Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2018

Mathematics

Unit T3
(With calculator)
Higher Tier

ML

[GMT31]
MONDAY 8 JANUARY, 9.15am–11.15am

TIME

2 hours, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

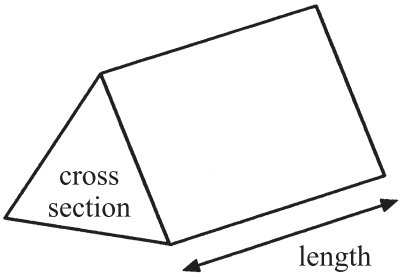
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only.
Answer **all twenty-five** questions.
All working should be clearly shown in the spaces provided. 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 **12**, **23** and **24**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

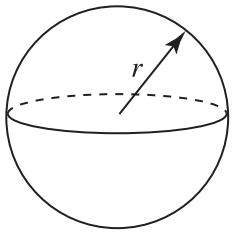
Formula Sheet

Volume of prism = area of cross section × length



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

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

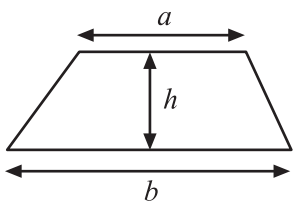


Quadratic Equation

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

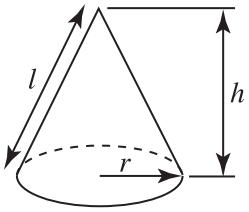
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

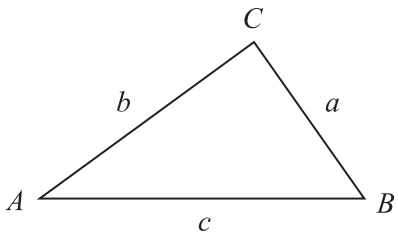


Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle *ABC*



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 The diagram below shows the position of a lighthouse (L) and a boat (B).

What is the bearing of the boat from the lighthouse?

Answer _____ ° [1]

[Turn over

2 Karan uses $\frac{2}{5}$ of a tin of baby food each day for her baby.

Karan and her baby are going on a 7-day holiday.

What is the smallest number of tins of baby food that Karan must bring with her?

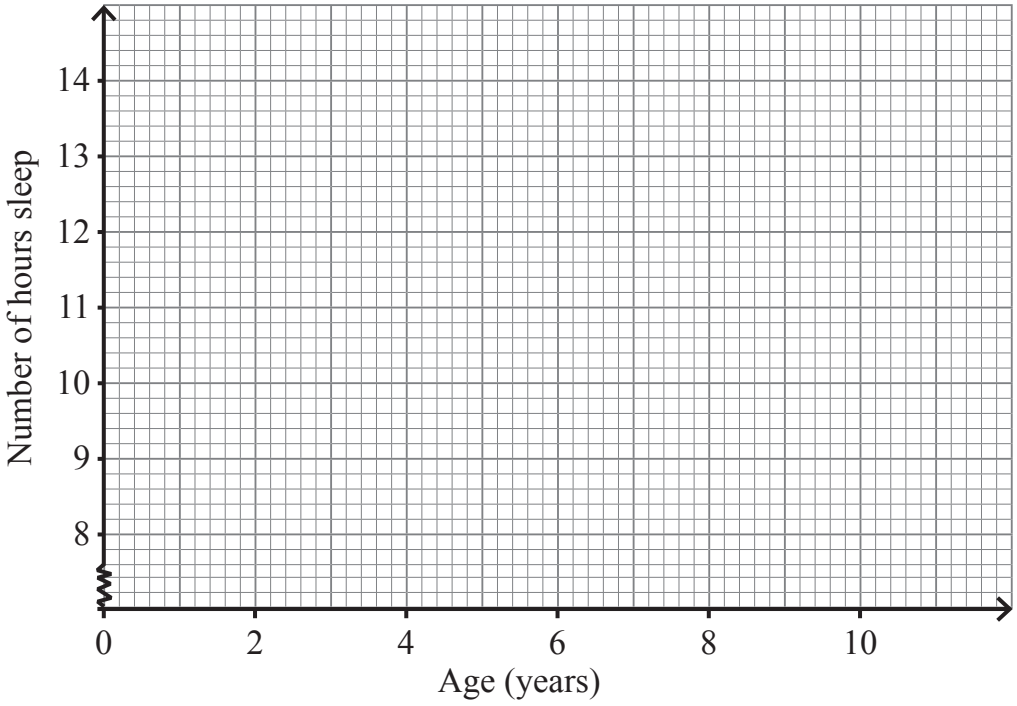
Show your working out.

Answer _____ tins [3]

3 The table below shows the ages of seven children and the number of hours sleep each child had last night.

Age (years)	4	5	6	7	8	10	11
Number of hours sleep	13	12	12.5	11.5	11.4	10.8	10

(a) Use the grid below to show this information on a scatter graph.



[2]

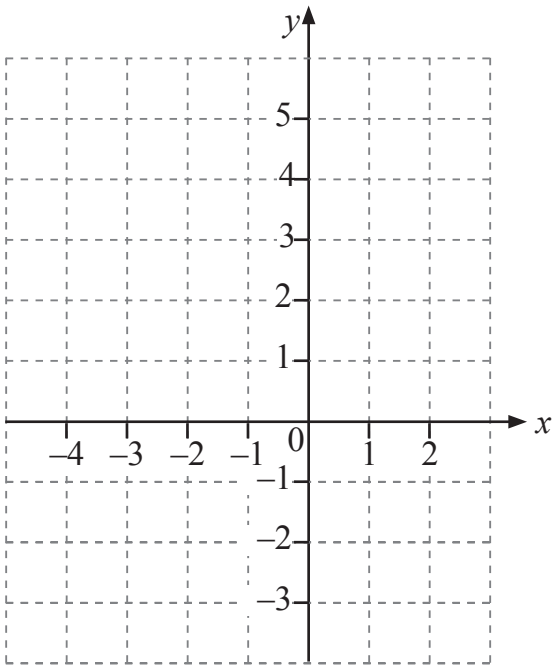
(b) Draw a line of best fit on the scatter graph. [1]

(c) Use your line of best fit to estimate the number of hours sleep for a 9 year-old child last night.

Answer _____ hours [1]

[Turn over

4



P is the point (–4, 3) and Q is the point (0, –2).

Find the co-ordinates of the midpoint of PQ.

Answer (_____ , _____) [2]

5

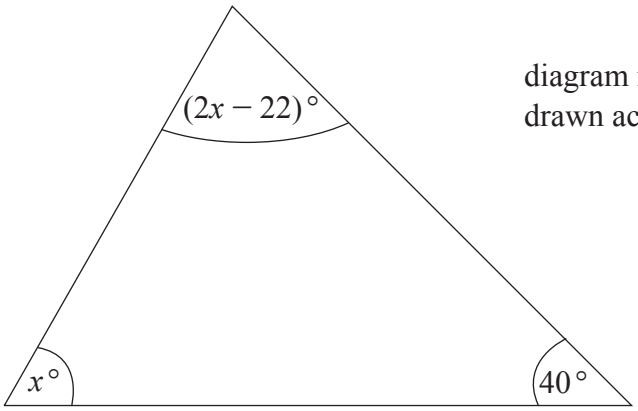


diagram not
drawn accurately

The diagram shows a triangle with angles of 40°, x° and $(2x - 22)$°

Work out the value of x.

Answer x = _____ [4]

[Turn over

6

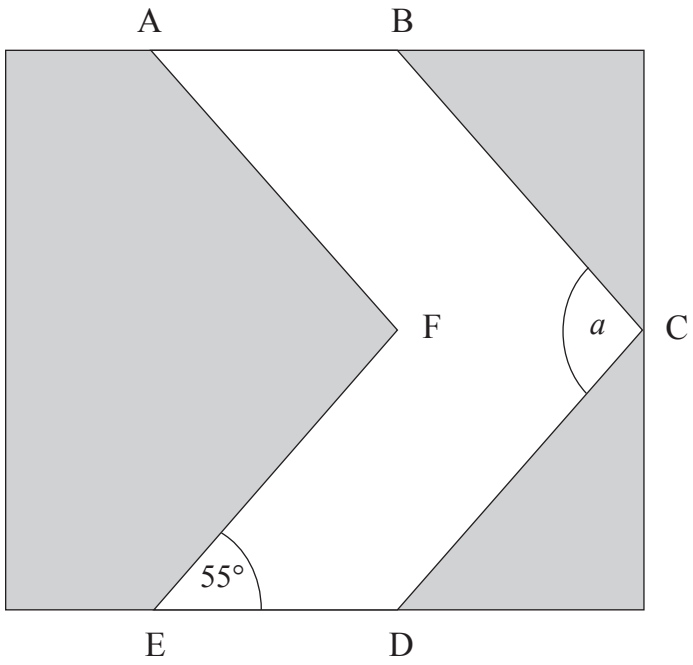


diagram not drawn accurately

The diagram above shows a symmetrical road sign.

AB is parallel to ED.

AF is parallel to BC.

EF is parallel to DC.

The angle DEF = 55°

Work out the size of angle *a*.

Answer _____ ° [2]

7 To work out a gas bill each month, the Gas Company charges 4.12 p for each unit of gas used.

There is also a fixed charge of 9.43 p per day.

Finally, VAT at 5% is added to the total amount.

Conor used 2435 units of gas during November.

Work out his monthly gas bill for November.

Answer £ _____ [5]

[Turn over

8 Here are the ages, in years, of 21 teachers.

45	35	52	42	27	36	49
23	31	47	50	55	34	41
37	44	30	28	45	53	26

Draw a stem and leaf diagram to show this data.

[3]

9 Twenty-five students scored goals for the school team last month.

The table gives information about the number of goals they scored.

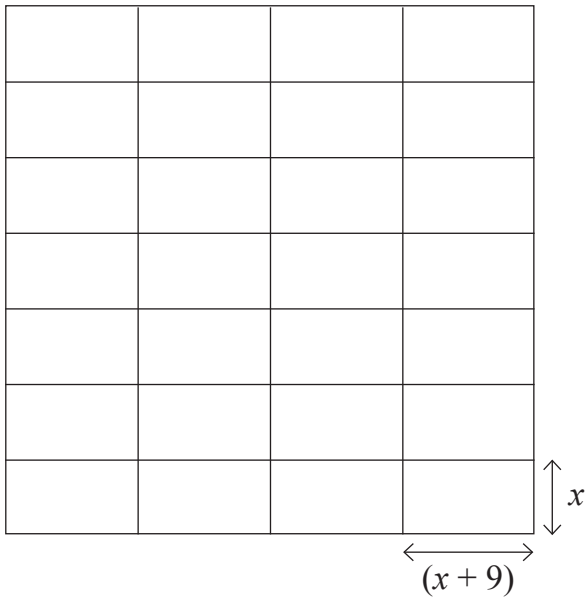
Goals scored	Number of students	
1	12	
2	7	
3	4	
4	2	

Work out the mean number of goals scored per student last month.

Answer _____ [3]

[Turn over

10



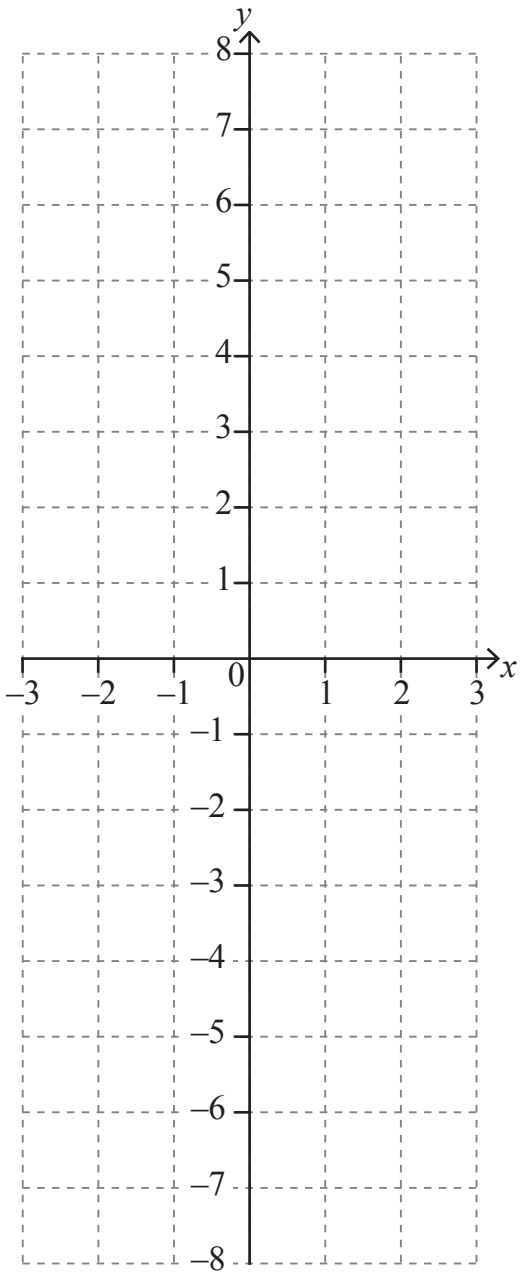
The diagram above shows how 28 rectangular tiles have been arranged on a kitchen wall to produce a square.

Each tile has a width of x cm and a length of $(x + 9)$ cm.

Form an equation in x and solve it to find the value of x.

Answer $x =$ _____ [4]

11 **(a)** Draw the graph of $y = 5x - 3$ on the grid below.



[3]

(b) Hence, or otherwise, write down the co-ordinates of the point where the line $y = 7$ crosses the line $y = 5x - 3$

Answer (_____ , _____) [2]

[Turn over

Quality of written communication will be assessed in this question.

12 (a) Which of the angles listed below could be the interior angle of a regular polygon?

Circle all the correct answers.

Show all your working out.

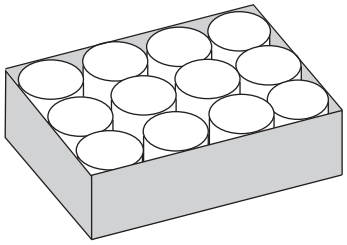
140° 135° 130° 125° 120° 115°

[4]

(b) Choose one of your answers to **(a)** and write down the name of the polygon.

Answer: The polygon with interior angle of _____° is called a _____ [1]

13 A box just holds 12 cylindrical tins as shown.
The diameter of each tin is 8 cm.



Calculate the area of the base of the box **not** covered by the tins.

Answer _____ cm^2 [5]

[Turn over

14 **(a)** Expand and simplify

$$a(a + b) + 3b(a - 2)$$

Answer _____ [2]

(b) Solve $\frac{x}{3} - \frac{1}{2} = 4$

Answer $x =$ _____ [3]

(c) Write down an expression for the n^{th} term of the sequence

4, 7, 10, 13, 16, ...

Answer _____ [2]

15 A solution to the equation $x^3 - 4x = 82$ lies between $x = 4$ and $x = 5$
Use trial and improvement to solve this equation.
Give your answer correct to 1 decimal place.
Show all your working clearly.

x	$x^3 - 4x$	

Answer $x =$ _____ [3]

[Turn over

16 **(a)** Given that $1001 = 7 \times 11 \times 13$, write 9009 as a product of primes.

Answer _____ [2]

(b) Given that $945 = 3^3 \times 5 \times 7$, use **(a)** to find the HCF of 945 and 9009

Answer _____ [2]

17 The length of time taken by workers in a factory to travel to work is recorded in the table.

Time (minutes)	Frequency		
$10 \leq t < 15$	2		
$15 \leq t < 20$	12		
$20 \leq t < 25$	18		
$25 \leq t < 30$	8		
$30 \leq t < 35$	6		
$35 \leq t < 40$	4		

(a) Calculate an estimate for the mean time taken by the workers to travel to work.

Answer _____ minutes [3]

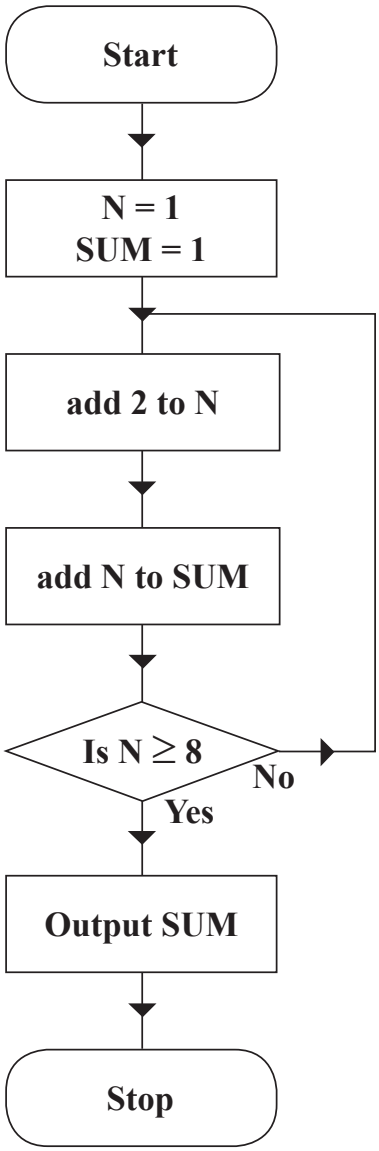
(b) Explain why your answer in **(a)** is only an estimate of the time taken.

Answer _____

_____ [1]

[Turn over

18



(a) Find the SUM output from the flowchart.

N	SUM

Answer SUM = _____ [2]

(b) (i) Describe in words the function carried out by the flowchart.

_____ [1]

(ii) Hence if the decision box N ≥ 8 was replaced with N ≥ 12, what would the output SUM be?

Answer SUM = _____ [2]

[Turn over

19 **(a)** Factorise

(i) $8rt + 12t^2$

Answer _____ [2]

(ii) $k^2 - 16$

Answer _____ [1]

(b) Solve the simultaneous equations $4x - y = 3$
$6x + 2y = 1$

Show all your working out.
A solution by trial and improvement will not be accepted.

Answer $x =$ _____

$y =$ _____ [3]

20 Bob was given a 3.5% pay rise.
His salary is now £25 378.20
What was his salary before the rise?

Answer £ _____ [3]

[Turn over

21 A square of side x cm is lengthened by 2 cm on one side and 4 cm on the other side to create a rectangle.

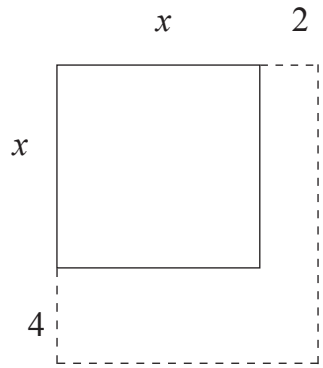


diagram not drawn accurately

(a) Write an expression for the area of the rectangle.

Answer _____ [2]

(b) The area of the rectangle is 48cm^2
Show that $x^2 + 6x - 40 = 0$

[2]

(c) Hence solve the equation to find the value of x.

Answer x = _____ [3]

22 Calculate the size of angle x below.

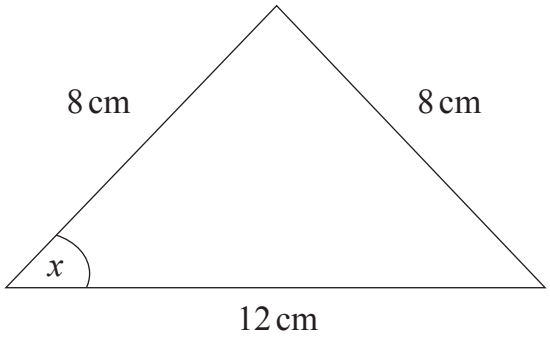


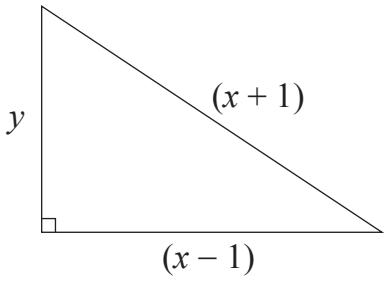
diagram not
drawn accurately

Answer _____ ° [4]

[Turn over

Quality of written communication will be assessed in this question.

23



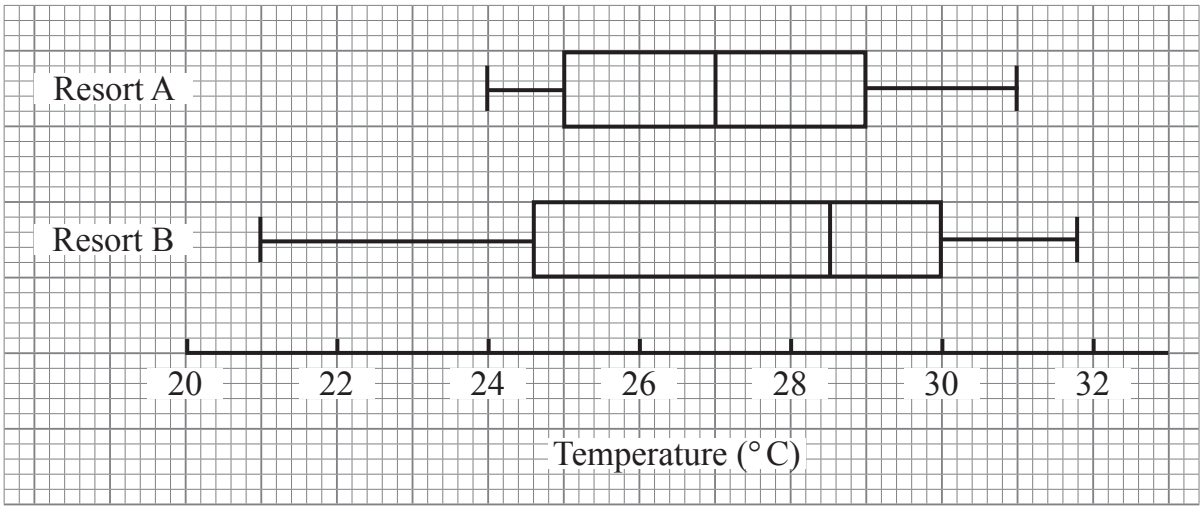
x is a square number.

Prove that y is an even number.

[5]

Quality of written communication will be assessed in this question.

24 The average daily temperature during the month of July was recorded each day in two holiday resorts. The data is represented in the box plots below.



Jill likes to holiday where it is warm.

Using appropriate statistical vocabulary, explain why Jill may choose to go to

(a) Resort A,

_____

_____ [1]

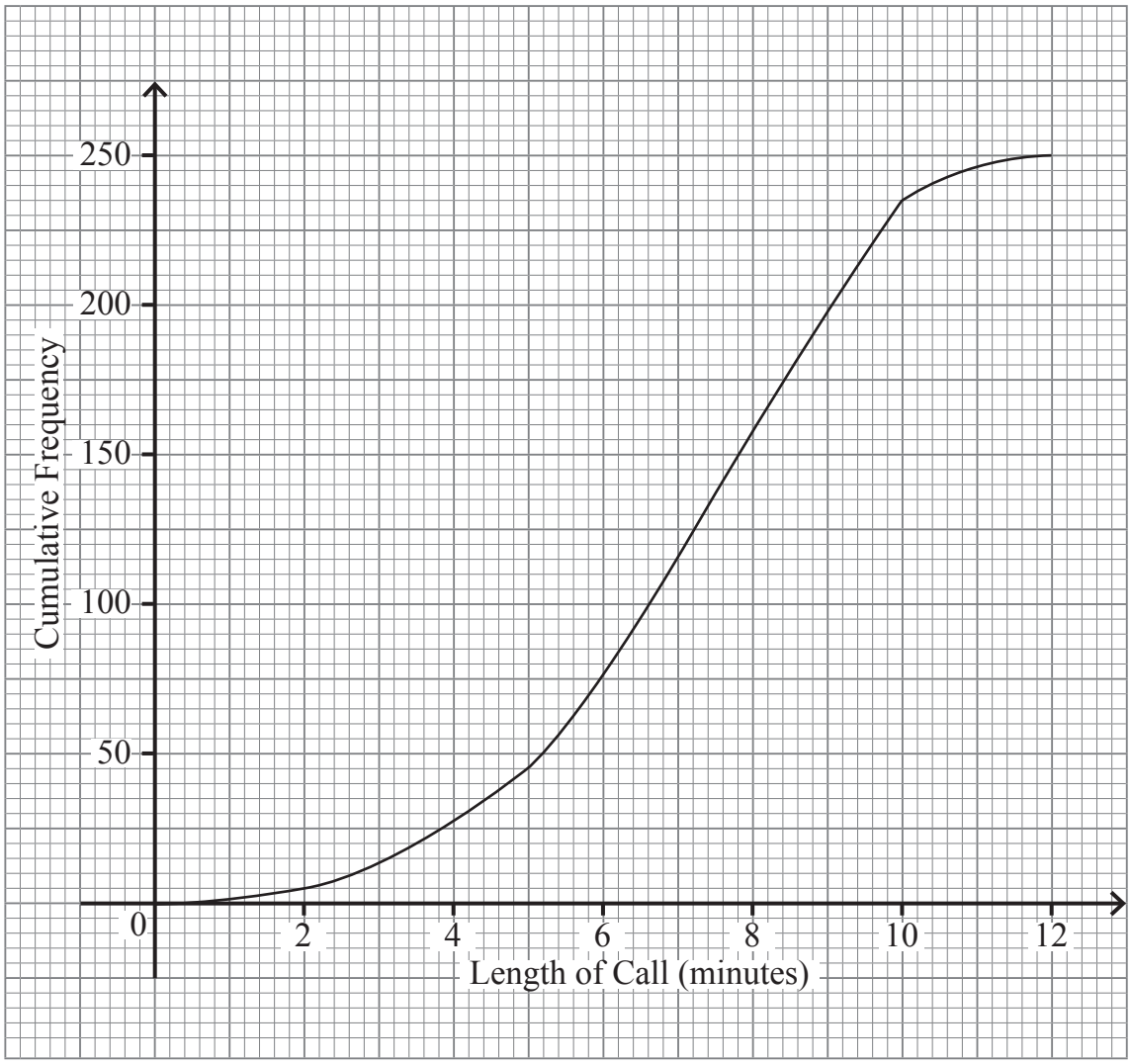
(b) Resort B.

_____

_____ [1]

[Turn over

25 The lengths of calls received by a call centre one day are recorded and shown on the cumulative frequency graph.



Use the graph to estimate

(a) the median,

Answer _____ minutes [1]

(b) the percentage of calls which lasted between 5 and 10 minutes.

Answer _____ % [3]

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For Examiner's use only	
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