



General Certificate of Secondary Education  
January 2016

Centre Number

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Candidate Number

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## Mathematics

Unit T4 (With calculator)

Higher Tier



**MV18**

[GMT41]

**MONDAY 11 JANUARY, 9.15 am–11.15 am**

### Time

2 hours, plus your additional time allowance.

### Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

**You must answer the questions in the spaces provided.**

Complete in blue or black ink only.

Answer **all twenty-one** questions.

All working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.

You **may** use a calculator for this paper.

## Information for Candidates

The total mark for this paper is 100.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Functional Elements will be assessed in this paper.

Quality of written communication will be assessed in

Questions **10** and **16**.

You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on pages 4 and 5.

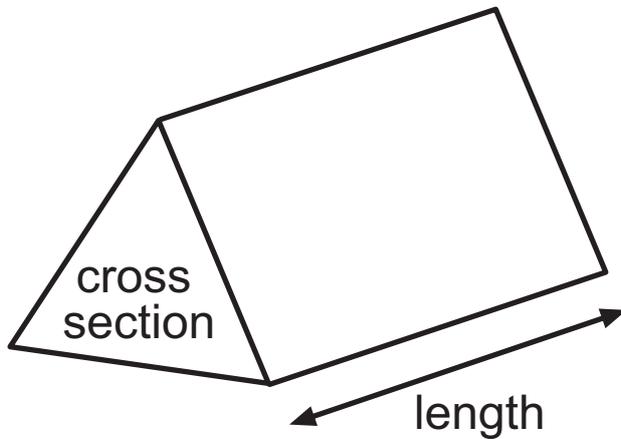
You may use any of the modified graph paper supplied as stationery if required.

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**(Questions start on page 7)**

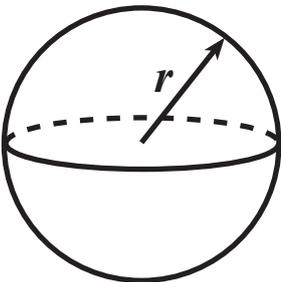
# Formula Sheet

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



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

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



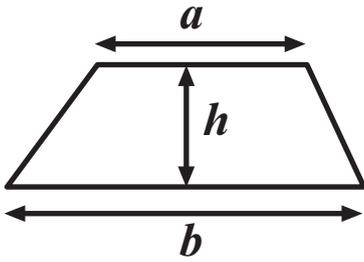
## Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$ , are given by

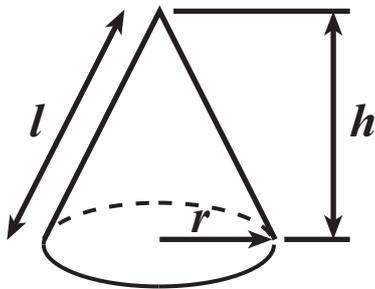
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

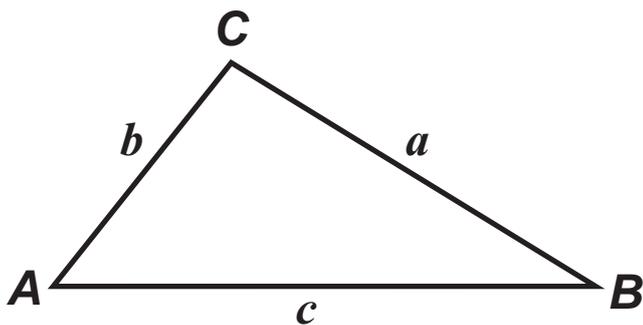


$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

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



In any triangle **ABC**



$$\text{Sine Rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

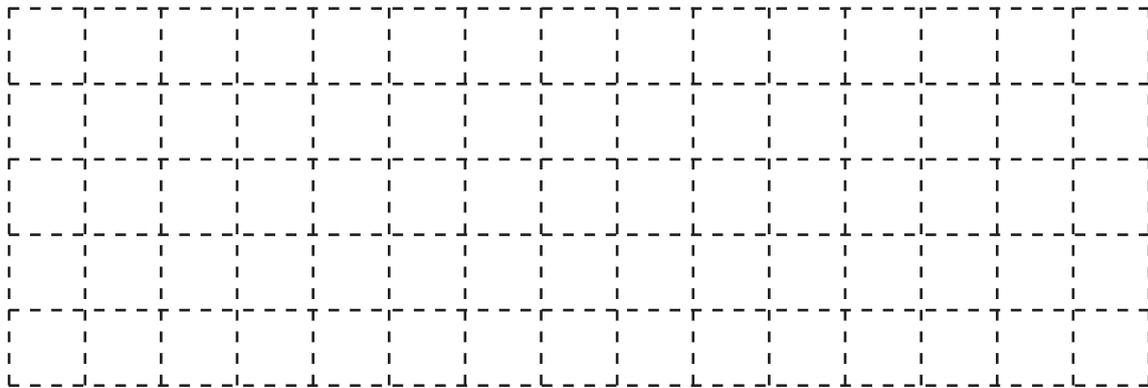
$$\text{Area of triangle} = \frac{1}{2} ab \sin C$$

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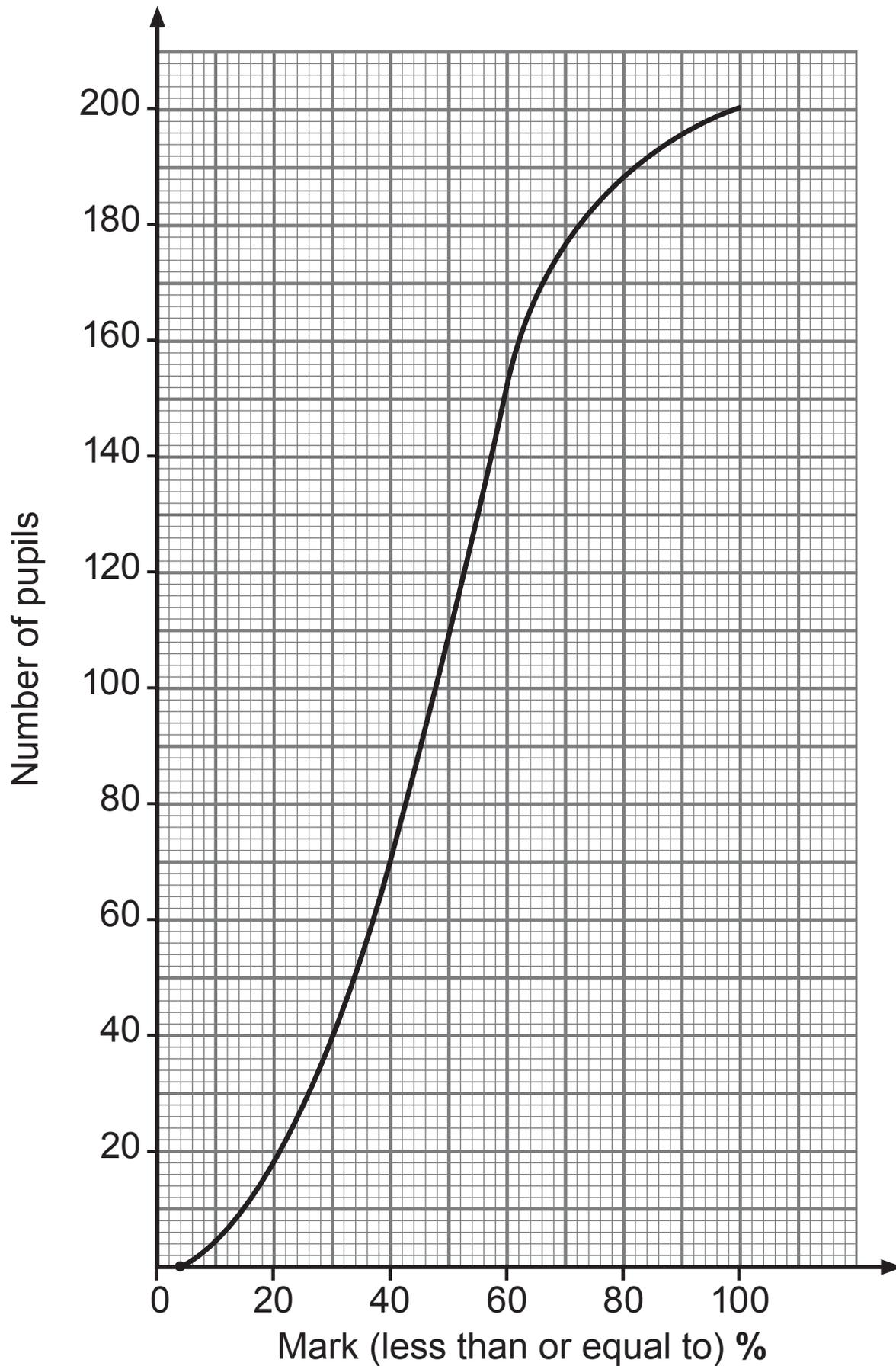
- 1 In a group of 11 pupils, the number of days absent from school was recorded as listed below.

12    6    5    2    8    2    3    11    4    10    7

Draw a box plot for this data on the grid.    [4 marks]



- 2 Two hundred pupils sat an English test. The cumulative frequency curve for the percentage marks gained is shown.



- (a) Use the graph to complete table (i) and hence table (ii) below: [table (i) 1 mark] [table (ii) 2 marks]

(i)

Percentage Mark	Cumulative Frequency
$\leq 20$	18
$\leq 40$	70
$\leq 60$	
$\leq 80$	
$\leq 100$	

(ii)

Percentage Mark	Frequency
$0 < p \leq 20$	18
$20 < p \leq 40$	52
$40 < p \leq 60$	
$60 < p \leq 80$	
$80 < p \leq 100$	

- (b) Use the graph to estimate the median mark. [1 mark]

Answer \_\_\_\_\_

- (c) Use the graph to estimate the range of marks for the top 30 pupils. [2 marks]

Answer \_\_\_\_\_ %

- 3 The picture shows the dimensions of a label taken from a cylindrical tin of dog food.

The label covers all the curved surface of the tin with no overlap.

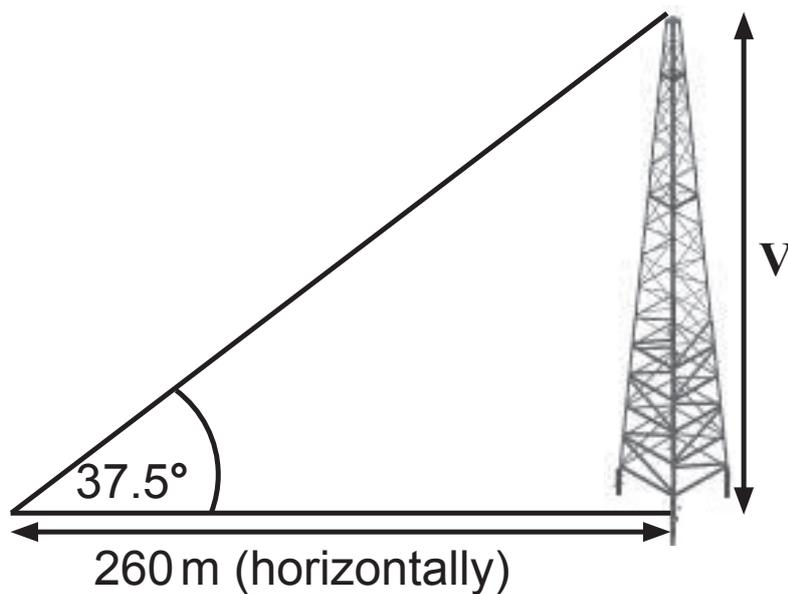
Calculate the volume of the tin. [4 marks]



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Answer \_\_\_\_\_  $\text{cm}^3$

- 4 Calculate the height  $V$  of this vertical radio mast.  
[3 marks]



© CCEA

Answer \_\_\_\_\_ m

- 5 The population of a town in 2014 was 80 058  
This was a 65% increase on its population in 1994  
What was the population in 1994? [3 marks]

Answer \_\_\_\_\_

- 6 (a) Find the equation of the line joining the points  
A (0, -1) and B (6, -4). [3 marks]

Answer \_\_\_\_\_

- (b) Find the equation of the line perpendicular to AB which  
passes through B. [3 marks]

Answer \_\_\_\_\_

7 The total weight of 5 brown and 2 white eggs was 21.6 g.

The total weight of 3 brown and 5 white eggs was 23.6 g.

Write down two simultaneous equations and solve them to find the weight of a brown egg and the weight of a white egg.  
[5 marks]

You may assume that all brown eggs have the same weight and all white eggs have the same weight.

Show all your working.

Answer Brown egg weighs \_\_\_\_\_ g

White egg weighs \_\_\_\_\_ g

8 Solve

$$\frac{3x-2}{6} - \frac{x-2}{3} = \frac{7}{4} \quad [4 \text{ marks}]$$

Show all your working.

A solution by trial and improvement will not be accepted.

Answer  $x =$  \_\_\_\_\_

- 9 The time ( $T$ ) of swing of a pendulum varies as the square root of the length ( $L$ ) of the pendulum.  
When  $T = 1.8$  seconds the length of the pendulum is  $0.81$  m.

(a) Find the formula for  $T$  in terms of  $L$ . [3 marks]

Answer  $T =$  \_\_\_\_\_

(b) Use your formula to find  $T$  when  $L = 1.21$  m. [1 mark]

Answer \_\_\_\_\_ seconds

(c) Find the value of  $L$  for which the time of swing is  $0.5$  seconds. [1 mark]

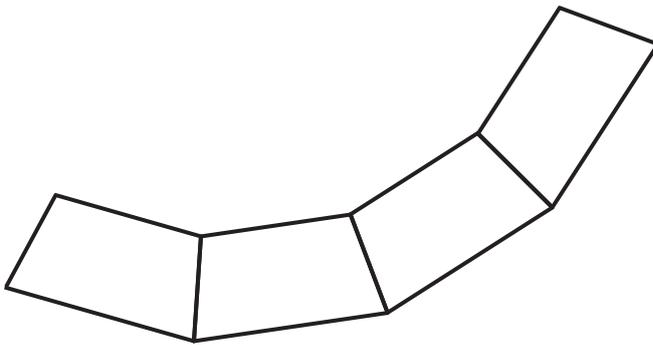
Answer \_\_\_\_\_ m

Quality of written communication will be assessed in this question.

- 10 The diagram shows a tile in the shape of an isosceles trapezium.



Some of these tiles are put together as a path all the way around a garden as shown.



How many exterior sides will the path have? [3 marks]

Show all your working clearly.

Answer \_\_\_\_\_

**11** The angle of elevation of the top of a vertical tower is  $27^\circ$

From a point 30 metres closer, the angle of elevation is  $36^\circ$

Calculate the height of the tower. [5 marks]

Answer \_\_\_\_\_ m

**12 (a)** Factorise fully

$$3x^2 - 27y^2 \quad [3 \text{ marks}]$$

Answer \_\_\_\_\_

**(b)** Simplify fully

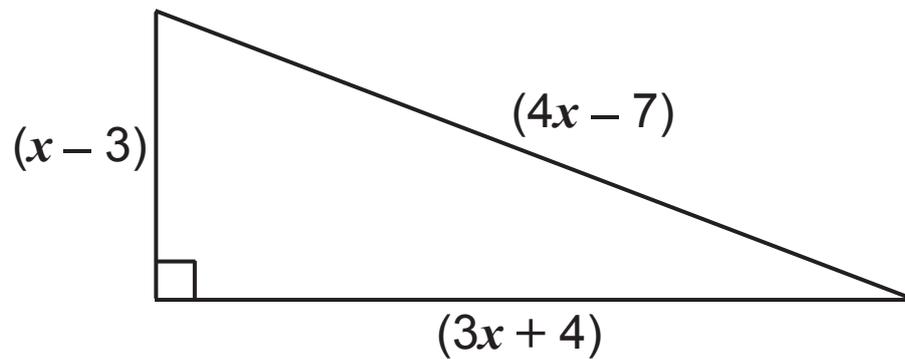
$$\frac{3x^2 - 27y^2}{x^2 - 6xy + 9y^2} \quad [3 \text{ marks}]$$

Answer \_\_\_\_\_

- 13** In the triangle shown find  $x$  and hence the length of the longest side. [7 marks]

A solution by trial and improvement will not be accepted.

Show all your working.



Answer  $x =$  \_\_\_\_\_

longest side = \_\_\_\_\_

- 14** A car dealer sells petrol cars and diesel cars.  
 In 2015 there were 876 petrol cars sold. This was 36.5% of the total number sold.  
 Janice questions a sample of all the people who had bought a car from this dealer in 2015.  
 Her sample was stratified by fuel type.  
 Estimate the number of diesel cars in her sample of 160.  
 [4 marks]

Answer \_\_\_\_\_

- 15** Paula recorded the time, in seconds, of each of the songs stored on her phone.

She plans to draw a histogram for the data. Some of the data is shown in the table.

<b>time (in seconds)</b>	<b>frequency</b>	<b>height of bar (cm)</b>
$90 < t \leq 140$	30	6
$140 < t \leq 160$	8	
$160 < t \leq 200$		1.5

Complete the table. [4 marks]

Quality of written communication will be assessed in this question.

16 Without using a calculator evaluate

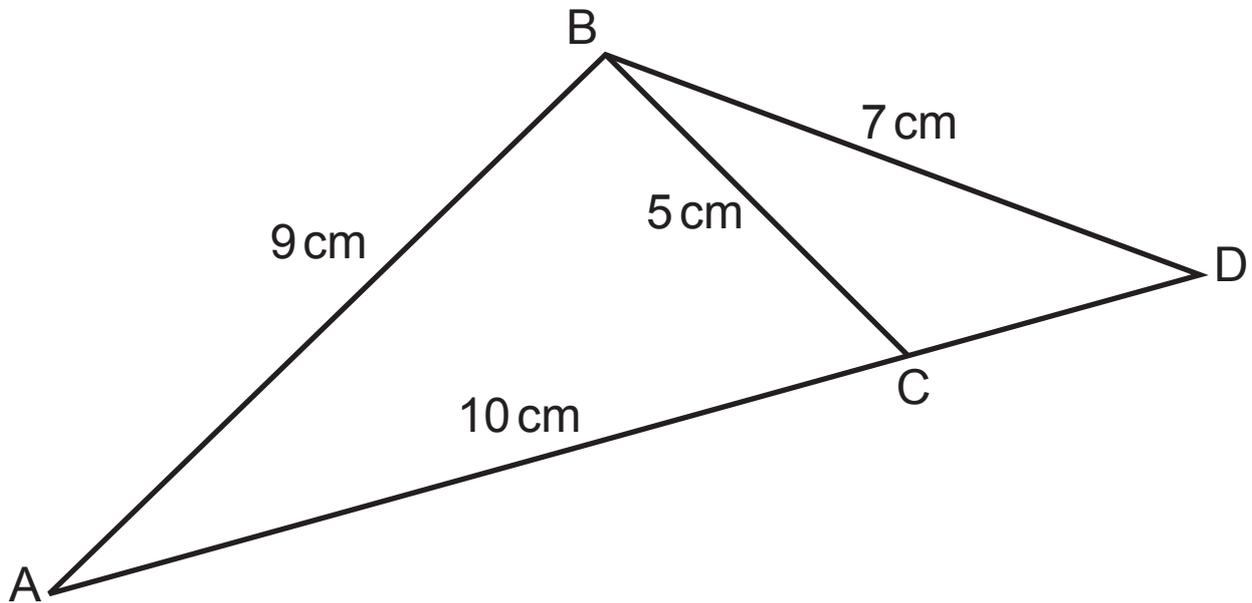
$$32\frac{6}{5} \div 0.25^{-0.5} \quad [3 \text{ marks}]$$

Show all your working.

Answer \_\_\_\_\_

17 The triangle ABC in the diagram shown has sides of 5, 9, 10 cm.

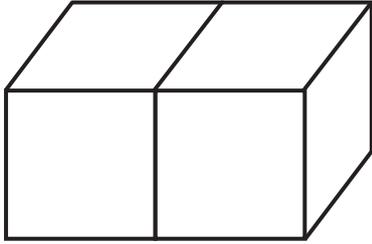
BD has length 7 cm. ACD is a straight line.



Calculate the size of the angle BDC. [5 marks]

Answer \_\_\_\_\_ °

18



Two cubes, each of side 1 cm, are set side by side.

Calculate the angle between the base and the space diagonal from the bottom left hand corner to the top right hand corner. [3 marks]

Answer \_\_\_\_\_°

**19** Solve the simultaneous equations

$$x + 2y = -3 \quad \text{and} \quad x^2 - 2xy = 20 \quad [7 \text{ marks}]$$

Answer \_\_\_\_\_

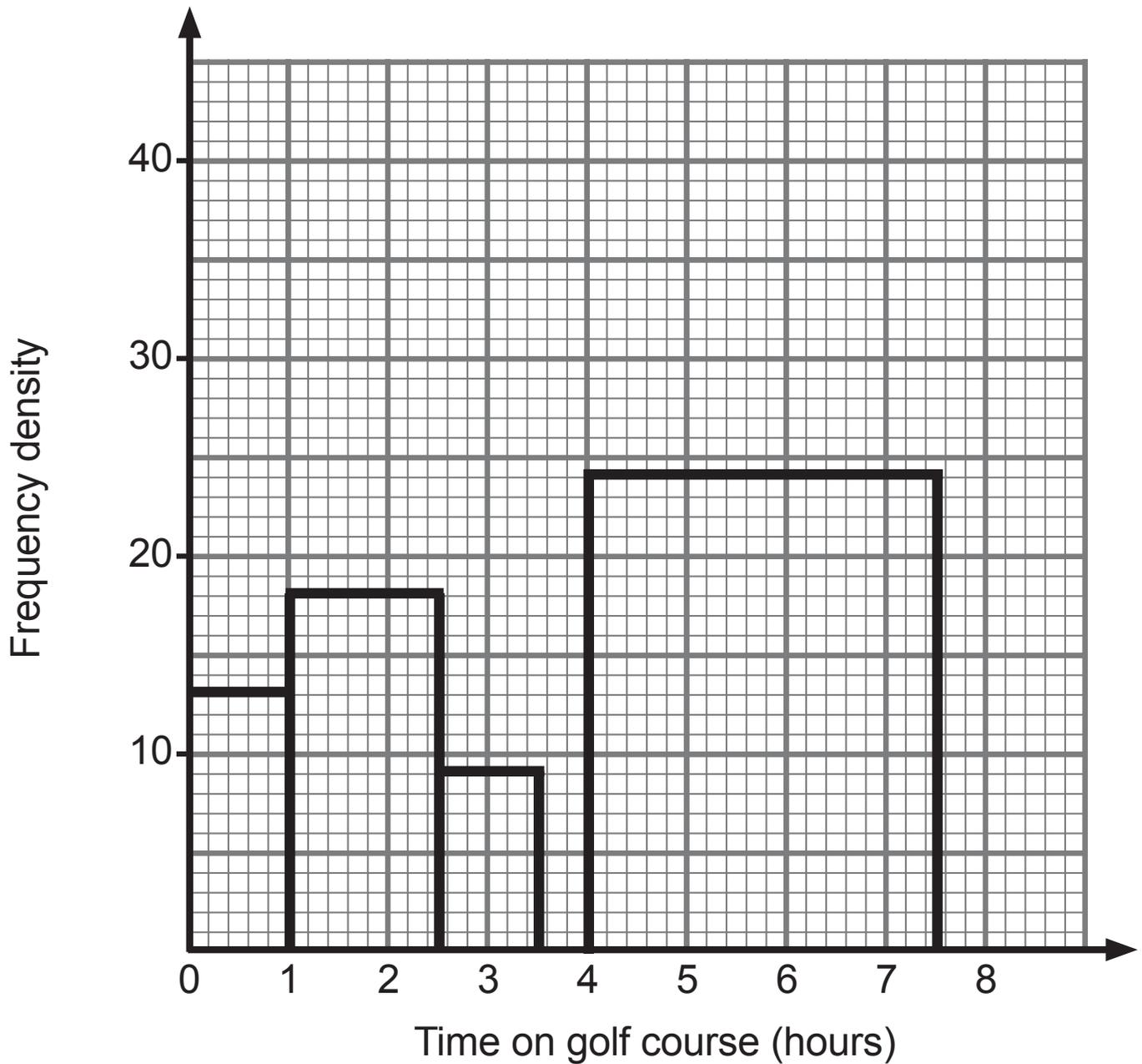
**20** An events manager orders 600 sandwiches for a finger buffet. This will give all the guests the same number of sandwiches each.

At the last minute 10 extra guests arrive. This will still give all the guests the same number of sandwiches each, but two less each than previously calculated.

Let  $n$  be the original number of guests. Form an equation in  $n$  and solve to find  $n$ . [6 marks]

Answer  $n =$  \_\_\_\_\_

- 21 The histogram represents some information about the length of time a number of golfers spent on the golf course one Saturday. No one spent more than  $7\frac{1}{2}$  hours on the course.



The charges for using the golf course are shown in the table below.

<b>Length of time</b>	<b>Up to 2.5 hours</b>	<b>2.5 up to 3.5 hours</b>	<b>3.5 to 4 hours</b>	<b>Over 4 hours</b>
<b>Cost (£)</b>	25	30	35	40

The amount of money raised for the Saturday was £5295

Use all the given information to complete the missing bar on the histogram. [7 marks]

**Show all your working clearly.**

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**THIS IS THE END OF THE QUESTION PAPER**

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For Examiner's use only	
Question Number	Marks
1	
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<b>Total Marks</b>	
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Examiner Number

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