



Rewarding Learning

General Certificate of Secondary Education  
January 2014

Centre Number

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Candidate Number

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## Mathematics

Unit T4

(With calculator)



Higher Tier

[GMT41]



\*GMT41\*

FRIDAY 10 JANUARY 9.15 am–11.15 am

### TIME

2 hours.

### 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. Do not write outside the box, around each page, on blank pages or tracing paper.**

Complete in blue or black ink only. **Do not write with a gel pen.**

Answer **all twenty** questions.

Any 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 down the right-hand side of pages 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 3(b) and 10**.

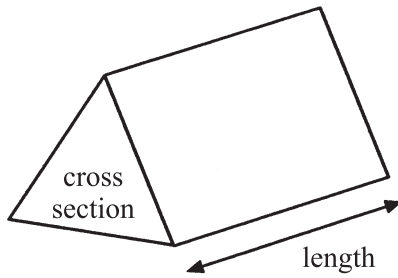
You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.

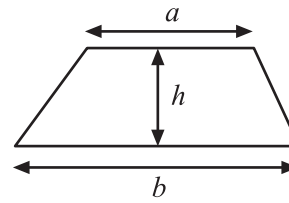


# Formula Sheet

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

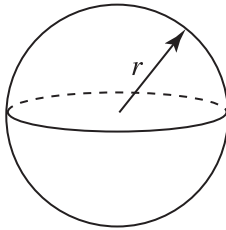


**Area of trapezium** =  $\frac{1}{2}(a+b)h$



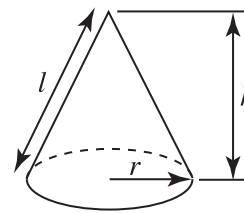
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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

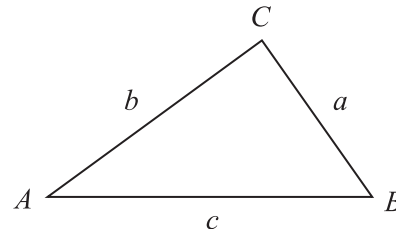


**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

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



**In any triangle ABC**



**Quadratic Equation**

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

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

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

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

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





1 On every swing, a pendulum reaches 60% of the previous distance.

The pendulum swings 1.8 metres on its first swing.

After how many swings will the distance first fall below 20 cm?

Examiner Only	
Marks	Remark

Total Question 1	

Answer \_\_\_\_\_ swings [2]

2 During a very cold winter a glacier increased its volume by 32%.

At the end of the winter its volume was found to be  $6864 \text{ km}^3$ .

What was its original volume at the start of that winter?

Total Question 2	

**[Turn over**

8693

Answer \_\_\_\_\_  $\text{km}^3$  [3]



\*24GMT4103\*

Quality of written communication will be assessed in part (b) of this question.

3 The information given below relates to the ages (in years) of members of a badminton club.

Lower Quartile = 28

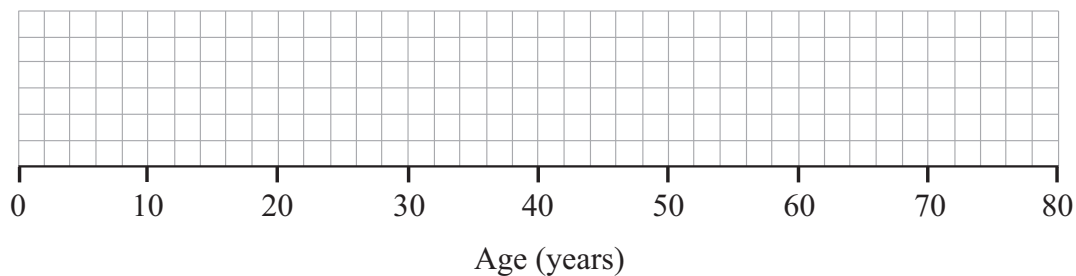
Median = 32

Upper Quartile = 54

Youngest = 12

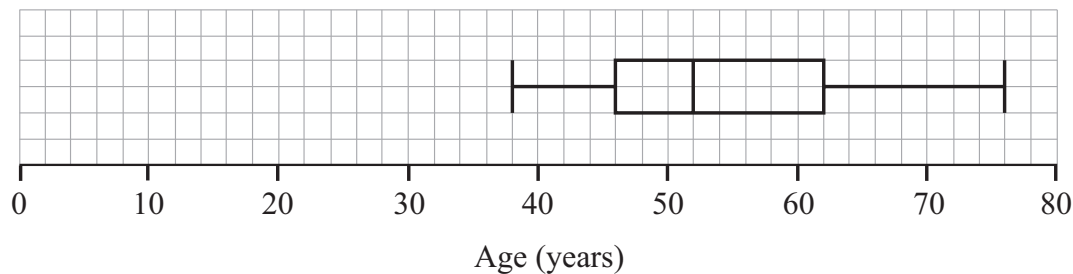
Range = 58

(a) Draw a box plot to show this information.



[3]

(b) The box plot below shows the age distribution of members of a bowls club.



Compare the age distributions of the members of the badminton club and the bowls club.

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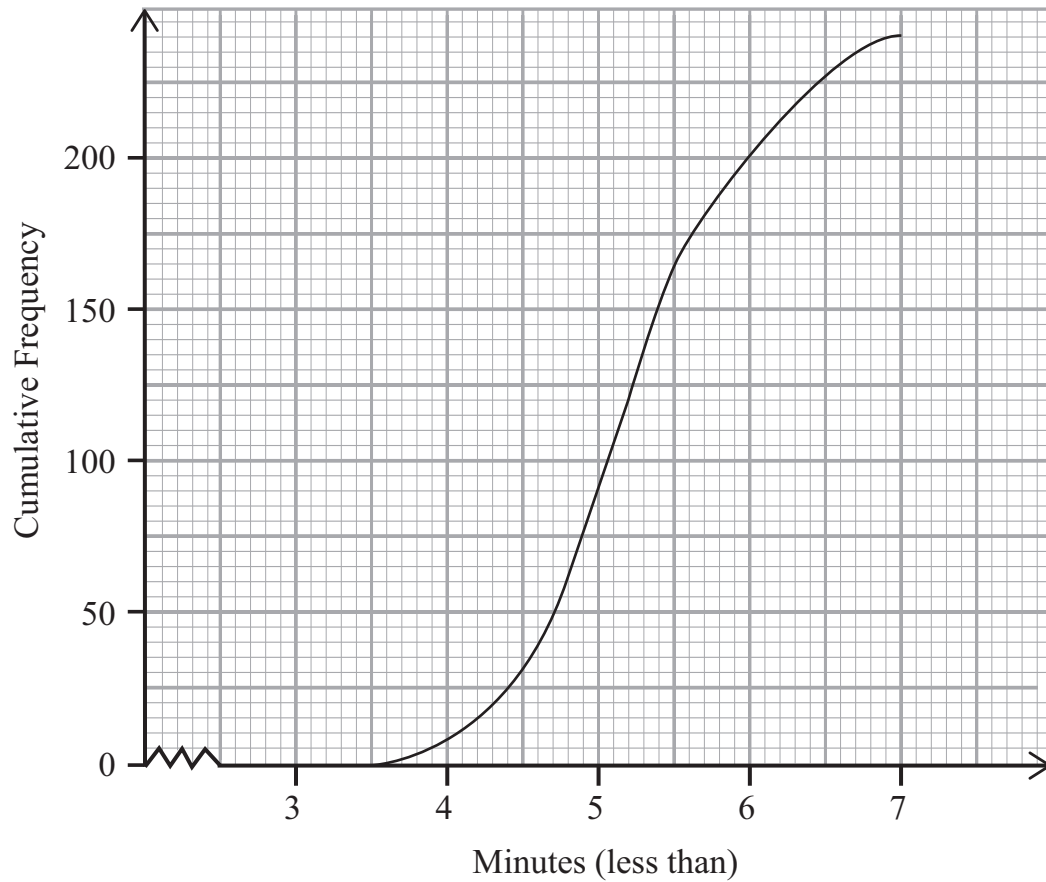
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[2]

Examiner Only	
Marks	Remark
Total Question 3	



- 4 The cumulative frequency curve represents the times taken to run 1500 m by each of the members of a running club.



- (a) Use the graph to estimate the interquartile range.

Answer \_\_\_\_\_ minutes [2]

- (b) Any member taking more than  $5\frac{1}{2}$  minutes has to do extra training. Use the graph to estimate the percentage of runners who have to undertake extra training.

Answer \_\_\_\_\_ % [2]

Examiner Only

Marks	Remark

Total Question 4

[Turn over



5 PQRS represents a rectangular gate. PS = 200 cm and SR = 300 cm.

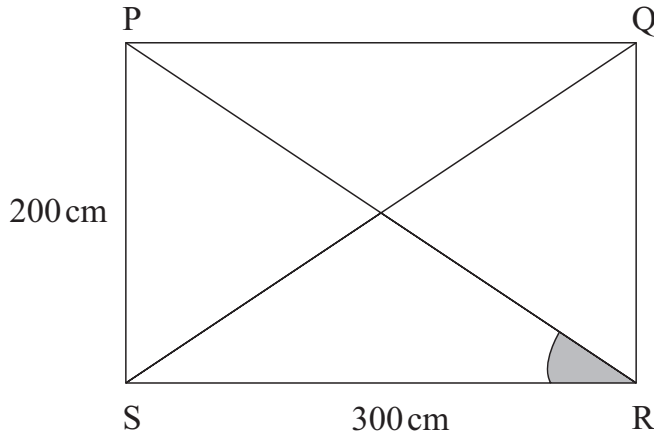


diagram not drawn accurately

(a) Calculate the size of angle PRS

Answer \_\_\_\_\_ ° [3]

(b) The measurements of the gate are all to the nearest centimetre. What is the smallest possible perimeter of the gate?

Answer \_\_\_\_\_ cm [2]

Examiner Only	
Marks	Remark
Total Question 5	





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**(Questions continue overleaf)**  
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- 6 (a) R, S, T and U are points on the circumference of a circle, centre O.  
The angle RUS is  $46^\circ$  and the angle URT is  $36^\circ$

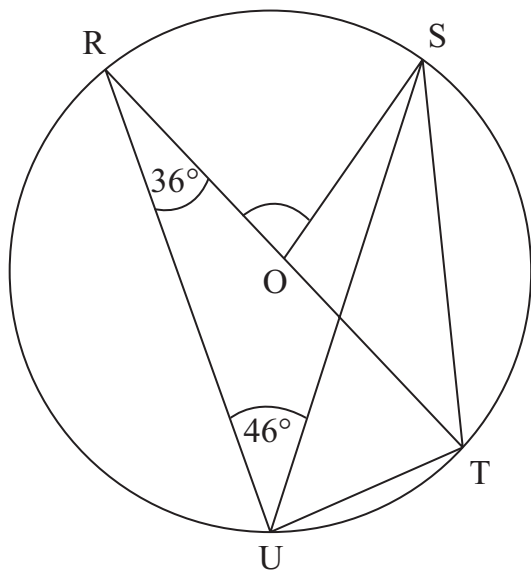


diagram not  
drawn accurately

Calculate

- (i) the angle RTS,

Answer \_\_\_\_\_  $^\circ$  [1]

- (ii) the angle ROS,

Answer \_\_\_\_\_  $^\circ$  [1]

- (iii) the angle SUT.

Answer \_\_\_\_\_  $^\circ$  [1]

Examiner Only	
Marks	Remark





- (b) D, E, F and G are points on the circumference of the circle below.  
 The angle FDG =  $62^\circ$  and the angle DFG =  $31^\circ$   
 HG is a tangent to the circle.

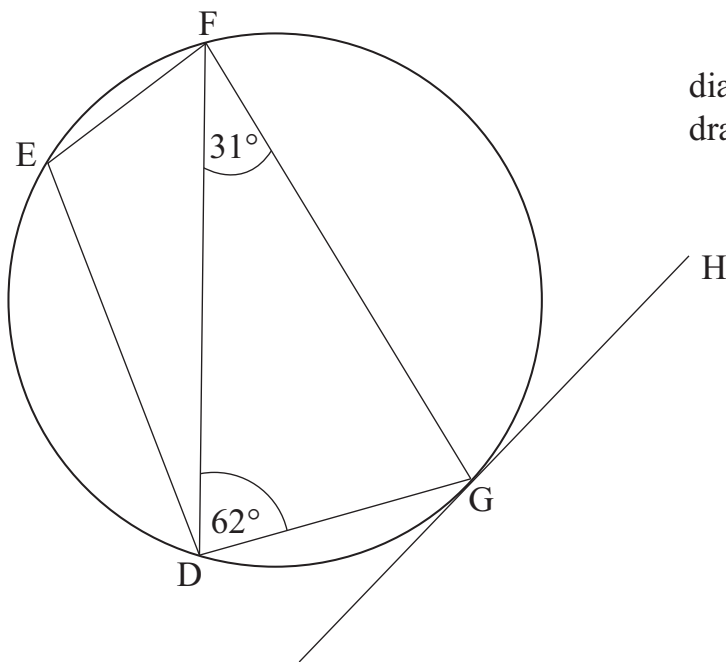


diagram not  
drawn accurately

- (i) Write down the size of angle FGH.

Answer \_\_\_\_\_  $^\circ$  [1]

- (ii) Calculate the size of angle DEF.

Answer \_\_\_\_\_  $^\circ$  [2]

Examiner Only

Marks	Remark
Total Question 6	

[Turn over





- 8 (a) Solve the simultaneous equations  
**Show your working.**  
**A solution by trial and improvement  
will not be accepted.**

$$3x + 2y = 10$$

$$2x - 6y = 3$$

Answer  $x =$  \_\_\_\_\_ ,  $y =$  \_\_\_\_\_ [3]

- (b) Hence write down the coordinates of the point of intersection of the two lines whose equations are

$$3x + 2y = 10 \quad \text{and} \quad 2x - 6y = 3$$

Answer ( \_\_\_\_\_ , \_\_\_\_\_ ) [1]

Examiner Only

Marks

Remark

Total Question 8

[Turn over



- 9 The breadth of a cuboid is 1 cm less than the length  $y$  cm.  
 The height is 6 cm.  
 The volume of the cuboid is  $72 \text{ cm}^3$ .

(a) Show that  $y^2 - y - 12 = 0$

[3]

(b) Solve the equation  $y^2 - y - 12 = 0$  by factorising.  
 Explain why only one answer makes sense in the question.

Answer \_\_\_\_\_  
 \_\_\_\_\_ [3]

Examiner Only	
Marks	Remark
Total Question 9	



Quality of written communication will be assessed in this question.

10 (a) The test results for a class are recorded as

26 26 29 32 37 38 40 41 99

Why would the mean **not** be the **most suitable** average to use when commenting on these results?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(b) In another test the results are recorded as

18 18 18 18 19 27 29 36 39 47 59 62

Which average would be **least suitable** to use when commenting on these results? Give a reason for your answer.

\_\_\_\_\_ because \_\_\_\_\_  
\_\_\_\_\_ [1]

Examiner Only

Marks

Remark

Total Question 10

[Turn over



**11** A park keeper wishes to estimate the number of frogs in a large pond. He catches 180 frogs, tags them and returns them to the pond. Later he catches 80 frogs and records that 24 of them are tagged. Estimate the number of frogs in the pond.

Answer \_\_\_\_\_ [2]

Examiner Only	
Marks	Remark
Total Question 11	



12 The electrical resistance,  $R$  ohms, of a wire varies inversely as the square of its diameter,  $d$  mm.

A wire, 6 mm in diameter, made from a certain alloy has a resistance of 36 ohms.

(a) Express  $R$  in terms of  $d$ .

Answer  $R =$  \_\_\_\_\_ [3]

(b) (i) Work out the electrical resistance of a wire made from the same alloy whose diameter is 9 mm.

Answer \_\_\_\_\_ ohms [1]

(ii) Another wire made from the same alloy has an electrical resistance of 20 ohms.

Work out the diameter of this wire.

Answer \_\_\_\_\_ mm [2]

Examiner Only

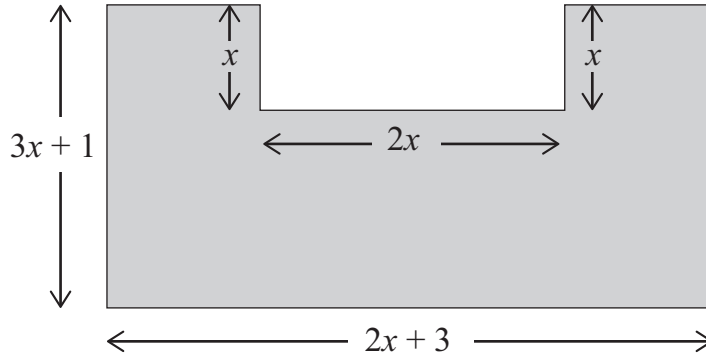
Marks Remark

Total Question 12

[Turn over



- 13** A rectangular piece of card has a length of  $(2x + 3)$  cm and a width of  $(3x + 1)$  cm.  
 A rectangle of length  $2x$  cm and width  $x$  cm is cut from it as shown in the diagram.  
 The remaining piece of card, shown shaded in the diagram, has an area of  $25 \text{ cm}^2$ .



- (a) Show that  $4x^2 + 11x - 22 = 0$

[3]

- (b) Solve the equation  $4x^2 + 11x - 22 = 0$  to find the value of  $x$ .  
 Give your answer to 3 significant figures.

Answer  $x =$  \_\_\_\_\_ [3]

Examiner Only	
Marks	Remark
Total Question 13	





14 Without using a calculator and showing every step clearly in your working, find the value of

$$\left(2\frac{1}{4}\right)^{-1.5}$$

Answer \_\_\_\_\_ [4]

Examiner Only

Marks Remark

Total Question 14

[Turn over



15 Town B is 73 km from Town A on a bearing of  $069^\circ$

Town C is 64 km from A on a bearing of  $112^\circ$

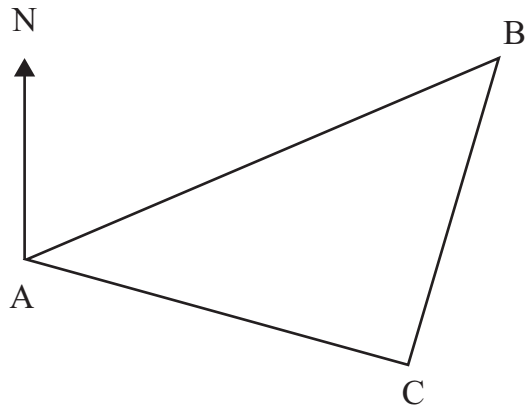


diagram not  
drawn accurately

Calculate

(a) the distance between B and C,

Answer \_\_\_\_\_ km [3]

(b) the area of triangle ABC,

Answer \_\_\_\_\_ km<sup>2</sup> [2]

Examiner Only

Marks	Remark



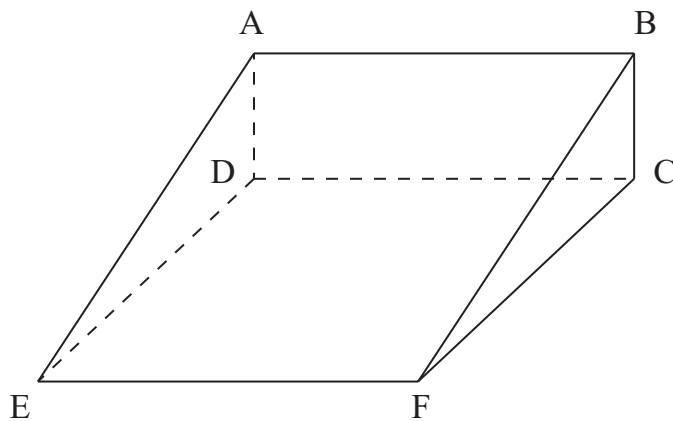
(c) the bearing of B from C.

Examiner Only

Marks	Remark
Total Question 15	

Answer \_\_\_\_\_ ° [4]

- 16** ABCDEF is a ramp which is in the shape of a triangular prism.  
AB = 120 cm, FC = 90 cm and BC = 30 cm. Angle FCB = 90°  
Calculate the angle between EB and the base DCFE.



Answer \_\_\_\_\_ ° [3]

Total Question 16

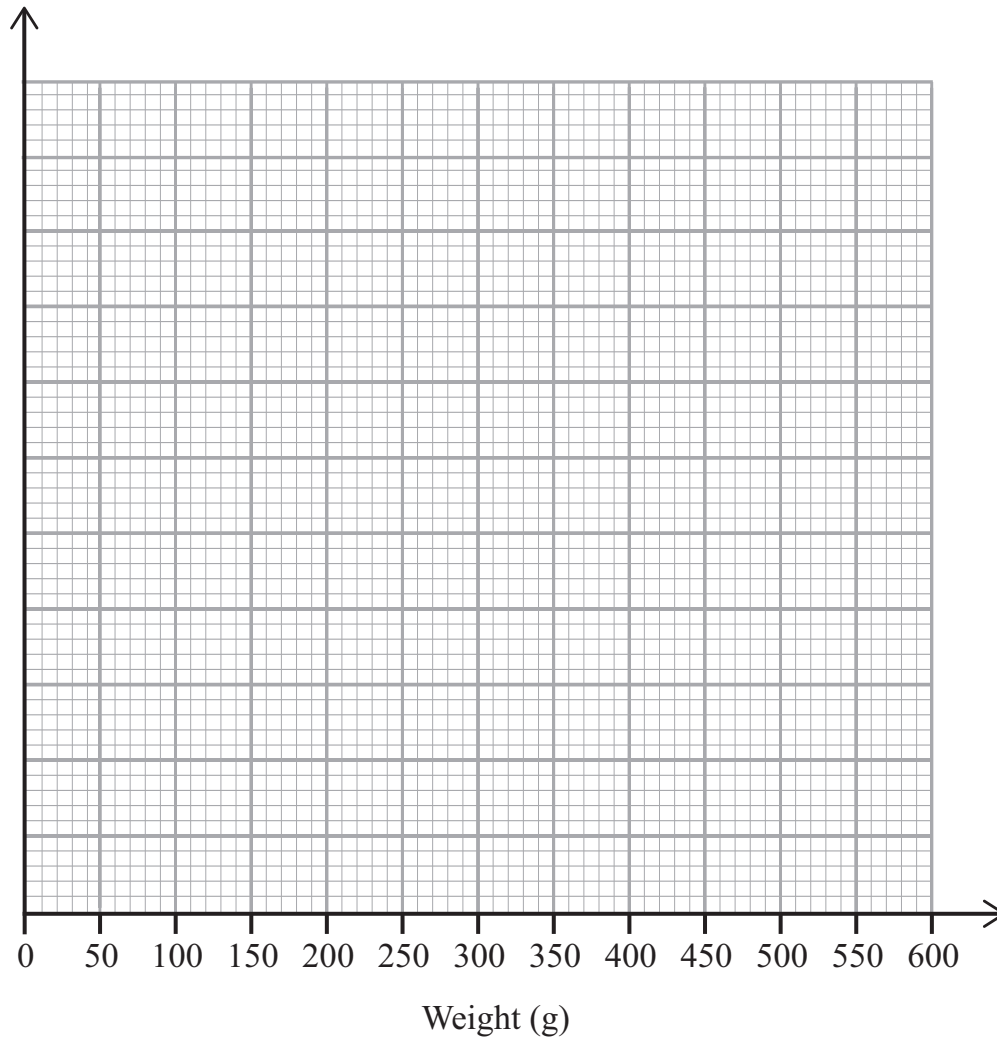
[Turn over



- 17 (a) The weights of packages passing through a Post Office in one day are recorded below.

Weight (g)	Frequency
$0 < w \leq 100$	80
$100 < w \leq 150$	200
$150 < w \leq 250$	160
$250 < w \leq 400$	540
$400 < w \leq 550$	360
$550 < w \leq 600$	130

On the axes below draw a clearly labelled histogram to illustrate this information.



[3]

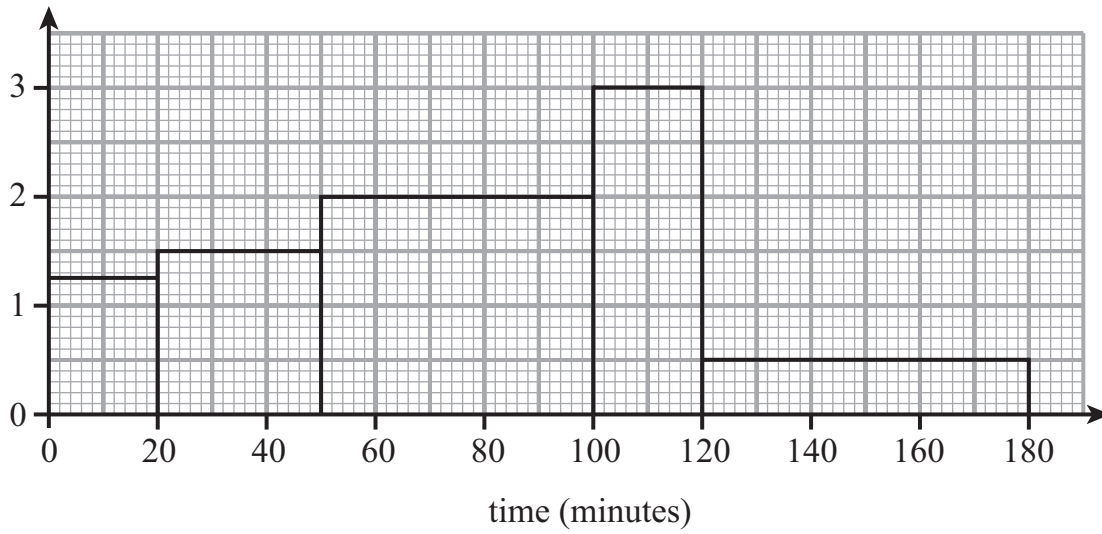


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Marks	Remark



(b) The histogram illustrates how much time cars spent in a car park.

frequency  
density



(i) Calculate an estimate for the mean time.

Answer \_\_\_\_\_ minutes [4]

(ii) Half the cars using the car park were there for more than M minutes.  
Calculate an estimate for the value of M.

Answer \_\_\_\_\_ minutes [3]

Examiner Only

Marks	Remark

Total Question 17

[Turn over





19 Simplify fully  $\frac{3}{x+3} + \frac{2x+21}{x^2+x-6}$

Examiner Only

Marks	Remark
Total Question 19	

Answer \_\_\_\_\_ [5]

20 Given that  $\frac{16^a}{9^b} = 54^{\frac{1}{2}}$   
find the values of  $a$  and  $b$ .

Answer  $a =$  \_\_\_\_\_ ,  $b =$  \_\_\_\_\_ [5]

Total Question 20



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Question Number	Marks
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Examiner Number

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