Mathematics

Unit T3 **(With calculator)**

Higher Tier

[GMT31]

GMT31

THURSDAY 21 MAY, 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 boxed area on 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-seven** 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.
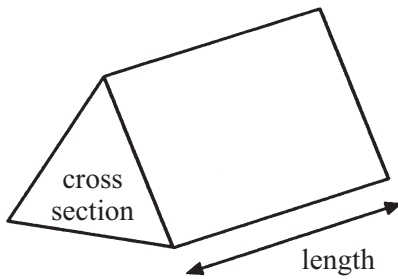Quality of written communication will be assessed in **Questions 3** and **23**.
You should have a calculator, ruler, compasses and a protractor.
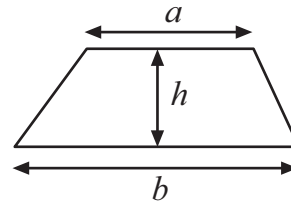The Formula Sheet is on page 2.

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Formula Sheet

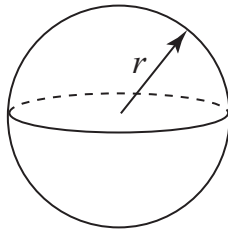**Volume of prism** $=$ area of cross section $\times$ length

cross section

length

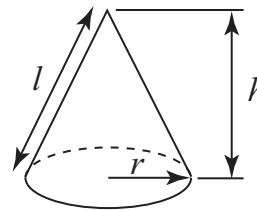**Area of trapezium** $= \frac{1}{2}(a+b)h$

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

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

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

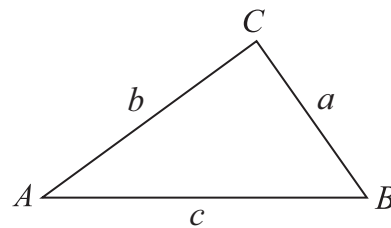**Curved surface area of cone** $= \pi r l$

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

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

In any triangle ABC

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

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

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

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1 The number of goals scored in each match in a football tournament are recorded in the table.

Number of Goals	Frequency	
0	2	
1	8	
2	13	
3	10	
4	9	
5	5	
6	2	
7	1	

Calculate the mean number of goals.

Answer _____ [3]

2 A salesman recorded the average temperature (°C) and his cold drink sales (£) during 8 weeks of the summer.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Average Temperature (°C)	**12**	**14**	**18**	13	16	15	14	18
Sales (£)	**204**	**268**	**392**	236	328	298	282	380

The first three points have already been plotted.

(a) Use the data to complete the scatter graph. [2]

(b) Draw the line of best fit. [1]
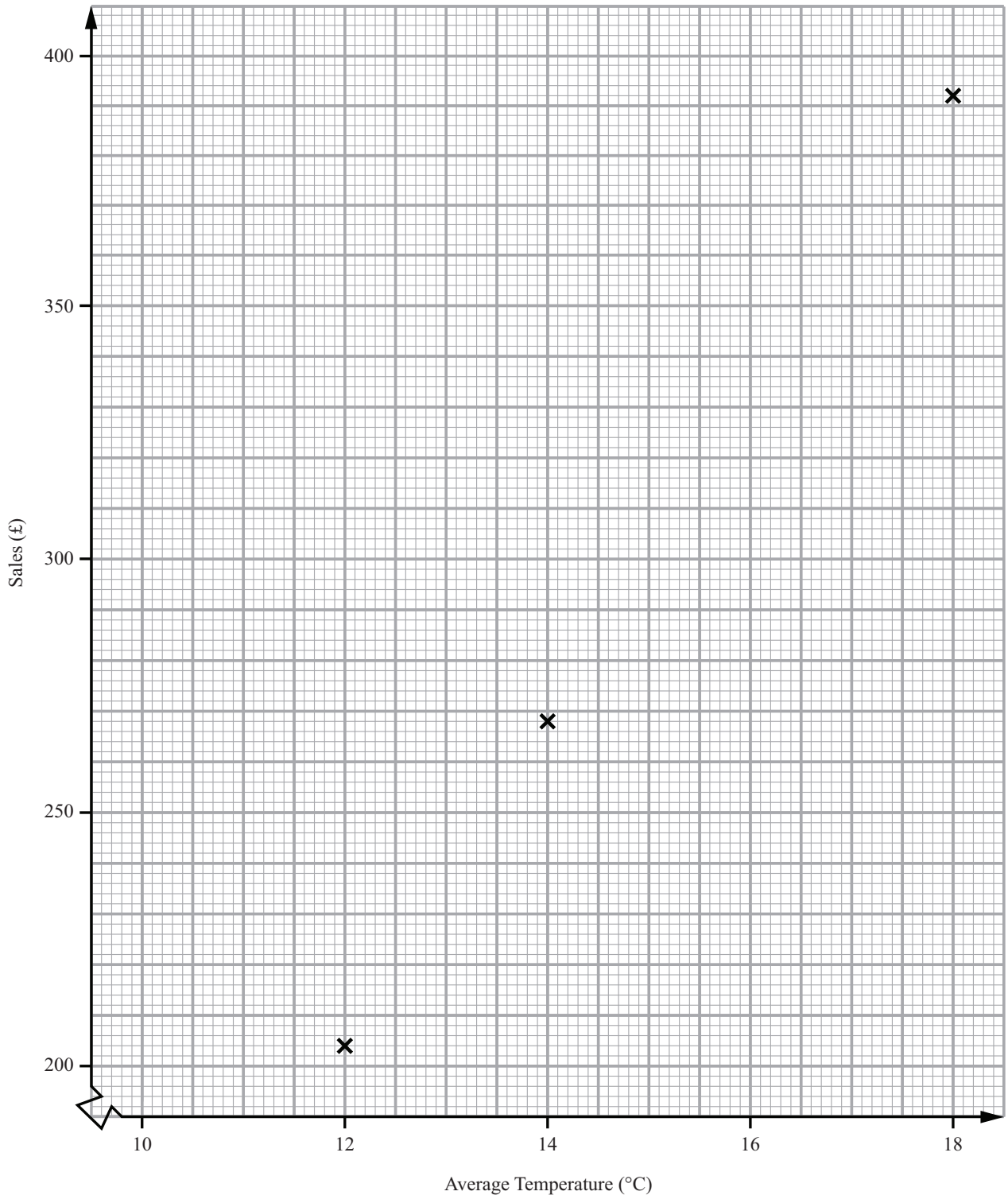
(c) In week 9 the average temperature was 17°C.

Estimate the sales for week 9

Answer £ _____ [1]

(d) What type of correlation does your graph show?

Answer _____ [1]

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Sales (£)

Average Temperature (°C)

Quality of written communication will be assessed in this question.

3 Jean and Joyce are both pupils at Eastwood Girls High School and they want to know how many times a month, on average, the people in their town go to church.

(a) Jean asks 300 pupils in her school.

Give **two** reasons why Jean's sample may not be representative of the people in her town.

Reason 1 _____

_____ [1]

Reason 2 _____

_____ [1]

(b) Joyce stands outside her local church and asks 300 people on their way in to church.

Give **one** reason why Joyce's sample is biased.

Reason _____

_____ [1]

4 An airport had 123 planes departing one day.
46 of these planes departed late.
What percentage were late?
Give your answer correct to one decimal place.

Answer _____ % [3]

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5 Grapefruit cost g pence each.
Mangoes cost m pence each.
Sarah buys 3 grapefruit and 4 mangoes.
The total cost is £5.
Write down an equation containing g and m.

Answer _____ [3]
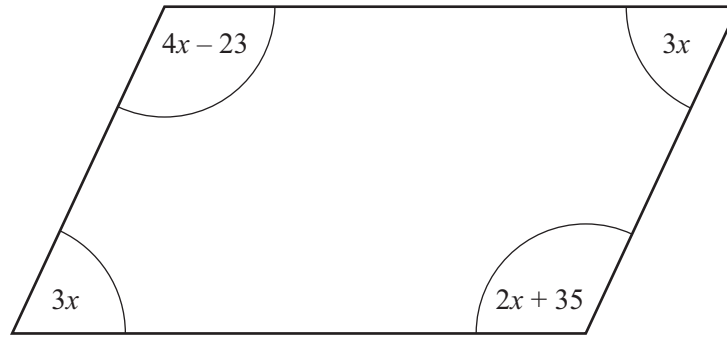
6 **(a)** Expand $m(m + 8)$

Answer _____ [2]

(b) Simplify $\dfrac{b}{5} - \dfrac{b}{8}$

Answer _____ [3]

7

The diagram above is a parallelogram.
The sizes of the angles in degrees are $3x$, $4x - 23$, $3x$ and $2x + 35$
Work out the value of x.

Answer $x =$ _____ [3]

8 The price of a coat in a shop is £129
Pat has £100 but he has also a discount card which allows him 20% off the shop price.
Does he have enough money to buy the coat using his discount card?
You must show working to explain your answer.

[3]

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9 *a* and *b* are different prime numbers less than 20

(a) Find a value for *a* and a value for *b* so that *a* + *b* is a square number.

Answer *a* = _____ , *b* = _____ [2]

(b) Find a value for *a* and a value for *b* so that *a* + *b* is a **different** square number.

Answer *a* = _____ , *b* = _____ [2]

[Turn over

10 A regular polygon has an interior angle of 150°

    (a) How many sides does it have?
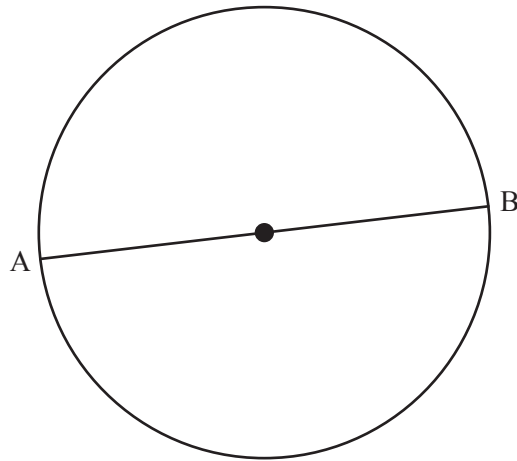
Answer _____ [2]

    (b) Two of these polygons are placed edge to edge.

        What regular shape would fit exactly in the space beside these touching edges?
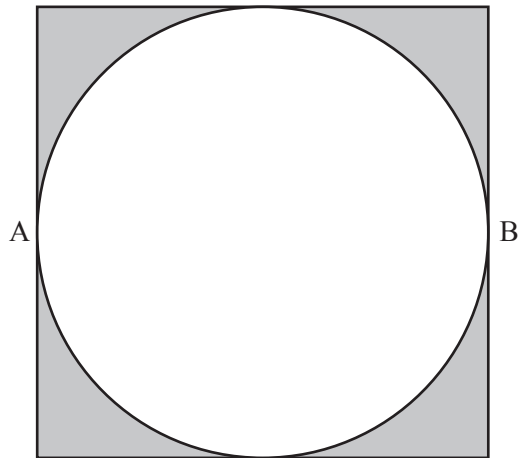
Answer _____ [2]

11

(a) AB is a diameter of the circle. AB is 13 cm.

Calculate the area of the circle.

Answer ———————————— [3]

(b) This circle is now set inside a square as shown. Find the shaded area.

Answer ———————————— [2]

[Turn over

12 Solve the equation $\dfrac{4y}{5} - 3 = 9$

Answer $y =$ _____ [3]

13 Five years ago 123 million CDs were sold in the UK.
69.4 million were sold last year.
Work out the percentage fall in sales of CDs.
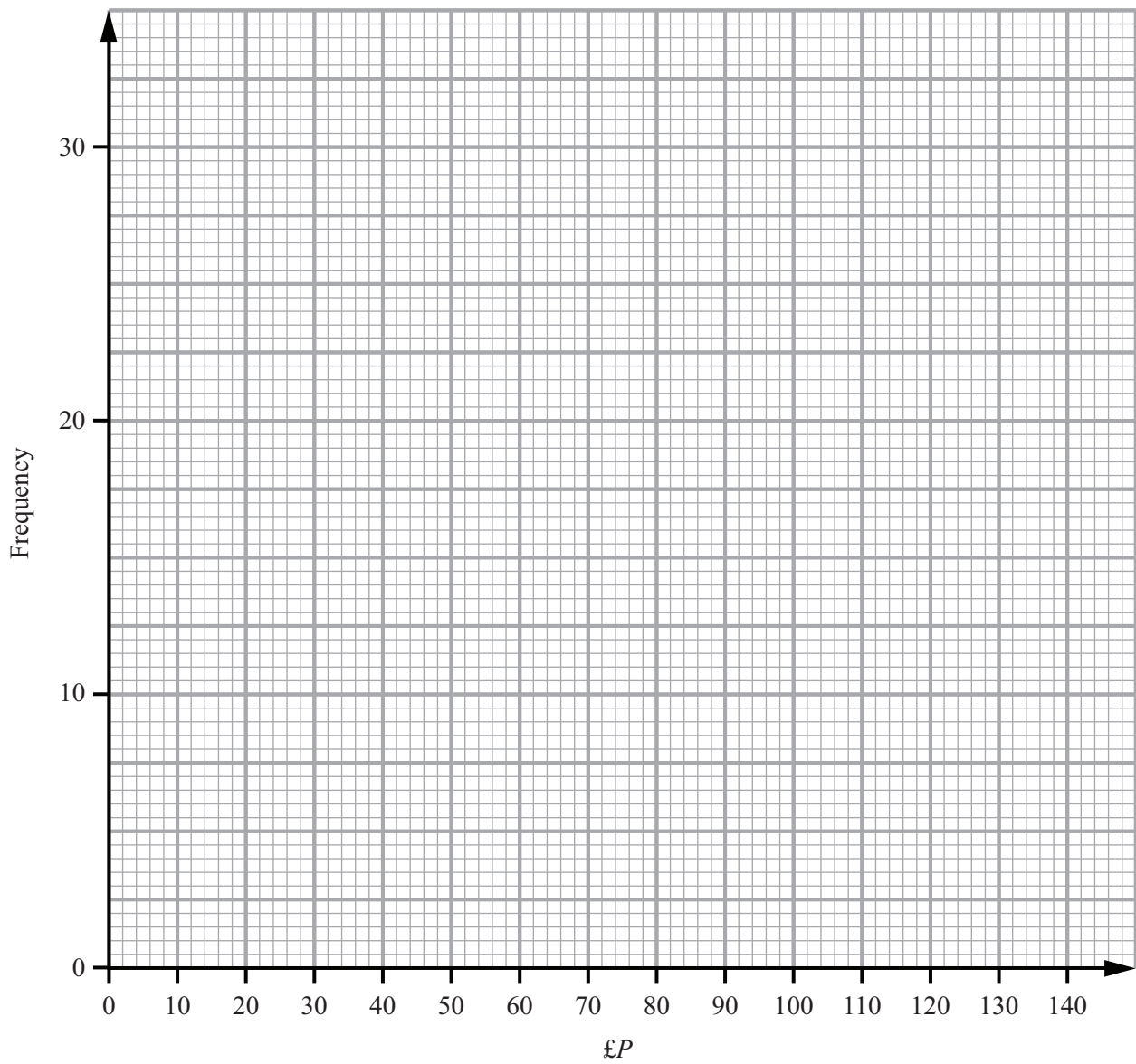
Answer _____% [3]

14 100 shoppers were asked how much they spent on food in one week.

Amount spent (£P)	Frequency
$20 < P \leqslant 40$	8
$40 < P \leqslant 60$	30
$60 < P \leqslant 80$	28
$80 < P \leqslant 100$	27
$100 < P \leqslant 120$	5
$120 < P \leqslant 140$	2

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(a) Draw a frequency polygon to show this information. [2]

Frequency (y-axis) from 0 to 30+, labelled at 10, 20, 30.

£*P* (x-axis) from 0 to 140, labelled at 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140.

(b) Which class interval contains the median?

Answer _____ [1]

15

Start

Input a, b

Calculate
R = $a^2 + b^2$

Is R a square number?

No → Add 1 to a
Add 1 to b

Yes

Print a, b, R

Stop
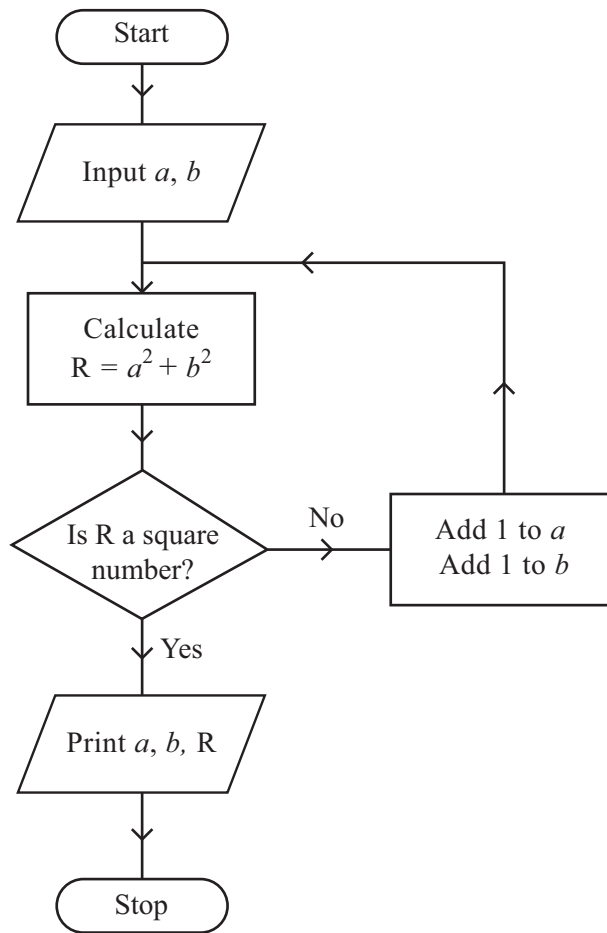
Starting with $a = 6$, $b = 13$ use the flow chart to find the values printed.

a	b	R
6	13	

Answer a = _____ , b = _____ , R = _____ [3]

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16 In the triangular prism ABC is a right-angled triangle.
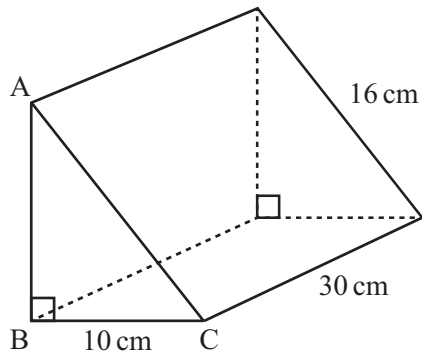
(a) Calculate the length of AB.

Answer _____ cm [3]

(b) Calculate the volume of the prism.

Answer _____ cm^3 [3]

17 The equation $x^3 + 4x^2 = 100$ has a solution between 1 and 5
Use a trial and improvement method to find this solution.
Give your answer correct to one decimal place.
You must show all your working.

Answer $x = $ _____ [4]

18 John thinks of a number.
He multiplies it by 9 and subtracts 4
The answer is three times the number he started with.
Work out the starting number.

Answer _____ [2]

19 (a) (i) Write 30 as a product of prime factors.

Answer 30 = _____ [1]

(ii) Write 22 as a product of prime factors.

Answer 22 = _____ [1]

(b) An airport bus leaves the city hall every 30 minutes.
A shuttle bus leaves the city hall every 22 minutes.
An airport bus and a shuttle bus both leave the city hall at 8.00 am.
At what time will an airport bus and a shuttle bus next leave the city hall at the
same time?

Answer _____ [3]

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(Questions continue overleaf)

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20 The times that students spent doing homework during one week were recorded as shown in the table.

Time t (hours)	Frequency	Cumulative Frequency
$0 < t \leqslant 5$	18	
$5 < t \leqslant 10$	30	
$10 < t \leqslant 15$	32	
$15 < t \leqslant 20$	15	
$20 < t \leqslant 25$	5	

(a) (i) Complete the table. [1]

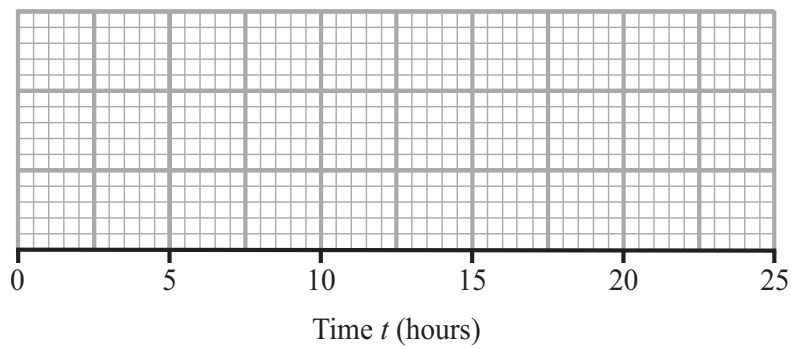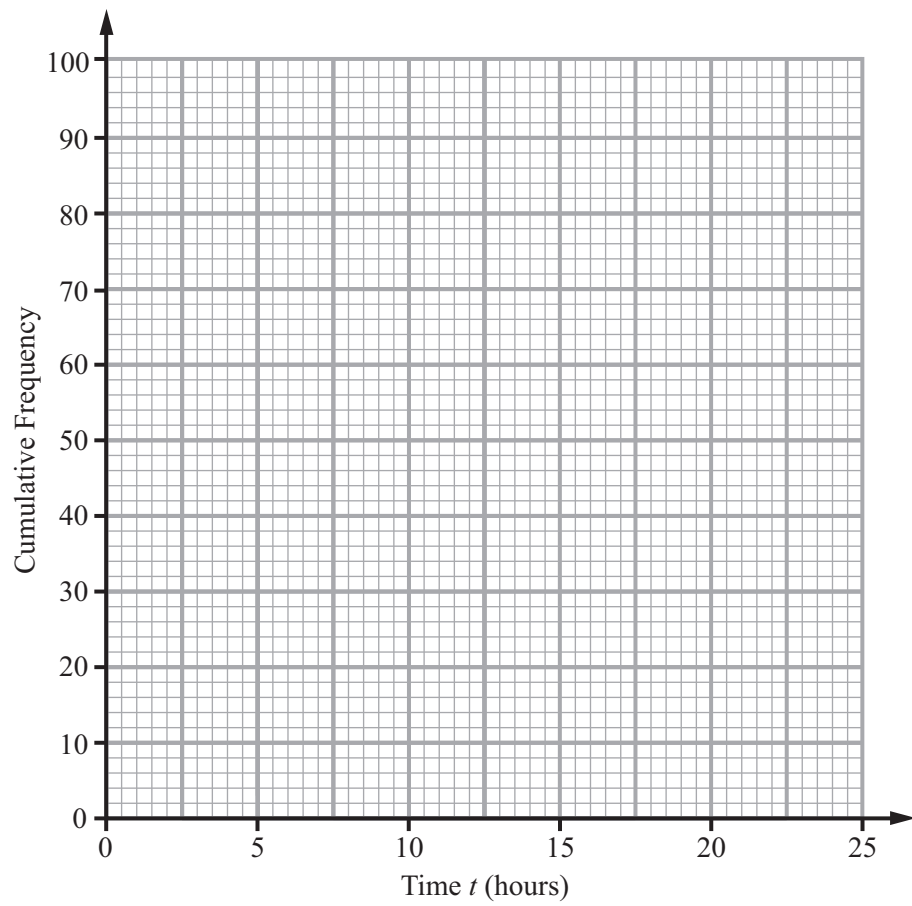**(ii)** Hence draw the cumulative frequency graph on the opposite page. [3]

(b) Use the graph to estimate the median.

Answer _____ hours [1]

(c) The least time was 2 hours and the greatest time was 24 hours.

Draw a box plot on the grid opposite to illustrate this information. [3]

Cumulative Frequency

0   5   10   15   20   25

Time *t* (hours)

0   5   10   15   20   25

Time *t* (hours)

21 Expand and simplify $(3w - 7)(5w - 8)$

Answer _____ [2]

22 The first three terms of a sequence are $\frac{1}{2}, \frac{2}{3}, \frac{3}{4} \ldots$

Write down the nth term.

Answer _____ [1]

Quality of written communication will be assessed in this question.

23 Marie gets a basic monthly salary of £560 plus a commission of 22% of her sales that month.
In April her total salary was £3299
Work out her sales in April.

Answer £ _____ [3]

24 Solve the simultaneous equations $5x + 2y = 19$
$4x - 3y = 29$

A solution by trial and improvement will not be accepted.
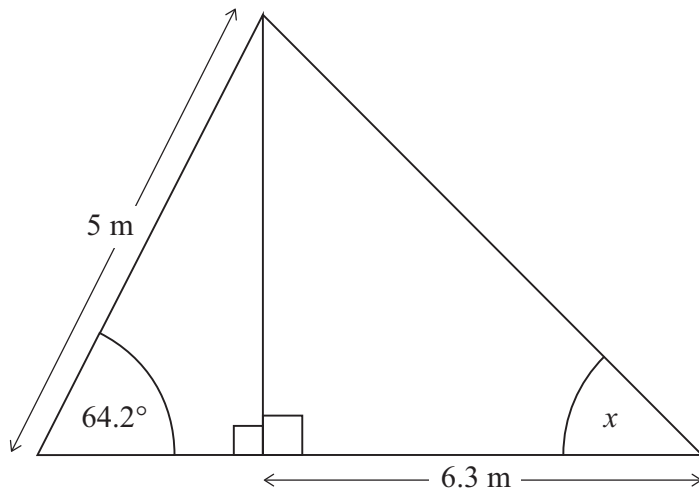
Answer $x =$ _____ , $y =$ _____ [4]

25 Factorise fully $14x^2y - 35x$

Answer _____ [2]

26 Find the value of the angle marked x in the triangle shown.

5 m

64.2°

6.3 m

x

Answer $x =$ _____ ° [6]

27 Solve the equation $\dfrac{2x+3}{4} + \dfrac{x-1}{3} = 5$

Show all your work.

Answer $x =$ _____ [4]

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