

|                     |  |  |  |  |  |                  |  |  |  |  |  |
|---------------------|--|--|--|--|--|------------------|--|--|--|--|--|
| 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**

|  |  |
|--|--|
| <p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>● mathematical instruments.</li> </ul> <p>You must <b>not</b> use a calculator.</p> |  |
|--|--|

### 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

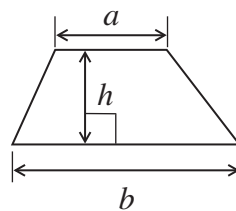
- In all calculations, show clearly how you work out your answer.



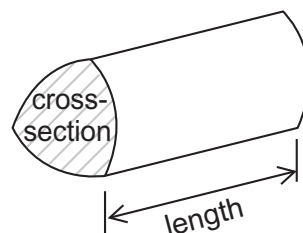
J U N 1 2 4 3 6 5 1 H 0 1

## Formulae Sheet: Higher Tier

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

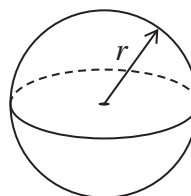


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



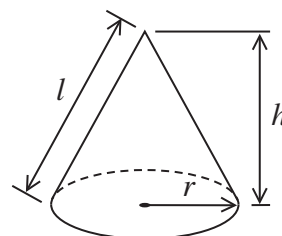
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$

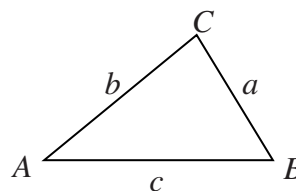


In any triangle  $ABC$

$$\text{Area of triangle} = \frac{1}{2}ab \sin C$$

$$\text{Sine rule} \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$



### The Quadratic Equation

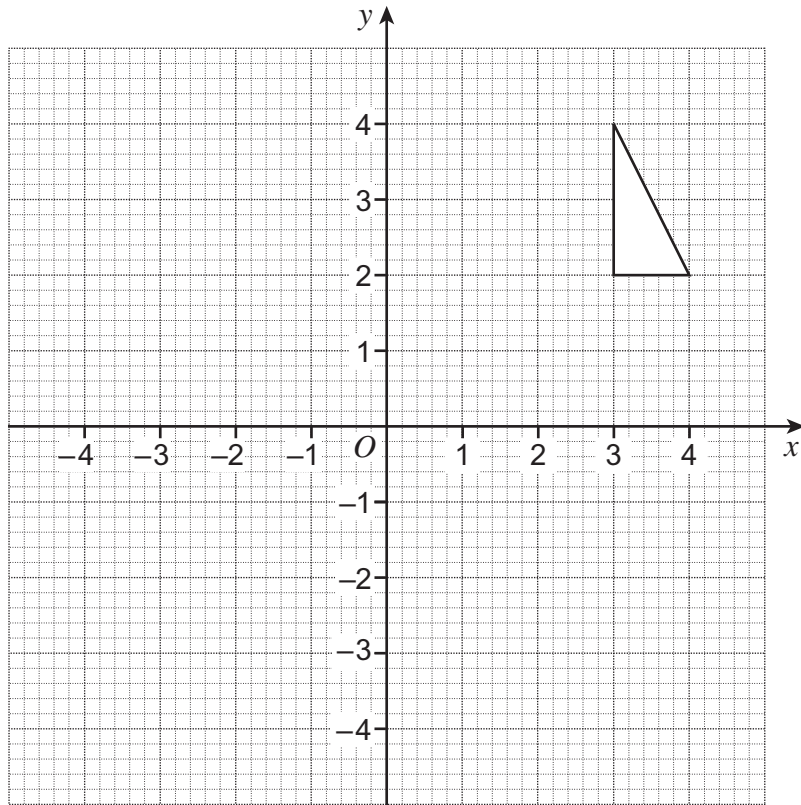
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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



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

- 1 Reflect the triangle in the line  $y = 2$



(2 marks)



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

.....

Answer ..... (1 mark)

**2 (b)** Factorise  $5y - 10$

.....

Answer ..... (1 mark)

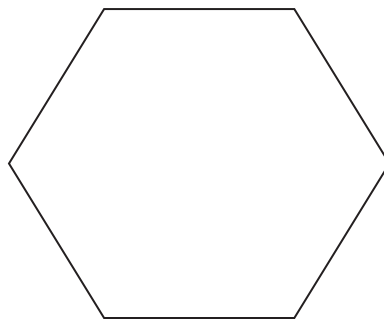
**2 (c)** Expand and simplify  $3(4w + 1) - 5(3w - 2)$

.....

.....

Answer ..... (3 marks)

**3** Show that the interior angle of a regular hexagon is  $120^\circ$ .



Not drawn  
accurately

.....

.....

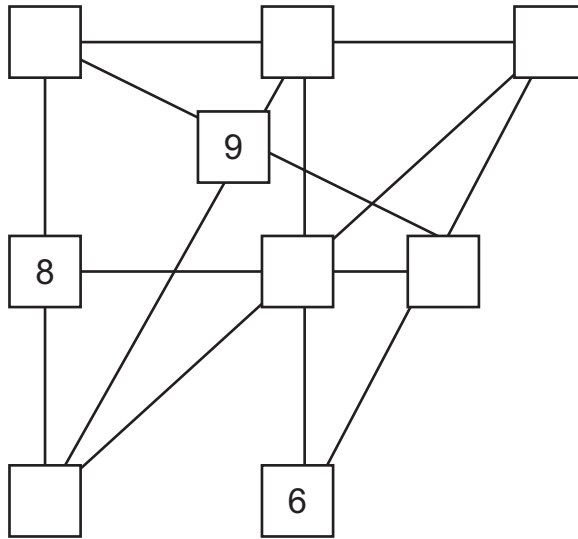
.....

(2 marks)

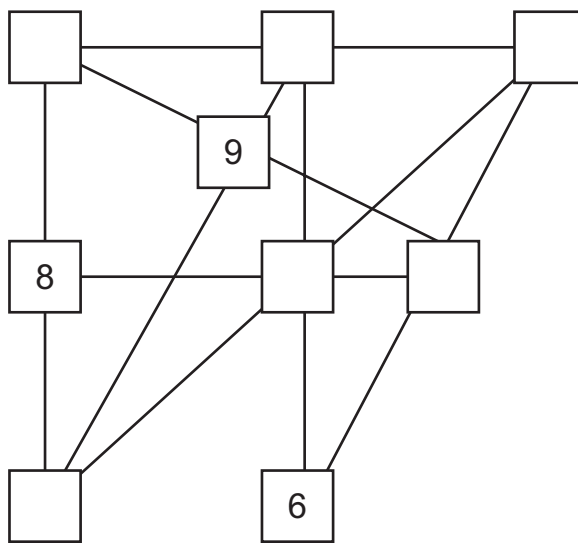


- 4 In the diagram, the three boxes in each straight line have a total of 14.  
Complete the diagram using the numbers 1, 2, 3, 4, 5 and 7.

You can use this diagram to practise.



Put your final answer on this diagram.



(3 marks)

10

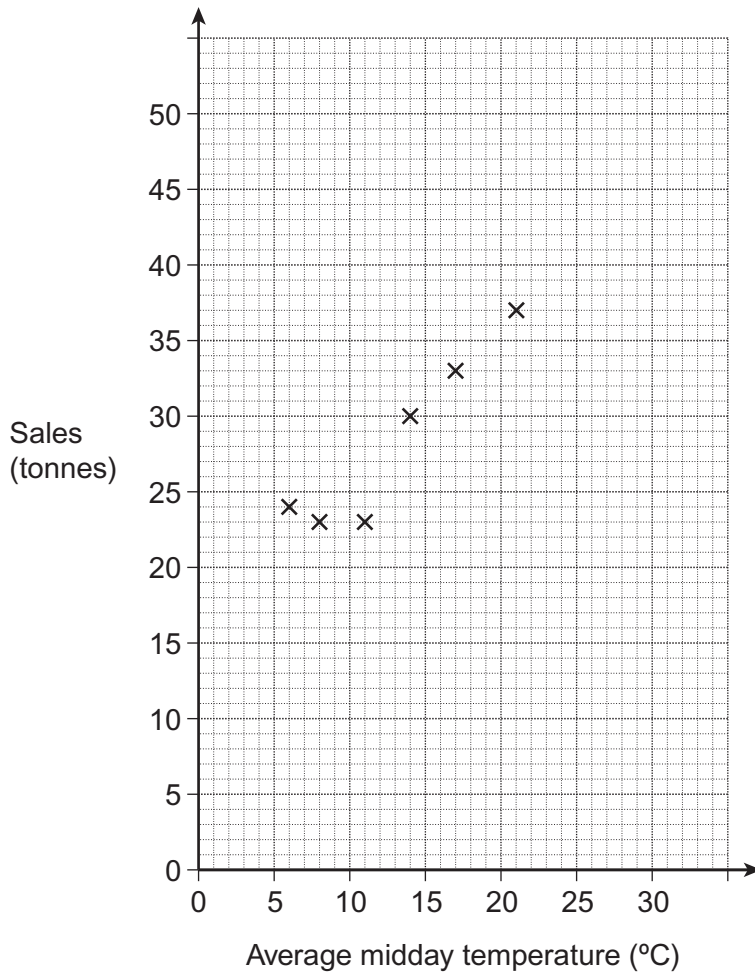
Turn over ►



- 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 |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>Average midday temperature (°C)</b> | 8   | 6   | 11  | 14  | 17  | 21  | 22  | 29  | 20  | 14  | 10  | 4   |
| <b>Sales (tonnes)</b>                  | 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 °C.

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

.....  
.....  
.....

Answer ..... tonnes (2 marks)

**5 (c)** In December 2012, the average midday temperature is predicted to be 5 °C 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.

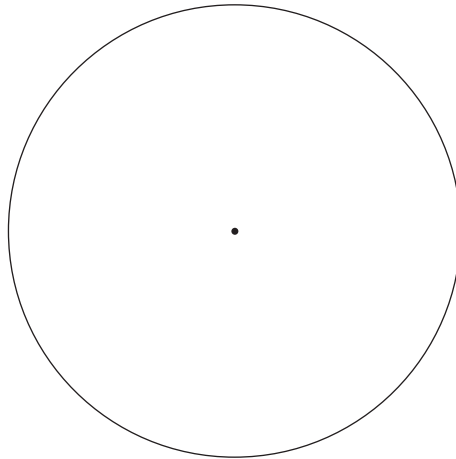
.....  
.....  
.....

(1 mark)

**Turn over for the next question**



6 This circle is drawn accurately.



Work out the area of the circle.  
Give your answer in terms of  $\pi$ .

State the units of your answer.

.....  
.....  
.....

Answer ..... (4 marks)

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

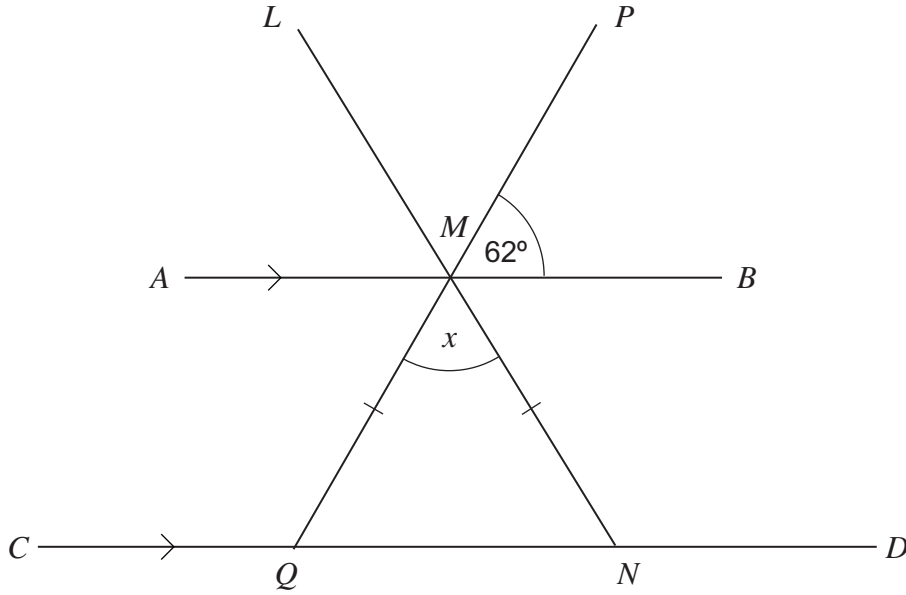
.....  
.....  
.....  
.....  
.....  
.....

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





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



Not drawn accurately

Work out the value of  $x$ .

.....

.....

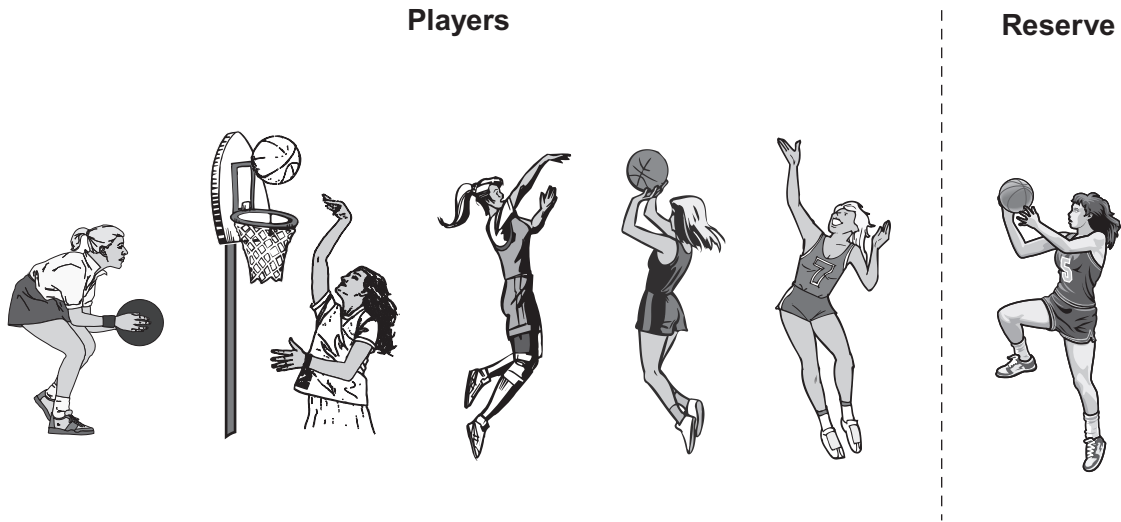
.....

.....

Answer ..... degrees (3 marks)



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.

.....

.....

.....

.....

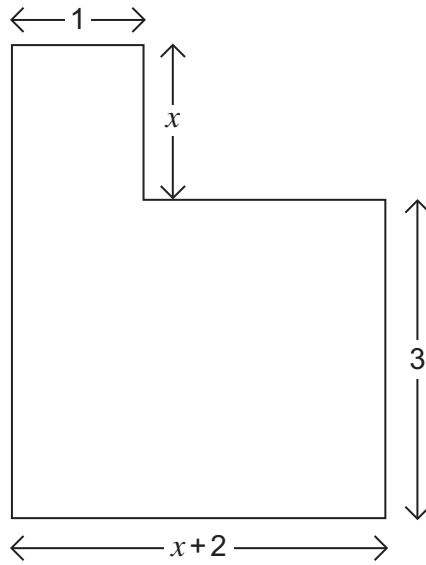
.....

.....

Answer ..... kg (3 marks)



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



Not drawn  
accurately

Work out the value of  $x$ .

.....

.....

.....

.....

.....

.....

.....

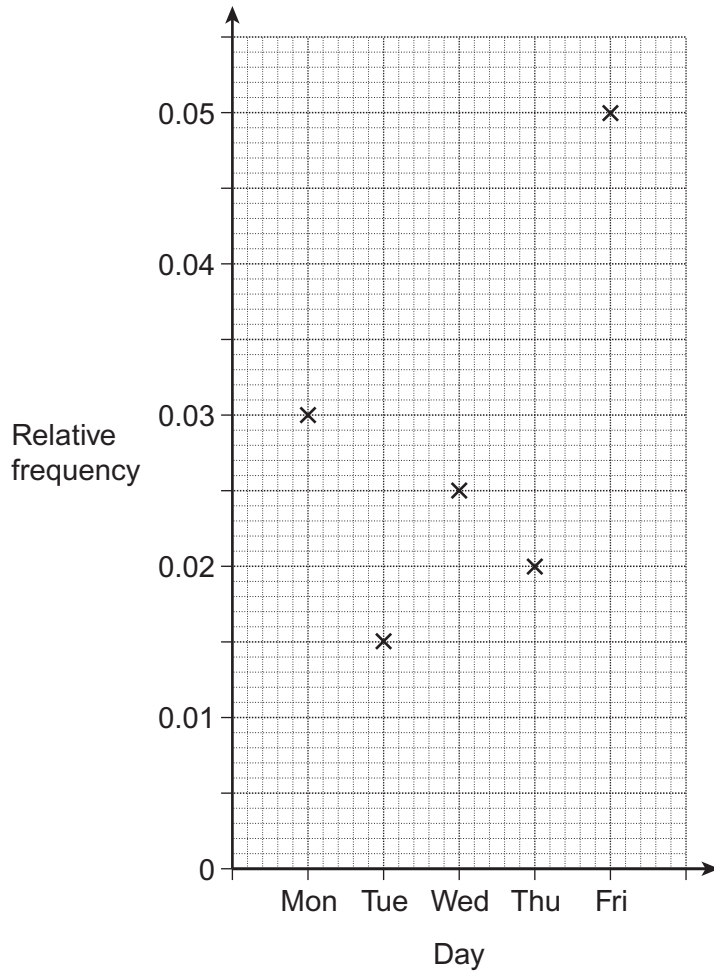
.....

.....

Answer ..... cm (4 marks)



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?

.....

.....

.....

.....

.....

Answer ..... (3 marks)



12 Solve the simultaneous equations

$$\begin{aligned} 2x + 4y &= 1 \\ 3x - 5y &= 7 \end{aligned}$$

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

$x =$  .....

$y =$  ..... (4 marks)

**Turn over for the next question**

7

**Turn over ►**



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

Give your answer in standard form.

.....

.....

.....

Answer ..... (2 marks)

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

Give your answer in standard form.

.....

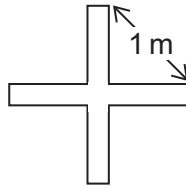
.....

.....

Answer ..... (2 marks)

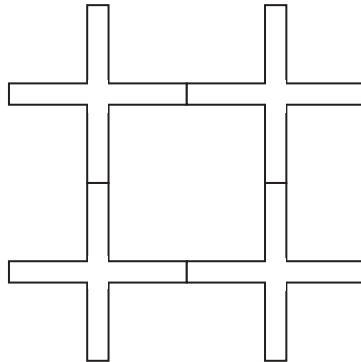


14 A cross has a distance of 1 metre between the ends of each arm.



Not drawn  
accurately

Four of these crosses are put together as shown.



Not drawn  
accurately

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

.....

.....

.....

.....

Answer ..... m<sup>2</sup> (3 marks)

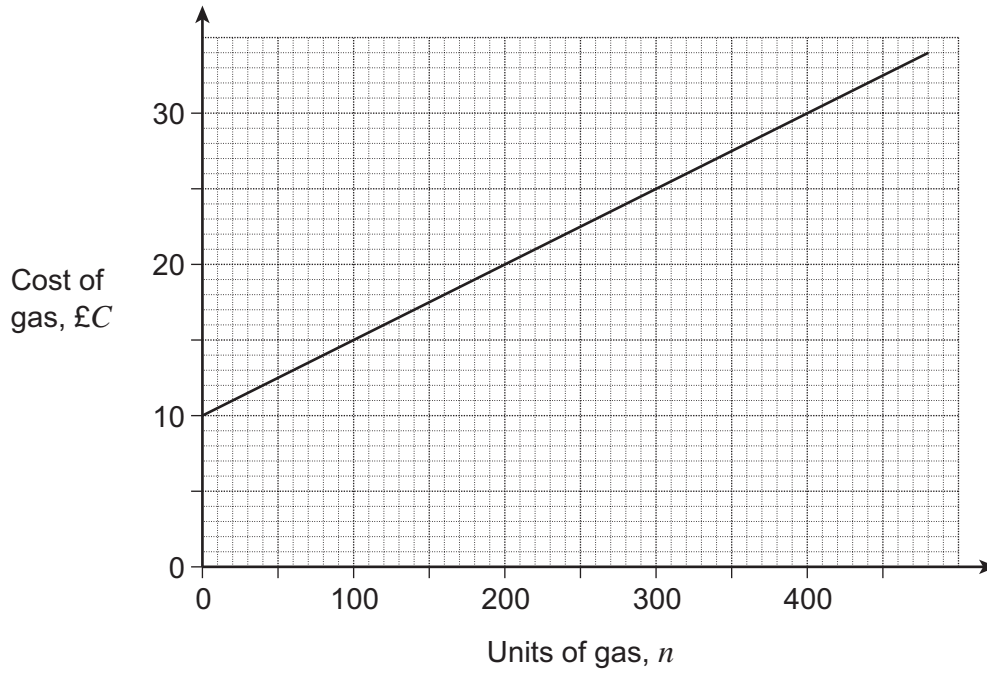
|   |
|---|
| 7 |
|---|

Turn over ►



\*15

The graph shows the cost of gas from GasCo.  
 $\pounds C$  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  $n$ .

.....

.....

.....

.....

.....

.....

.....

.....

.....

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  $x$ .

.....

.....

.....

.....

Answer ..... (3 marks)

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

.....

.....

.....

Answer ..... (2 marks)

**Turn over for the next question**



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

.....  
.....  
.....

Answer ..... (2 marks)

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

.....  
.....  
.....  
.....

Answer ..... (2 marks)



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

.....  
.....

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.

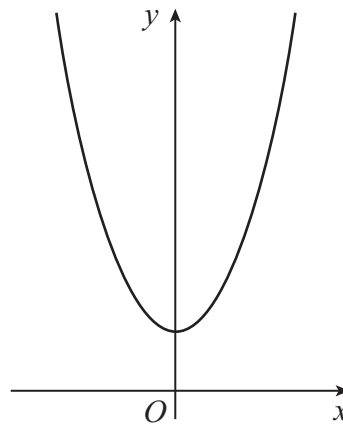
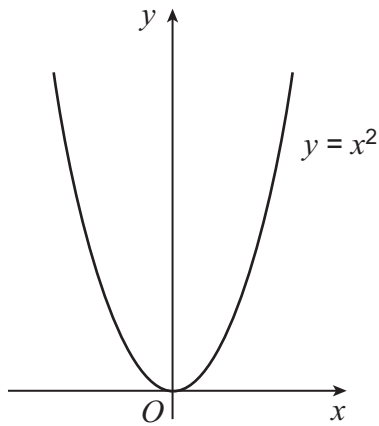
.....  
.....  
.....  
.....  
.....

Answer ..... (3 marks)

**Turn over for the next question**



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



Not drawn  
accurately

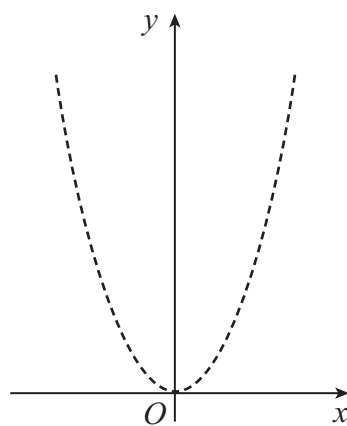
Write down the equation of the transformed graph.

Answer .....

(1 mark)

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

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



Not drawn  
accurately

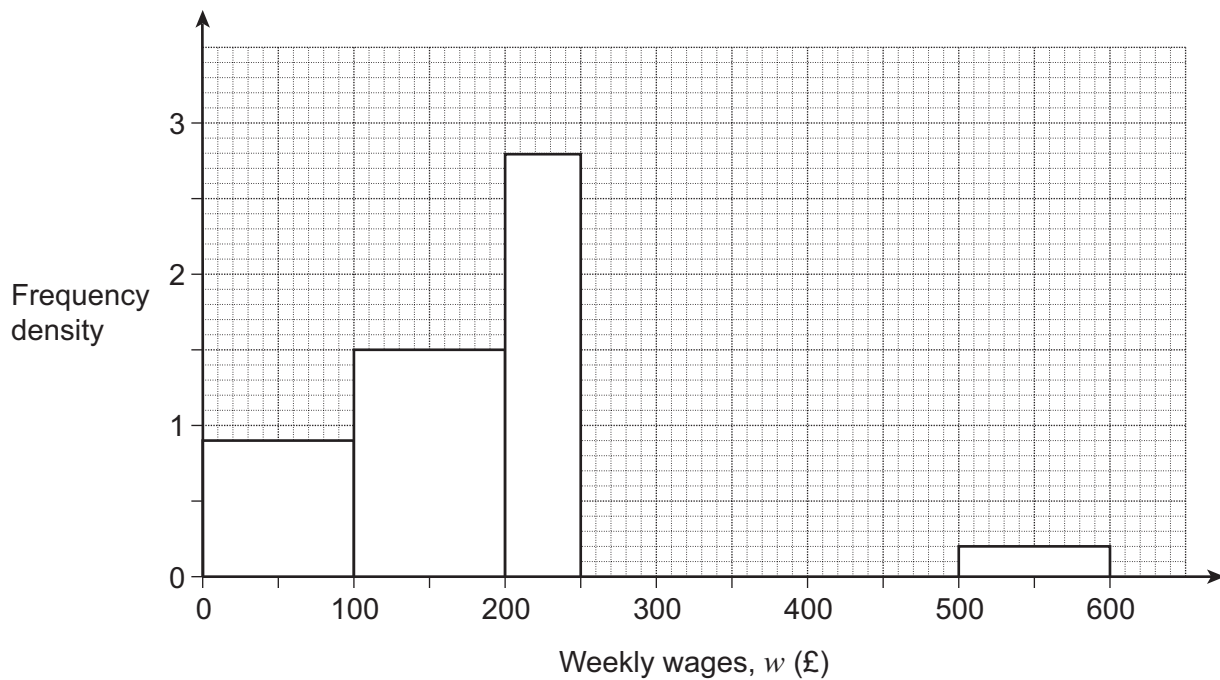
(1 mark)



20

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

| Weekly wages, $w$ (£) | Frequency  |
|-----------------------|------------|
| $0 < w \leq 100$      |            |
| $100 < w \leq 200$    | 150        |
| $200 < w \leq 250$    | 140        |
| $250 < w \leq 300$    | 120        |
| $300 < w \leq 500$    |            |
| $500 < w \leq 600$    | 20         |
| <b>Total</b>          | <b>800</b> |



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

(4 marks)

END OF QUESTIONS

6



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

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



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

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



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

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

