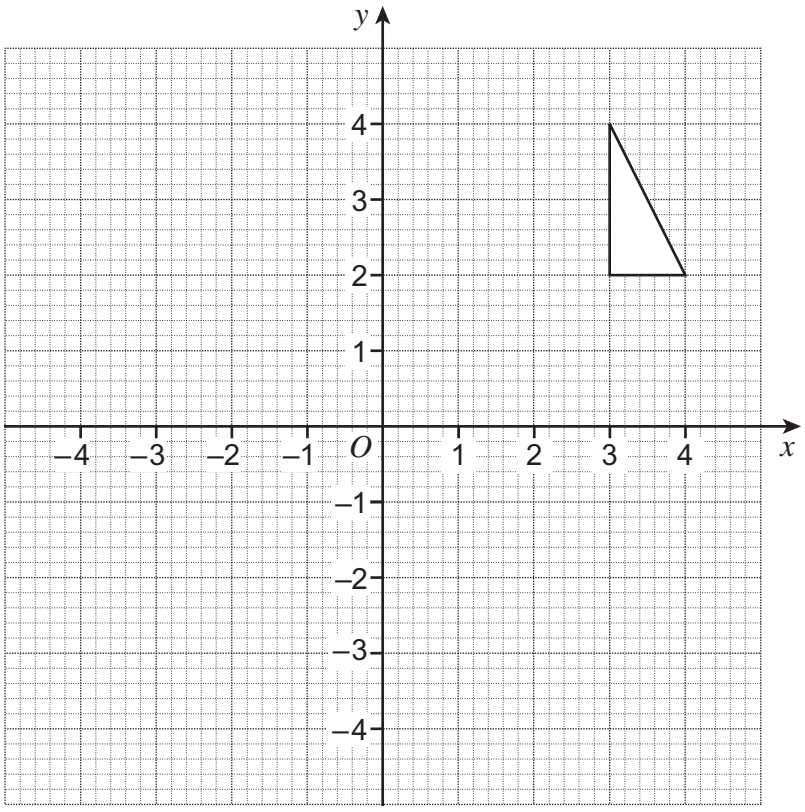
The Quadratic Equation

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 Reflect the triangle in the line $y = 2$



(2 marks)

2

2 (a) Expand $3(x - 6)$

.....

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

2 (b) Factorise $5y - 10$

.....

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

2 (c) Expand and simplify $3(4w + 1) - 5(3w - 2)$

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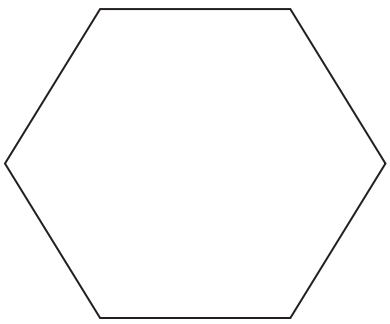
Answer ..... *(3 marks)*

3 Show that the interior angle of a regular hexagon is 120°.



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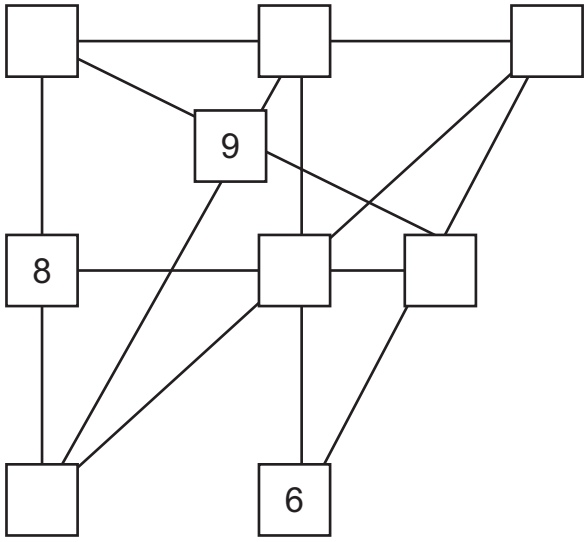
(2 marks)

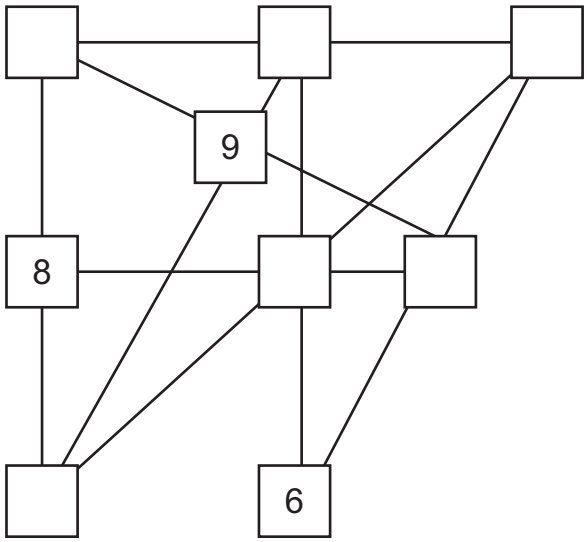
4 In the diagram, the three boxes in each straight line have a total of 14.

Complete the diagram using the numbers 1, 2, 3, 4, 5 and 7.

You can use this diagram to practise.



Put your final answer on this diagram.



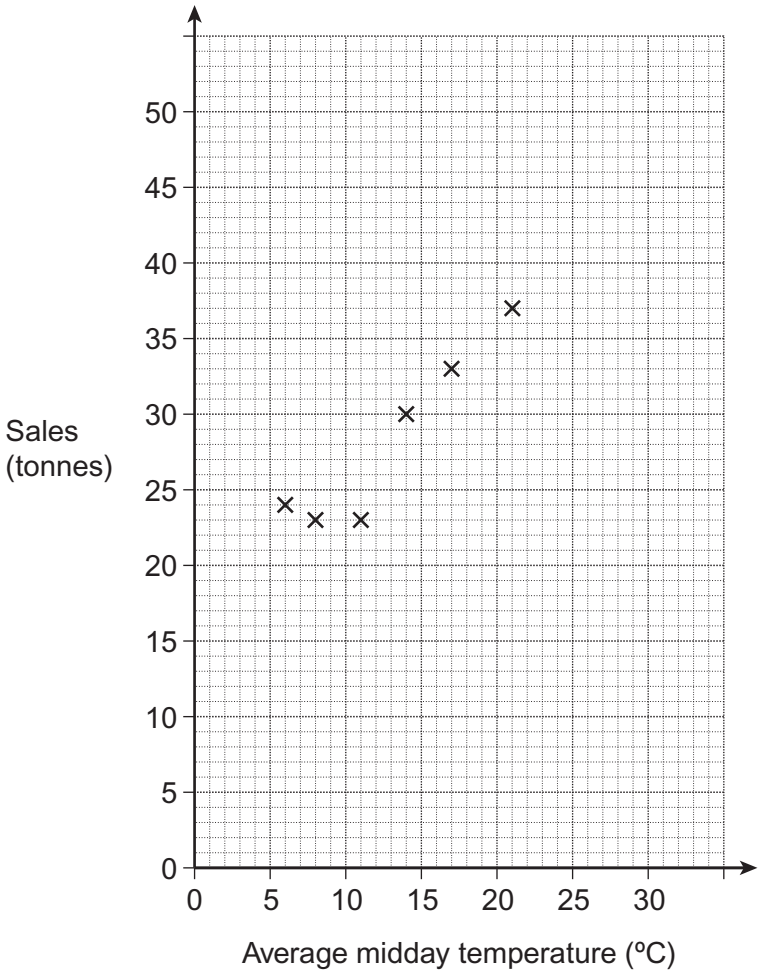
(3 marks)

10

5 A company sells ice cream.
The average midday temperature and the sales for each month in 2011 are shown.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average midday temperature (ºC)	8	6	11	14	17	21	22	29	20	14	10	4
Sales (tonnes)	23	24	23	30	33	37	39	47	36	28	22	23

5 (a) Complete the scatter diagram by plotting the values for July to December.
The values for January to June have been done for you.



(2 marks)

5 (b) In July 2012, the average midday temperature is predicted to be 25 ºC.

Use the graph to estimate the sales of ice cream in July 2012.
Show clearly how you obtain your answer.

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

5 (c) In December 2012, the average midday temperature is predicted to be 5 ºC higher than in December 2011.

Should the company increase its production of ice cream for December 2012?
Tick a box.

Yes ☐ No ☐

Give a reason for your answer.

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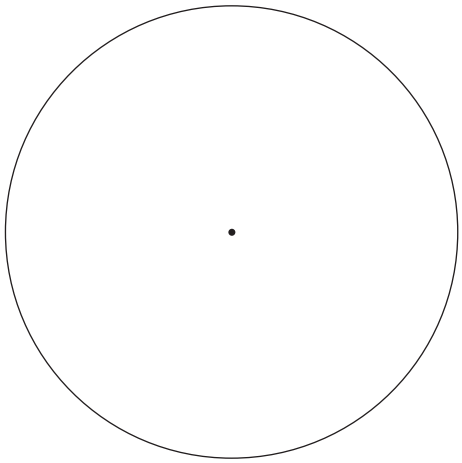
(1 mark)

Turn over for the next question

5

6 This circle is drawn accurately.



Work out the area of the circle.
Give your answer in terms of π.

State the units of your answer.

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

7 Solve $6x - 5 = 2x + 13$

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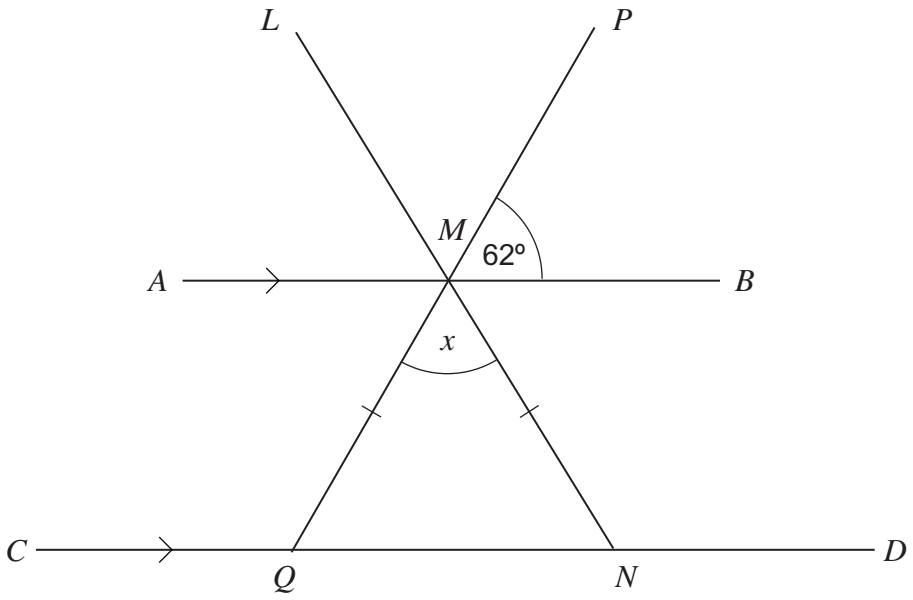
x = ... *(3 marks)*

***8** AB is parallel to CD.
LMN and PMQ are straight lines.
$MQ = MN$



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Work out the value of x.

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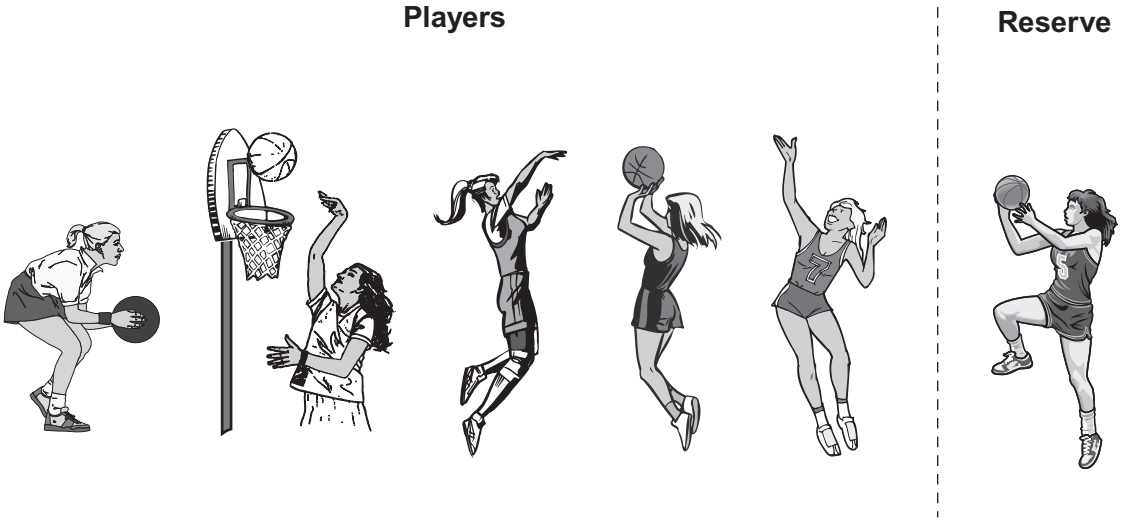
Answer ..... degrees *(3 marks)*

10

Turn over ▶

9 A basketball team has five players and one reserve.



The mean weight of the **five** players is 58 kg.
The reserve weighs 64 kg.

Work out the mean weight of all **six** team members.

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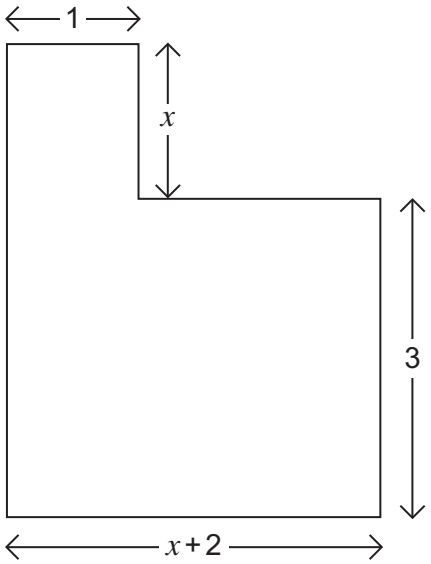
Answer ..... kg *(3 marks)*

10 The L-shape below has an area of 12 cm^2.
All corners are right angles.
All lengths are in centimetres.



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Work out the value of x.

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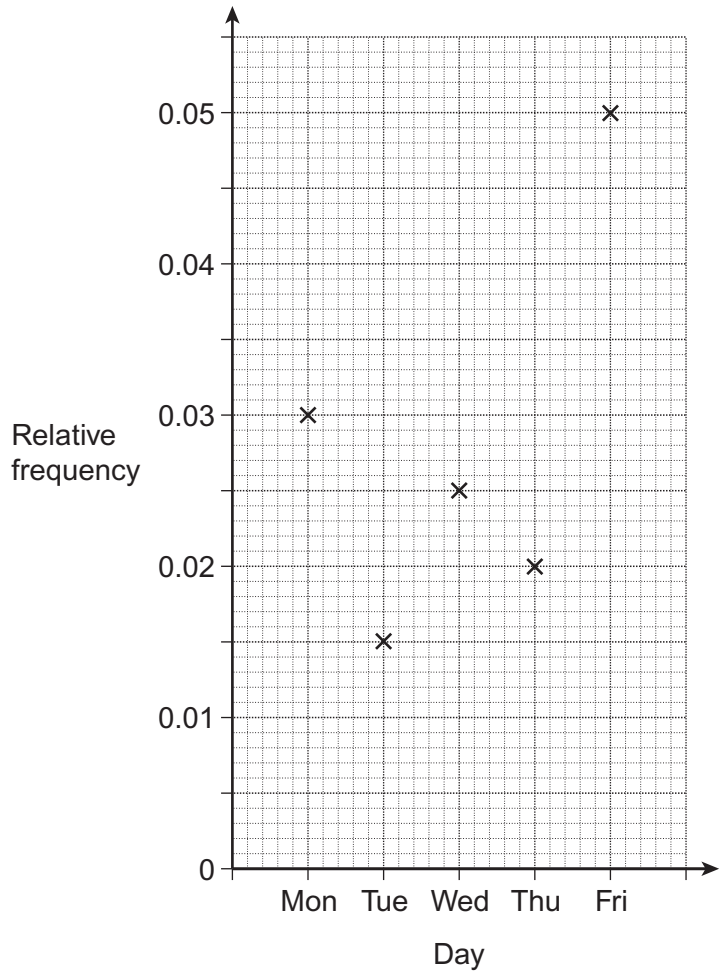
Answer ..... cm *(4 marks)*

7

11 The relative frequencies of the number of absences in a school on 5 days are shown.



There are 1600 students in the school.

How many more absences were there on Friday than on Monday?

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

12 Solve the simultaneous equations

$$2x + 4y = 1$$
$$3x - 5y = 7$$

Do **not** use trial and improvement.
You **must** show your working.

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x = ...

y = ... *(4 marks)*

Turn over for the next question

7

13 (a) Work out $(3 \times 10^5) \times (6 \times 10^9)$

Give your answer in standard form.

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

13 (b) Work out $(3 \times 10^5) \div (6 \times 10^9)$

Give your answer in standard form.

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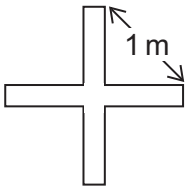
Answer ..... *(2 marks)*

14 A cross has a distance of 1 metre between the ends of each arm.



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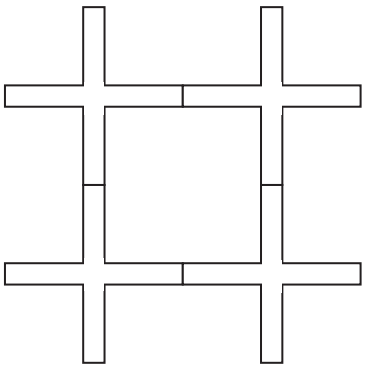
Four of these crosses are put together as shown.



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What is the area of the square formed in the middle?
Show clearly how you obtain your answer.

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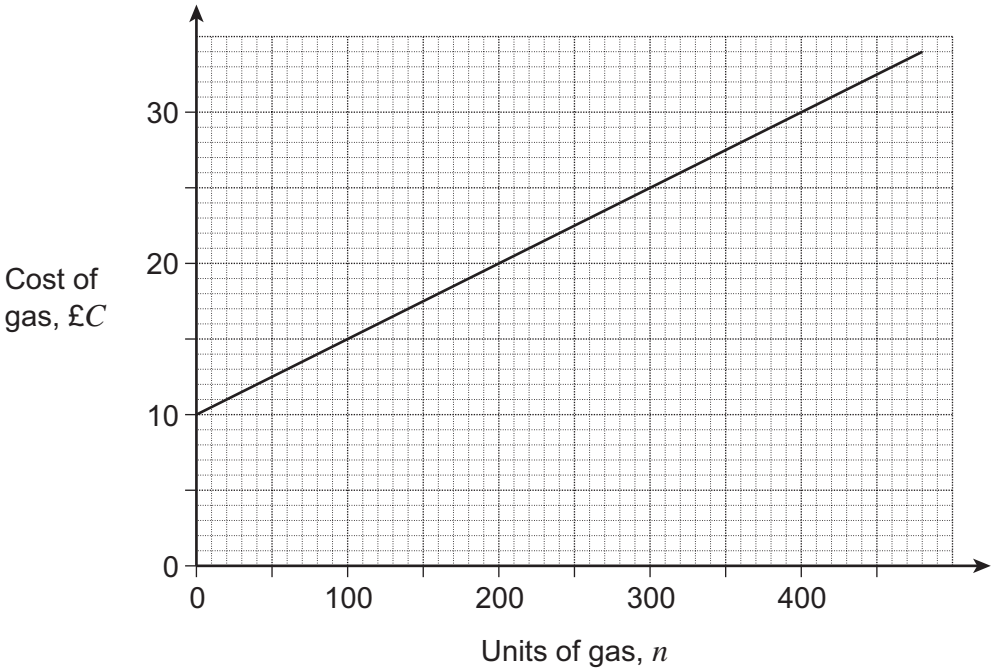
Answer ..... m^2 *(3 marks)*

7

***15** The graph shows the cost of gas from GasCo.
£C is the cost of the gas and n is the number of units of gas used.



Use the graph to obtain a formula for C in terms of n.

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

16 y is inversely proportional to the square of x.
When $x = 3$, $y = 8$

16 (a) Work out an equation connecting y and x.

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

16 (b) Work out the value of y when $x = 12$
Give your answer as a fraction in its simplest form.

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

Turn over for the next question

8

17 (a) Factorise $2x^2 - x - 3$

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

17 (b) Hence, simplify $\dfrac{2x^2 - x - 3}{4x^2 - 9}$

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

18 (a) Write $\sqrt{72}$ in the form $a\sqrt{2}$ where a is an integer.

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

18 (b) Work out $(\sqrt{6} + \sqrt{12})^2$

Give your answer in the form $c + d\sqrt{2}$ where c and d are integers.

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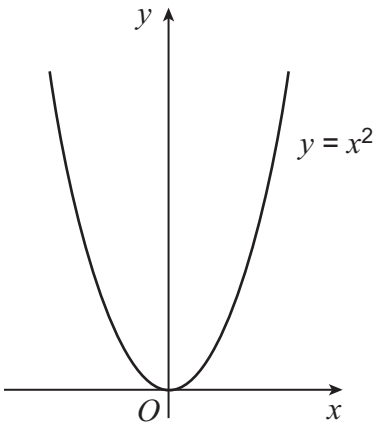
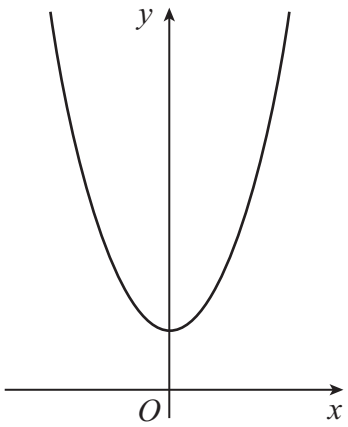
Answer ..... *(3 marks)*

Turn over for the next question

8

19 (a) The graph of $y = x^2$ is transformed by the vector $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$





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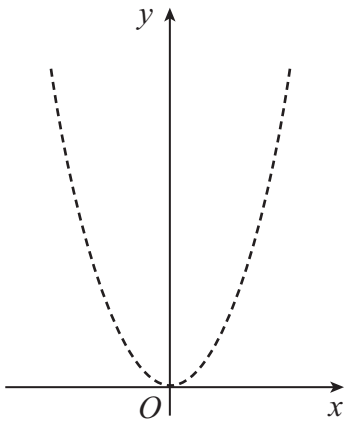
Write down the equation of the transformed graph.

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

19 (b) The diagram shows the graph of $y = x^2$

On the same diagram, sketch the graph of $y = (x + 1)^2$



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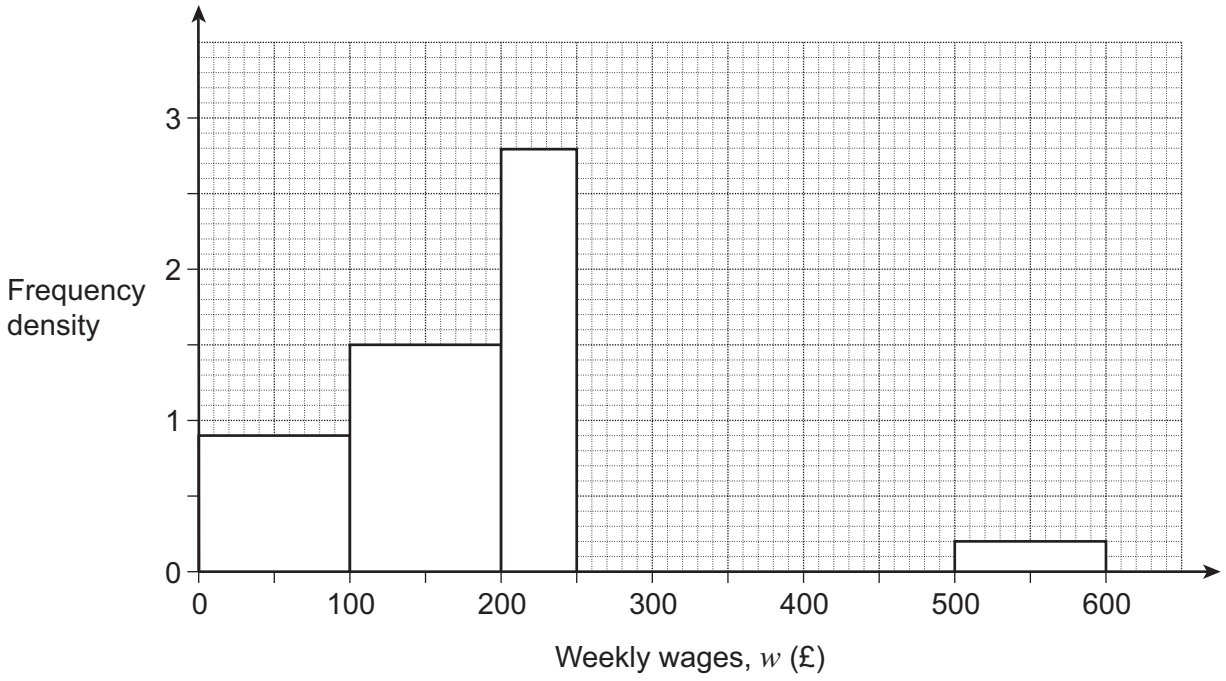
(1 mark)

20 A company has 800 workers.
The table and histogram show the distribution of weekly wages.

Weekly wages, w (£)	Frequency
$0 < w \leqslant 100$	
$100 < w \leqslant 200$	150
$200 < w \leqslant 250$	140
$250 < w \leqslant 300$	120
$300 < w \leqslant 500$	
$500 < w \leqslant 600$	20
Total	800



Complete **both** the table and the histogram.

(4 marks)

END OF QUESTIONS

6

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