Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2019

Mathematics

Unit T3
(With calculator)
Higher Tier

[GMT31]

GMT31

TUESDAY 8 JANUARY, 9.15am–11.15am

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 or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all twenty-six** 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 **4(b)** and **23**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

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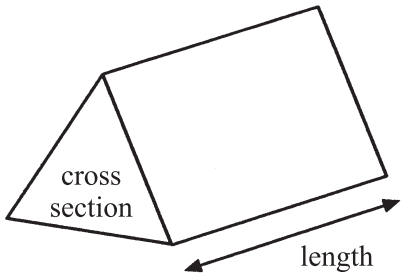
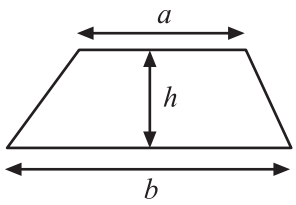
Formula Sheet

Volume of prism = area of cross section × length

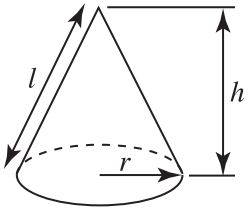


Area of trapezium $= \frac{1}{2}(a+b)h$



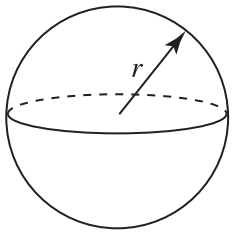
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

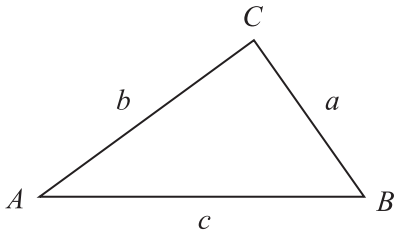


Volume of sphere $= \frac{4}{3}\pi r^3$

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



In any triangle *ABC*



Quadratic Equation

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

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

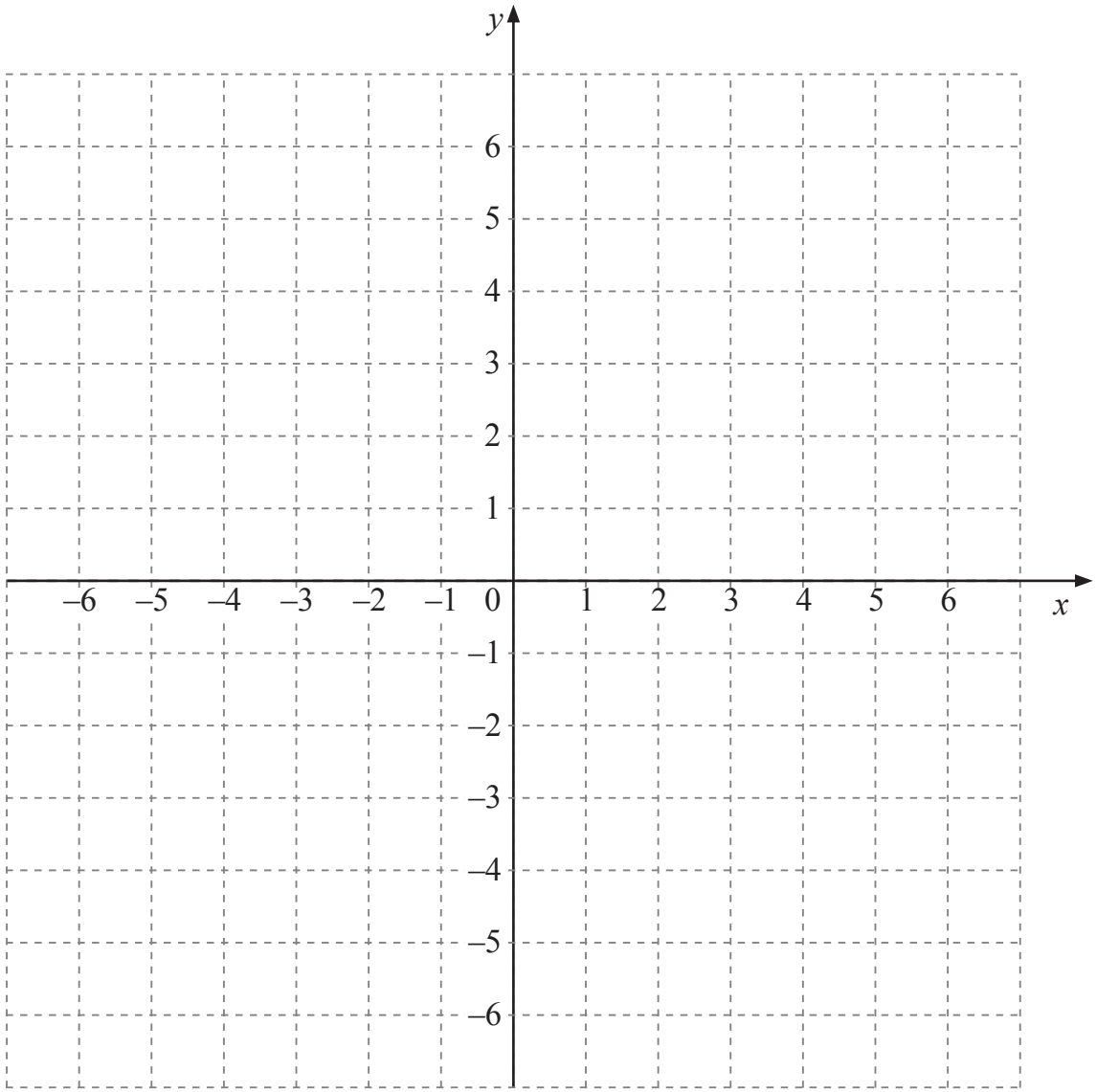
Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

1 P is the point (–4, 5). Q is the point (2, –3).

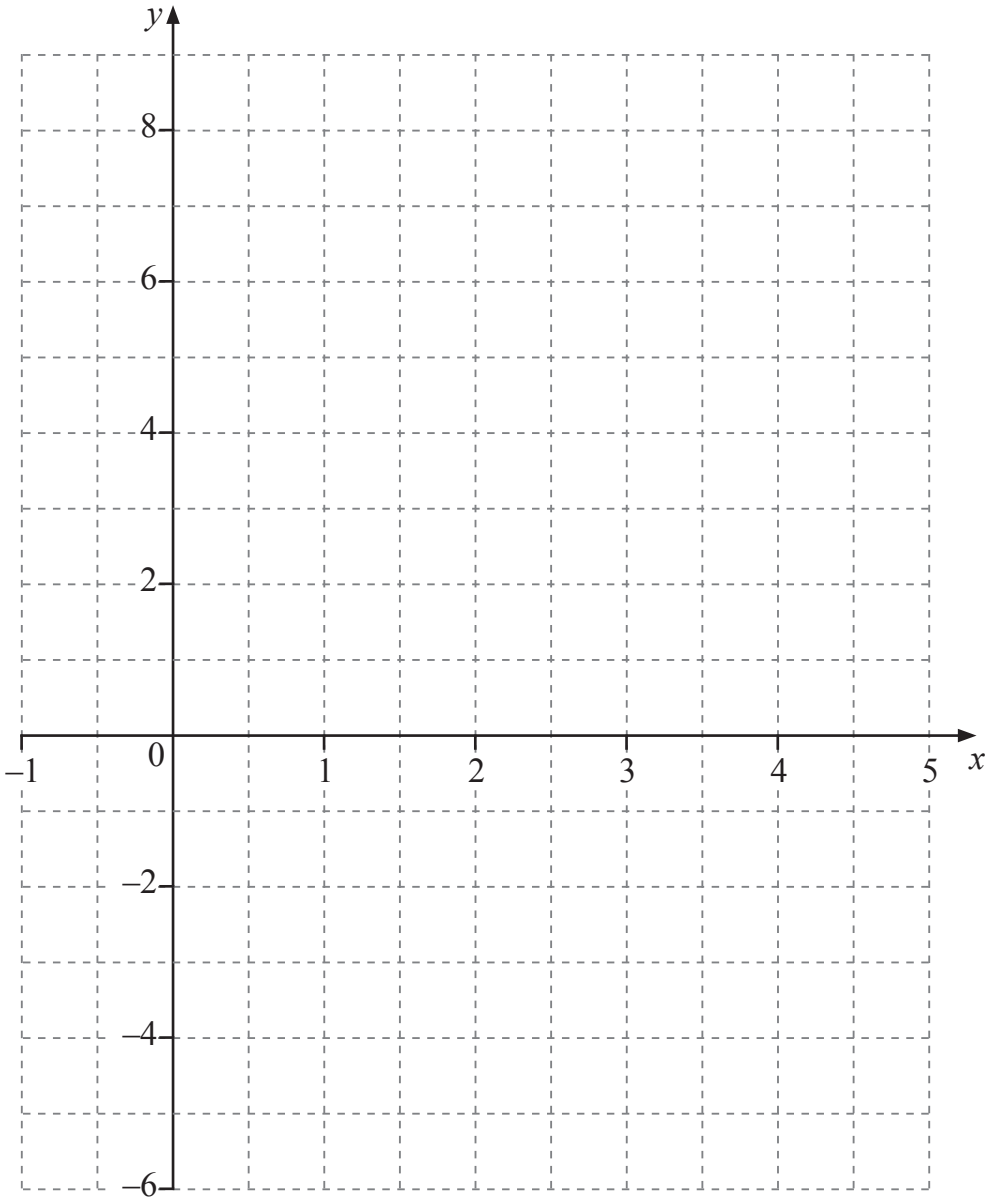
Write down the coordinates of the midpoint of PQ.



Answer (_____ , _____) [2]

[Turn over

2 **(a)** Draw the line of $y = 8 - 3x$ on the grid below.



[3]

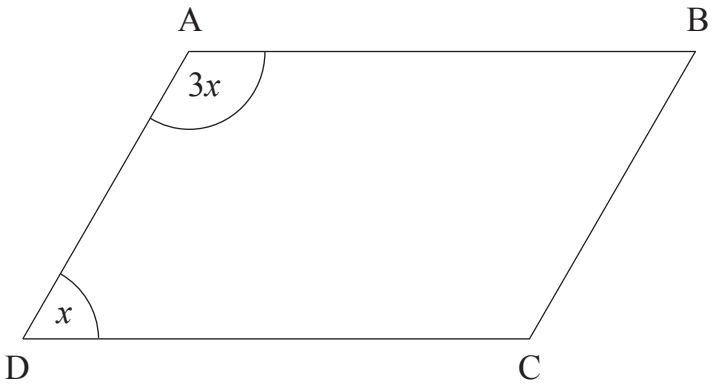
(b) The line $y = 5$ crosses the line $y = 8 - 3x$ at the point L.

Write down the coordinates of L.

Answer (_____ , _____) [1]

3 ABCD is a parallelogram.

Work out the size of angle x.



Answer x = _____° [2]

[Turn over

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

4 Don's Pizza sells an 8-inch circular pizza for £5 and a 12-inch circular pizza for £10

Both are the same thickness.

(a) Calculate the area of a circle with a diameter of 8 inches.

Answer _____ inches^2 [2]

(b) Which is better value for £10: two 8-inch circular pizzas or one 12-inch circular pizza?

Answer _____ [3]

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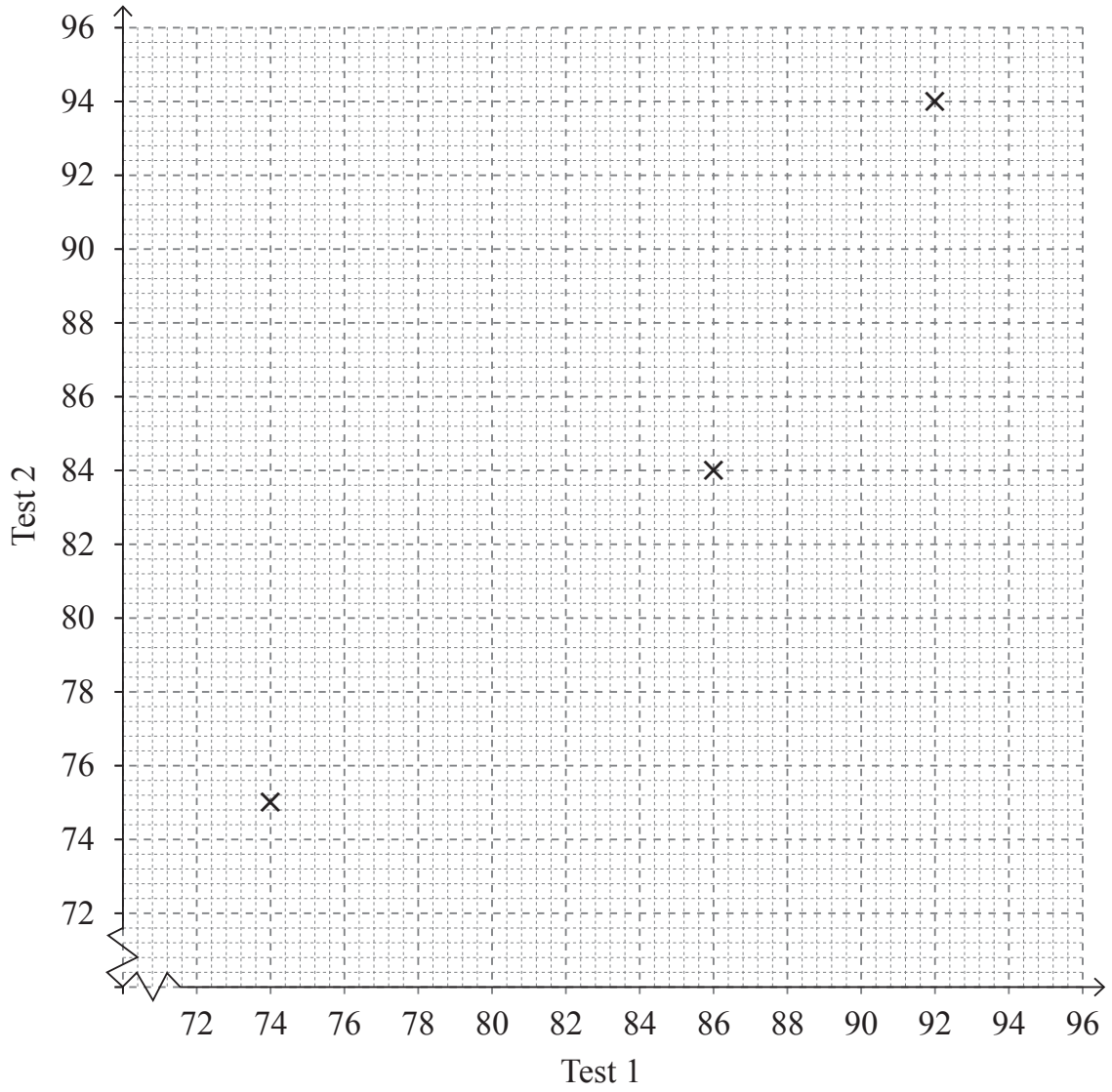
(Questions continue overleaf)

5 A teacher records the percentage test marks of eight pupils in two Maths tests.

	Amy	Brian	Clive	David	Eddie	Maurice	Noeleen	Rebekah
Test 1	**92**	**74**	**86**	88	80	90	76	82
Test 2	**94**	**75**	**84**	92	78	88	95	86



(a) Use the data to complete the scatter graph.

The first three results are already plotted. [2]

(b) The marks for one pupil were not recorded correctly.

Which pupil do you think this was?

Answer _____ [1]

(c) Draw the line of best fit, ignoring the incorrect point. [1]

(d) Sam got 84% in Test 1.

Use your line of best fit to estimate his percentage mark in Test 2.

Answer _____ % [1]

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

Answer _____ [1]

[Turn over

6 **(a)** A nonagon is a nine-sided polygon.

Work out

(i) the exterior angle of a regular nonagon,

Answer _____ ° [1]

(ii) the interior angle of a regular nonagon.

Answer _____ ° [1]

(b) The diagram shows a regular hexagon and a regular octagon placed side by side.

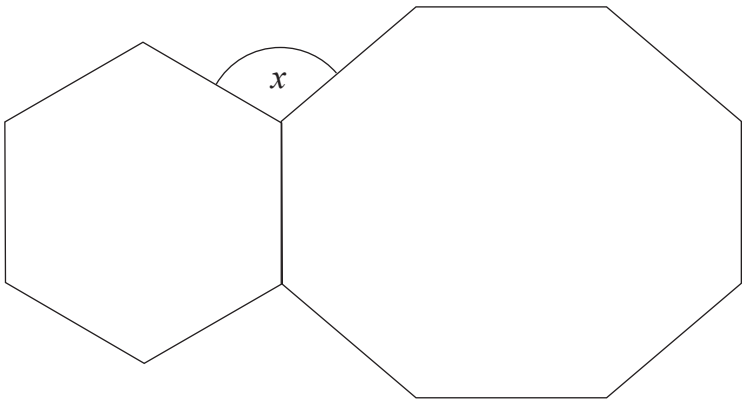


diagram not drawn accurately

Calculate the size of the angle marked x.

You must show all your working.

Answer x = _____ ° [3]

7 In a class there are 12 girls and 18 boys.

9 of the girls have blue eyes and 12 of the boys have blue eyes.

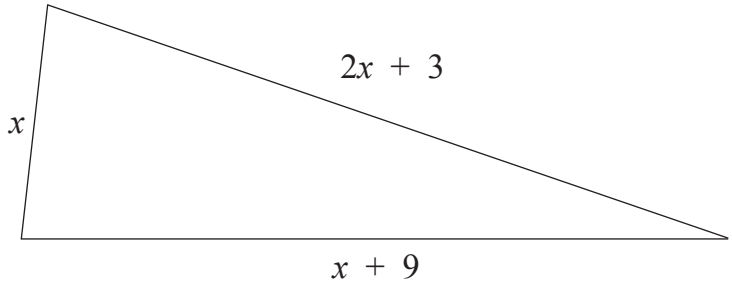
What percentage of the class have blue eyes?

Answer _____ % [2]

[Turn over

8 **(a)** Write an expression, in terms of x, for the perimeter of the triangle shown.

Give your answer in its simplest form.



Answer _____ [2]

(b) The perimeter of this triangle is 32

(i) Write down an equation in terms of x.

Answer _____ [1]

(ii) Solve your equation to find x.

Answer _____ [1]

9 Alex wants to buy a new phone.

It costs £280

Alex's weekly wage is £420

He saves 15% of his wage each week.

How many weeks does it take Alex to save enough money to buy the phone?

Answer _____ weeks [4]

10 Solve $8t - 3 = 5t + 18$

Answer t = _____ [3]

[Turn over

11 Calculate the perimeter of the quarter circle.

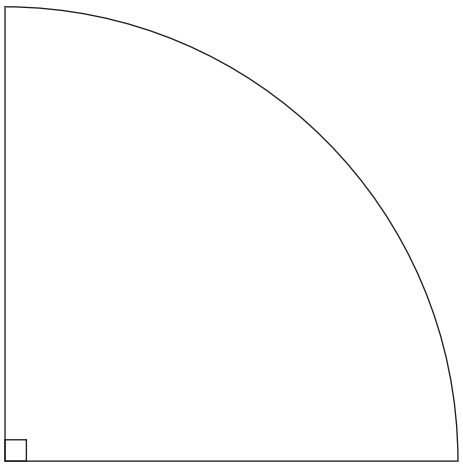


diagram not drawn accurately

Answer _____ cm [3]

12 **(a)** Given that $4\,500 = 2^a \times 3^2 \times 5^b$

work out the values of a and b.

Answer a = _____ b = _____ [3]

(b) Hence, write down the lowest value by which 4 500 needs to be multiplied to make a **cube** number.

Answer _____ [2]

13 Expand and simplify $(p - 3)(p - 4)$

Answer _____ [2]

[Turn over

14 ABCD is a square of side 6 cm.

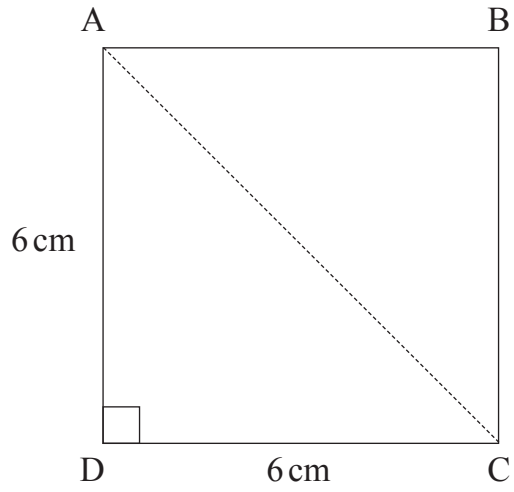


diagram not drawn accurately

How much longer is AC than AD?

You must show all your working.

Answer _____ cm [4]

15 The first four terms of a sequence are

$$-1, \quad 2, \quad 5, \quad 8, \quad \ldots$$

Write down the n^{th} term of the sequence.

Answer _____ [2]

16 A solution to the equation $3x^2 - x = 50$ 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.

x	$3x^2 - x$	

Answer $x =$ _____ [3]

17 The speeds of cars on a road were recorded.

The results are recorded in the grouped frequency table.

Speed (s miles per hour)	Frequency		
$20 < s \leq 30$	12		
$30 < s \leq 40$	16		
$40 < s \leq 50$	18		
$50 < s \leq 60$	2		
$60 < s \leq 70$	2		

(a) How many cars were travelling at more than 40 mph?

Answer _____ [1]

(b) Which class interval contains the median speed?

Answer _____ [1]

(c) Calculate an estimate for the mean speed of the cars on the road.

Answer _____ mph [4]

[Turn over

18 Show, **without using a calculator**, that

$$5\frac{1}{3} - 2\frac{5}{6} = 2\frac{1}{2}$$

[3]

19 The test scores for 10 boys in a class are

7 8 5 8 7 9 4 5 3 9

The mean test score for the 5 girls in the class is 8

Calculate the mean for this class.

Show your working clearly.

Answer _____ [3]

20 Peter, Jack and Colin share a flat. They pay the rent monthly.

Peter pays 30% of the monthly rent.

Jack pays $\frac{3}{8}$ of the monthly rent.

Colin pays £520 of the monthly rent.

Calculate the total monthly rent for the flat.

Answer £ _____ [5]

21 Solve $\frac{x+3}{2} = \frac{5x}{6}$

Answer x = _____ [4]

22 Factorise

(a) $6x - 18$

Answer _____ [1]

(b) $10cp^2 - 4cp$

Answer _____ [2]

(c) $y^2 - 1$

Answer _____ [1]

(d) $k^2 - 2k - 3$

Answer _____ [2]

[Turn over

Quality of written communication will be assessed in this question.

23 PQR is a right-angled triangle.

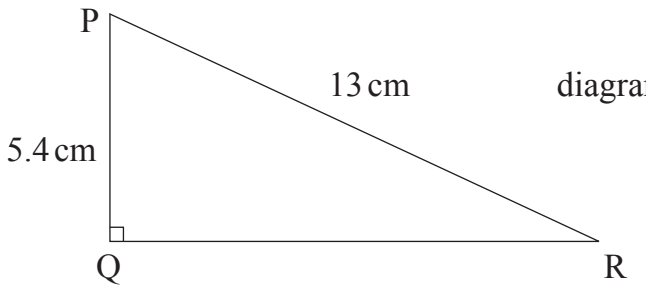


diagram not drawn accurately

By how many degrees is angle P bigger than angle R?

Give your answer to the nearest degree.

Show all your working clearly.

Answer _____ ° [5]

24 Adam needs to know the weight of his filled suitcase.

He weighs himself on the scales. The reading is 76 kg to the nearest kg.

He then weighs himself holding the filled suitcase.

The reading is 104 kg to the nearest kg.

Find the minimum possible weight of the filled suitcase.

Answer _____ kg [3]

[Turn over

25 The area of the sector shown is $22.62\,cm^2$

Calculate the size of angle A.

Give your answer to the nearest degree.

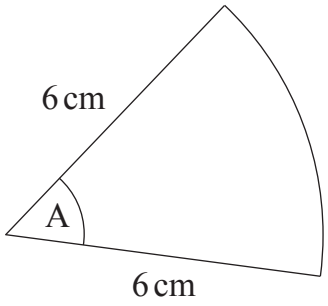


diagram not drawn accurately

Answer _____ ° [3]

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(Questions continue overleaf)

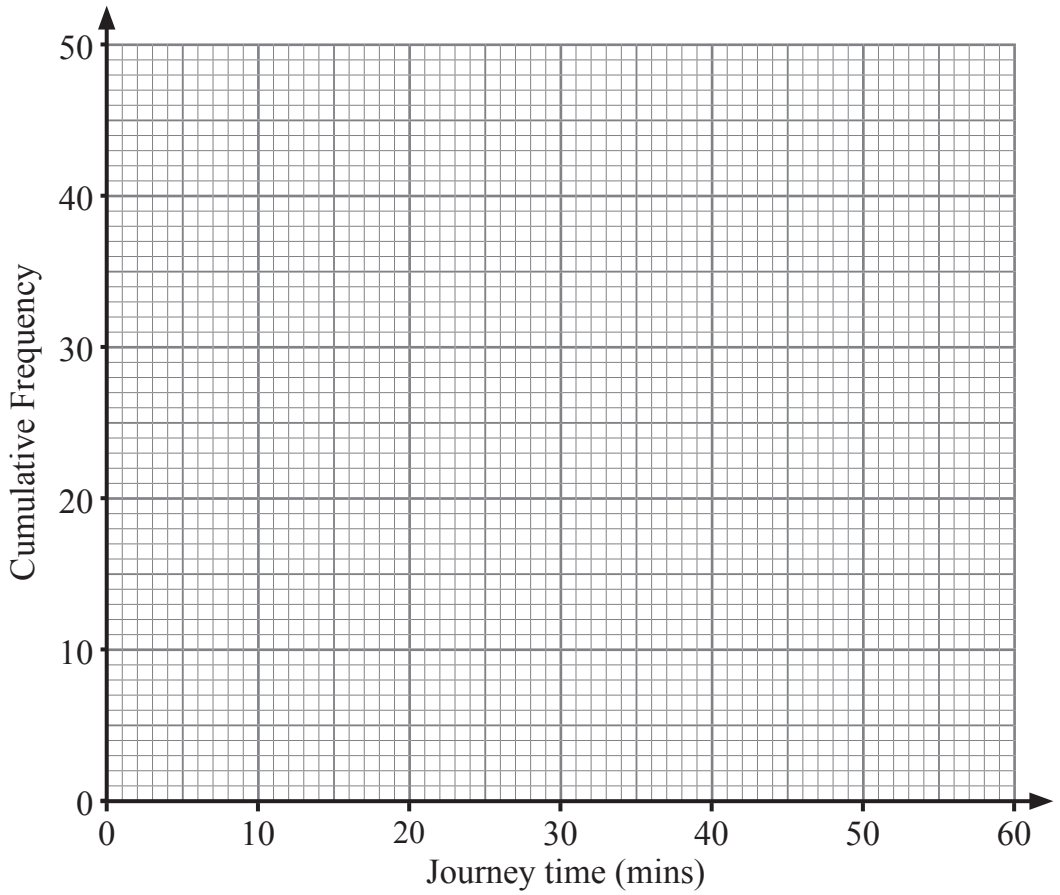
26 The cumulative frequency table gives data about the length of time it takes for 50 workers to travel to work one morning.

Journey time (t minutes)	Cumulative Frequency
$t \leq 20$	7
$t \leq 25$	22
$t \leq 30$	36
$t \leq 35$	45
$t \leq 45$	49
$t \leq 60$	50

(a) How many workers had a journey time between $\frac{1}{2}$ and $\frac{3}{4}$ hour?

Answer _____ [1]

(b) On the graph paper below, draw a cumulative frequency graph to illustrate the data.



[3]

(c) Use the graph to estimate the percentage of workers whose journey time was longer than 40 minutes.

Answer _____ % [2]

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For Examiner's use only	
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