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Rewarding Learning

Centre Number

71

Candidate Number

General Certificate of Secondary Education
January 2015

Mathematics

Unit T3

(With calculator)

Higher Tier

MV18

[GMT31]

FRIDAY 9 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.
Complete in blue or black ink only.
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.

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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 2 and 10**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on pages 4 and 5.

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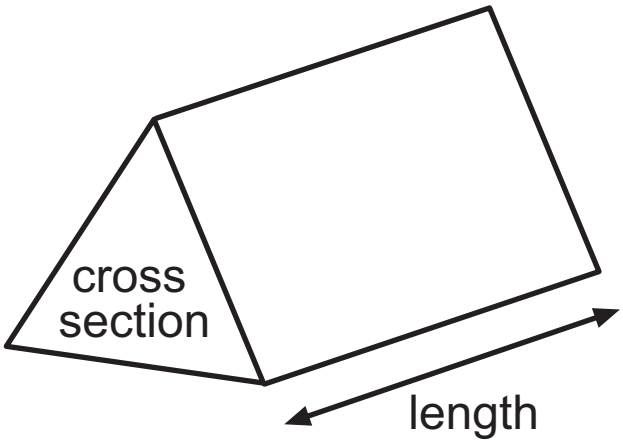
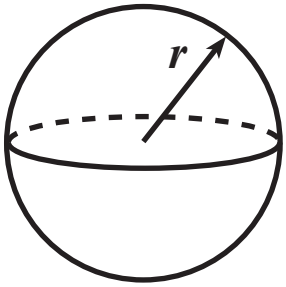
Formula Sheet

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

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

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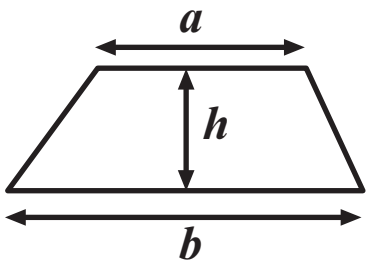
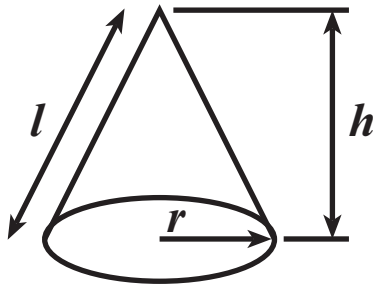
Area of trapezium $= \frac{1}{2}(a + b)h$

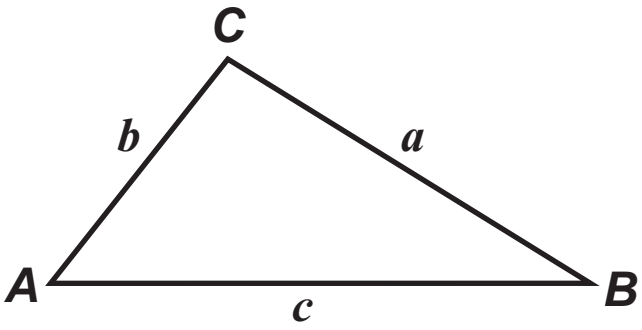


Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi rl$



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 $= \frac{1}{2}ab \sin C$

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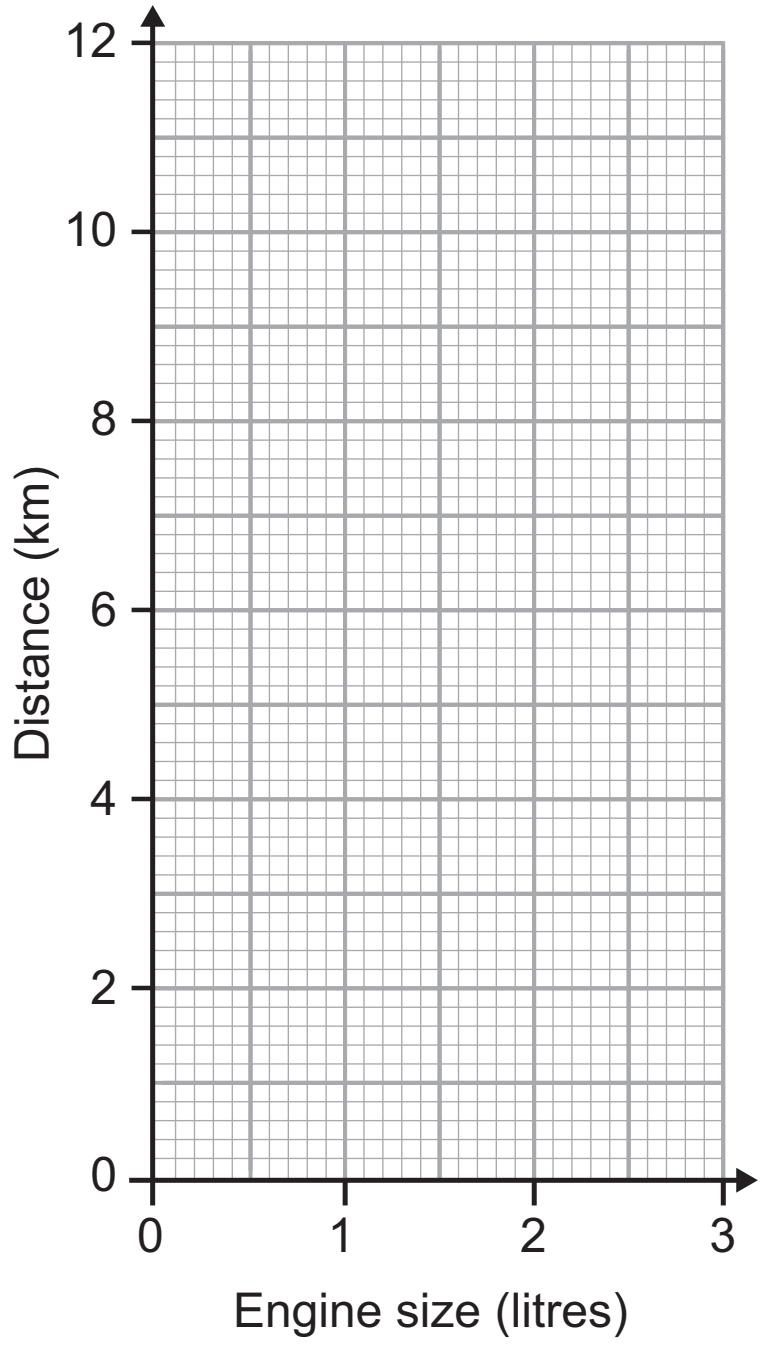
1 The table shows the engine size (litres) of different cars and the distance (km) that the cars can travel on one litre of petrol.

Engine size	1.0	1.8	2.4	1.2	2.1	1.5	2.7
Distance	12	8.6	5	9.4	5.9	10.2	3.8

(a) Draw a scatter graph. [2 marks]



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(b) Draw a line of best fit. [1 mark]

(c) Another car travels 7 km on one litre of petrol. Use your line of best fit to estimate the engine size of this car. [1 mark]

Answer _____ litres

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Quality of written communication will be assessed in this question.

2 Joanne is having a party. She needs forty packets of crisps.
A single packet of crisps costs 30 pence in each of two local stores.
Each store has a special offer on packets of crisps.

Bargain Store	Discount Store
20% off every ten packets	buy 3 and get one more free

Which is better value? [4 marks]

Show your working clearly.

Answer _____

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3 Complete the spaces **(a)**, **(b)**, **(c)** and **(d)** on the electricity bill. [5 marks]

Northern Electricity					
	Meter Reading				
Date	Current units	Previous units	Units used	Price per unit	Total **(£)**
30 June	43458	42763	**(a)**	15 pence	**(b) £**
				VAT @ 5%	**(c) £**
				Total Charge	**(d) £**

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4 **(a)** Write the recurring decimal 0.375375375... using dot notation. [1 mark]

Answer _____

(b) Write $0.\dot{2}\dot{8}$ correct to 4 decimal places. [1 mark]

Answer _____

(c) Fill in the box to make the statement correct.

Explain how you get the missing number. [2 marks]

$$\frac{1}{\square} + \frac{2}{9} = \frac{5}{9}$$

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5 **(a)** A toy lorry has 6 wheels and a toy car has 4 wheels.

Write down an expression for the **total** number of wheels on x lorries and y cars. [2 marks]

Answer _____

(b) Write down the first 3 terms of the sequence whose n^{th} term is $n^2 + 3$ [2 marks]

Answer _____,

_____,

_____

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6 The diagram shows a regular pentagon placed on top of a regular hexagon.

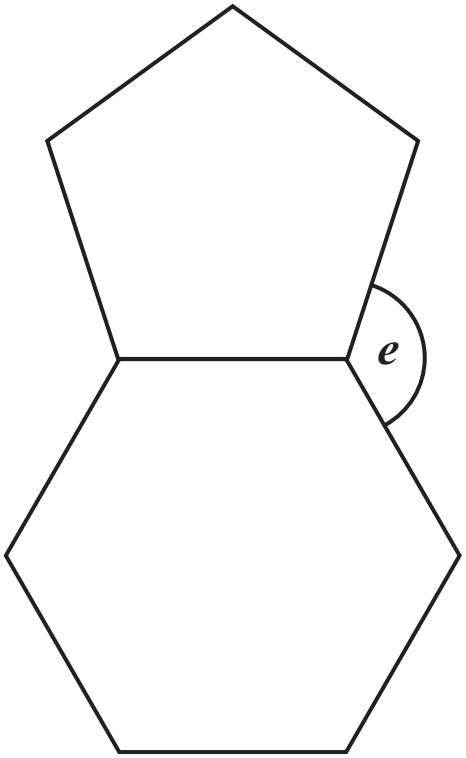

diagram not drawn accurately

Calculate the size of the angle marked e. [4 marks]

Show all your working.

Answer e = _____°

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7 ABCD is a parallelogram.

Angle DAB = 125°

Angle ADB = 37°

Angle CEB = 51°

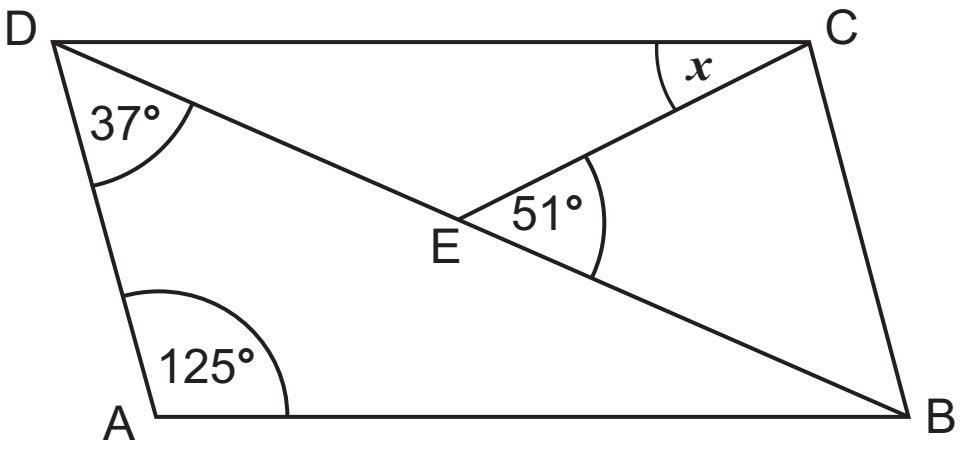

diagram not drawn accurately

Calculate the size of the angle x. [4 marks]

Answer x = _____°

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8 The bearing of a fishing boat from a lighthouse is 118°.

Work out the bearing of the lighthouse from the fishing boat.
[2 marks]

Answer _____°

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9 The marks for pupils in a test are shown.

12	58	39	40	52	59	43
59	26	39	44	42	56	54
58	43	47	24	27	26	30
26	38	56	36	36	35	12

Construct a stem and leaf diagram for these marks.
[3 marks]

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Quality of written communication will be assessed in this question.

10 A questionnaire about their use of a mobile phone was given out to a sample of 20 people who left a supermarket between 10 am and 11 am on a Monday morning.
[2 marks]

Give two reasons why this sample may not be very suitable.

Reason 1 _____

_____

Reason 2 _____

_____

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11 Factorise

(a) $8x + 12$ [1 mark]

Answer _____

(b) $x^2 + 7x$ [1 mark]

Answer _____

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

Work out the coordinates of the midpoint of the line PQ.
[2 marks]

Answer (_____, _____)

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13 The volume of oil in a tank **decreases** by 5**%** every hour.
At 11 am there are 9000 litres of oil in the tank.
What will the volume of oil be at 2 pm? [3 marks]

Answer _____ litres

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14 In a group of golfers there are 37 males and 23 females.
19 of the males are wearing glasses and 14 of the females are wearing glasses.
What percentage of the group are wearing glasses?
[3 marks]

Answer _____ **%**

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15 The masses of 300 stones found on a beach are shown in the table.

Mass (g)	Number of stones		
$10 < m \leqslant 20$	33		
$20 < m \leqslant 30$	88		
$30 < m \leqslant 40$	57		
$40 < m \leqslant 50$	52		
$50 < m \leqslant 60$	43		
$60 < m \leqslant 70$	17		
$70 < m \leqslant 80$	10		

(a) Which interval contains the median mass? [1 mark]

Answer _____

(b) Calculate an estimate of the mean mass of the stones. [3 marks]

Answer _____ **g**

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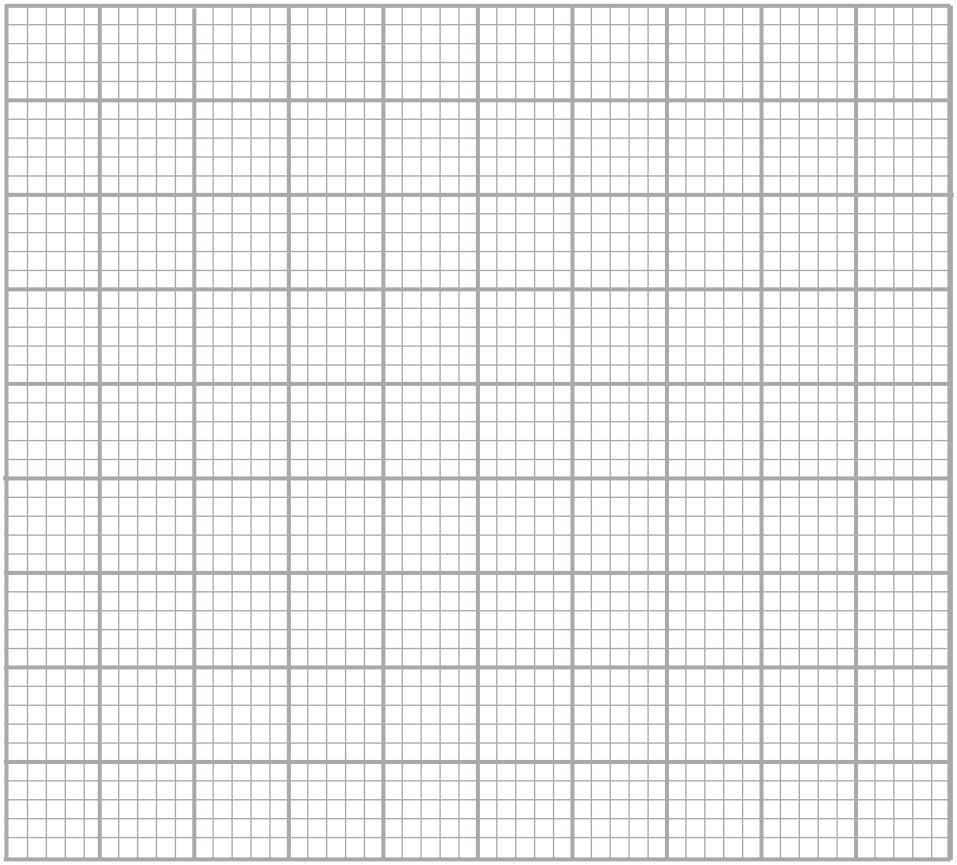
(c) Draw a frequency polygon to represent the data.
[4 marks]



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16 Write 600 as a product of prime factors.

Express your answer in index notation. [3 marks]

Answer _____

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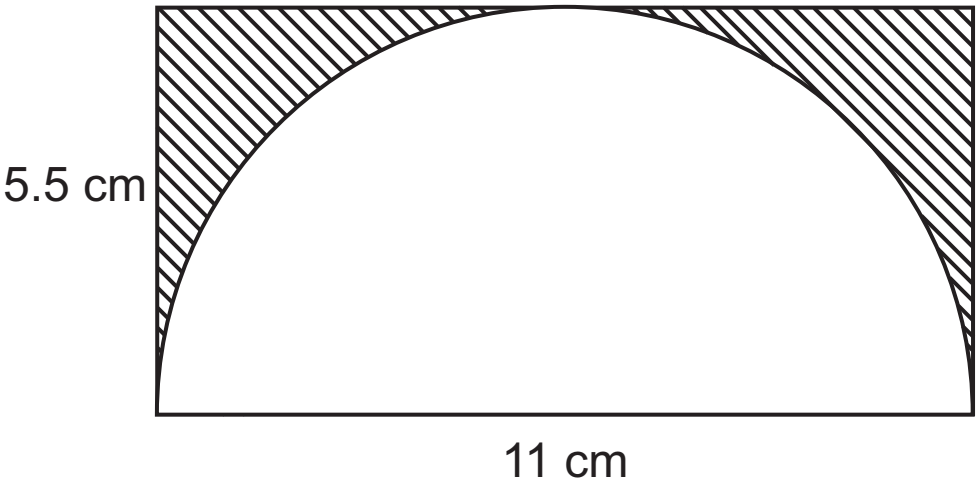
17 The diagram shows a semicircle inside a rectangle.



Work out the area of the shaded region. [3 marks]

Answer _____ cm^2

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18 A sheet of A4 paper measures 297 mm by 210 mm.
Work out the length between diagonally opposite corners.
[3 marks]

Answer _____ **mm**

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(Questions continue overleaf)

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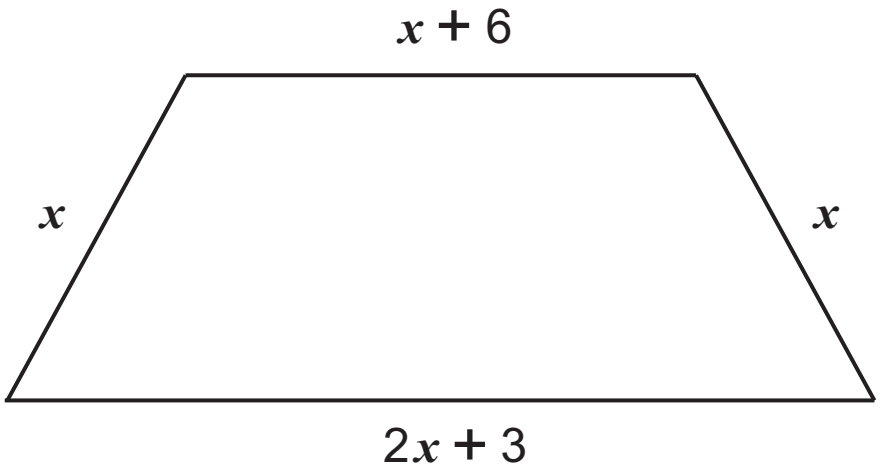
19 (a) Write an expression, in terms of x, for the perimeter of the trapezium shown.

Give your answer in its simplest form. [2 marks]



Answer _____

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(b) The perimeter of this trapezium is 34 cm.

(i) Using the perimeter, write down an equation in terms of x. [1 mark]

Equation _____

(ii) Solve the equation to find x. [1 mark]

Answer x = _____

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20 A solution to the equation $x^3 - 4x = 26$ lies between 3 and 4

Use trial and improvement to solve this equation.

Give your answer correct to 1 decimal place.

Show each stage of your working. [3 marks]

x	$x^3 - 4x$	

Answer $x =$ _____

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(Questions continue overleaf)

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21 In a survey, a group of people were asked to state their weekly wage. The results are shown.

Weekly wage (£)	Frequency	⩽(£)	Cumulative frequency
$0 < w \leqslant 100$	4	100	4
$100 < w \leqslant 200$	16	200	20
$200 < w \leqslant 300$	25	300	
$300 < w \leqslant 400$	32	400	
$400 < w \leqslant 500$	54	500	
$500 < w \leqslant 600$	25	600	
$600 < w \leqslant 700$	20	700	
$700 < w \leqslant 800$	6	800	
$800 < w \leqslant 900$	2	900	

(a) Complete the cumulative frequency column. [1 mark]

(b) Draw the cumulative frequency graph on the axes provided opposite. [3 marks]

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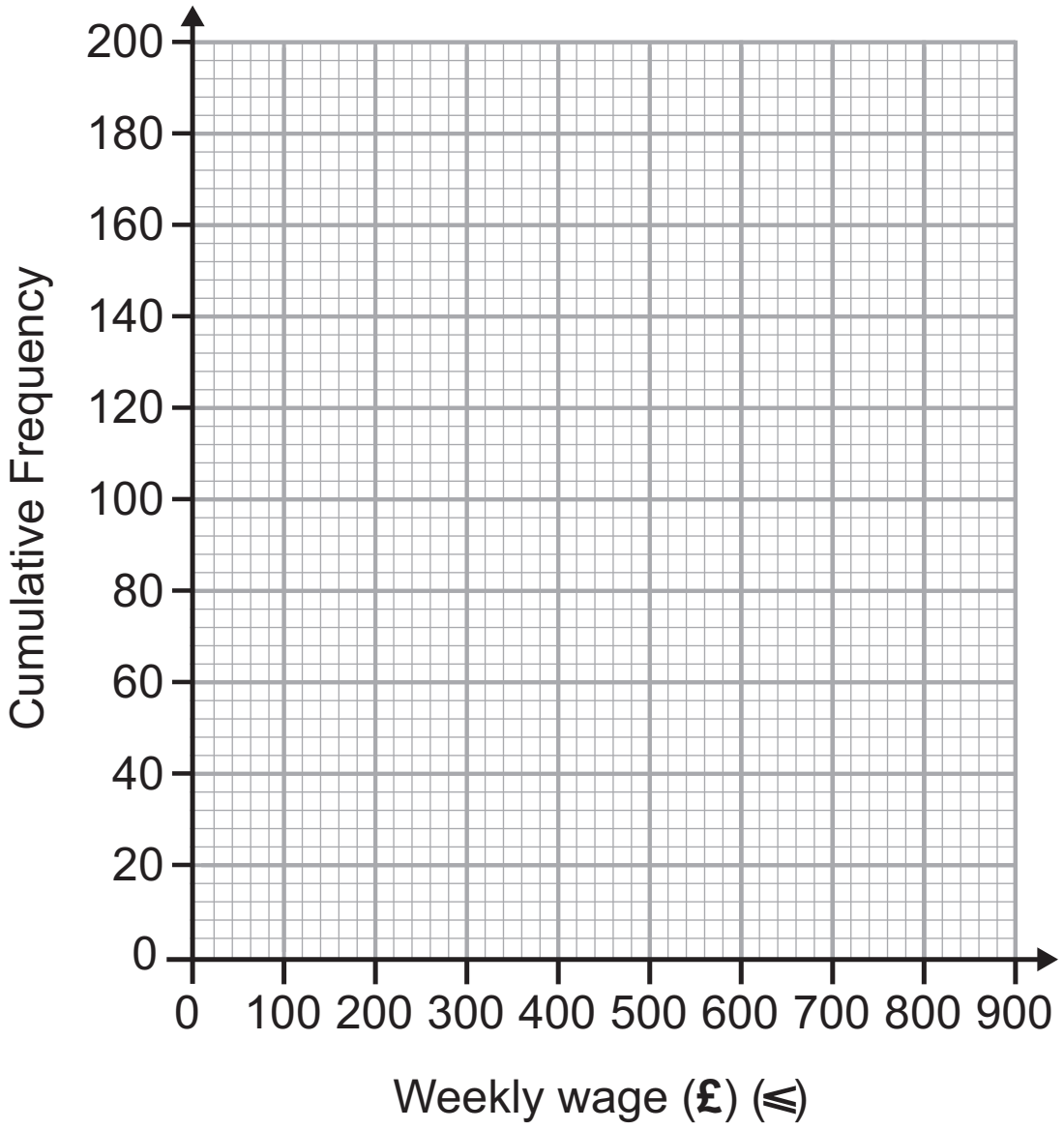

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(c) Use your graph on page 31 to estimate

(i) the median, [1 mark]

Answer **£** _____

(ii) the percentage of people who earn more than **£**640 per week. [2 marks]

Answer _____ **%**

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22 A bed has a sale price of **£**257.40
This is a saving of 22**%** on the original price.

What was the original price of the bed? [3 marks]

Answer **£** _____

23 Find the lowest common multiple (LCM) of 54 and 90
[2 marks]

Answer _____

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24 (a) Solve the simultaneous equations $9x + 4y = 51$
$5x + 4y = 23$

[2 marks]

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

Answer $x =$ _____, $y =$ _____

(b) Solve the equation $\frac{2x - 1}{5} + \frac{4x + 5}{10} = \frac{5}{2}$ [4 marks]

Answer $x =$ _____

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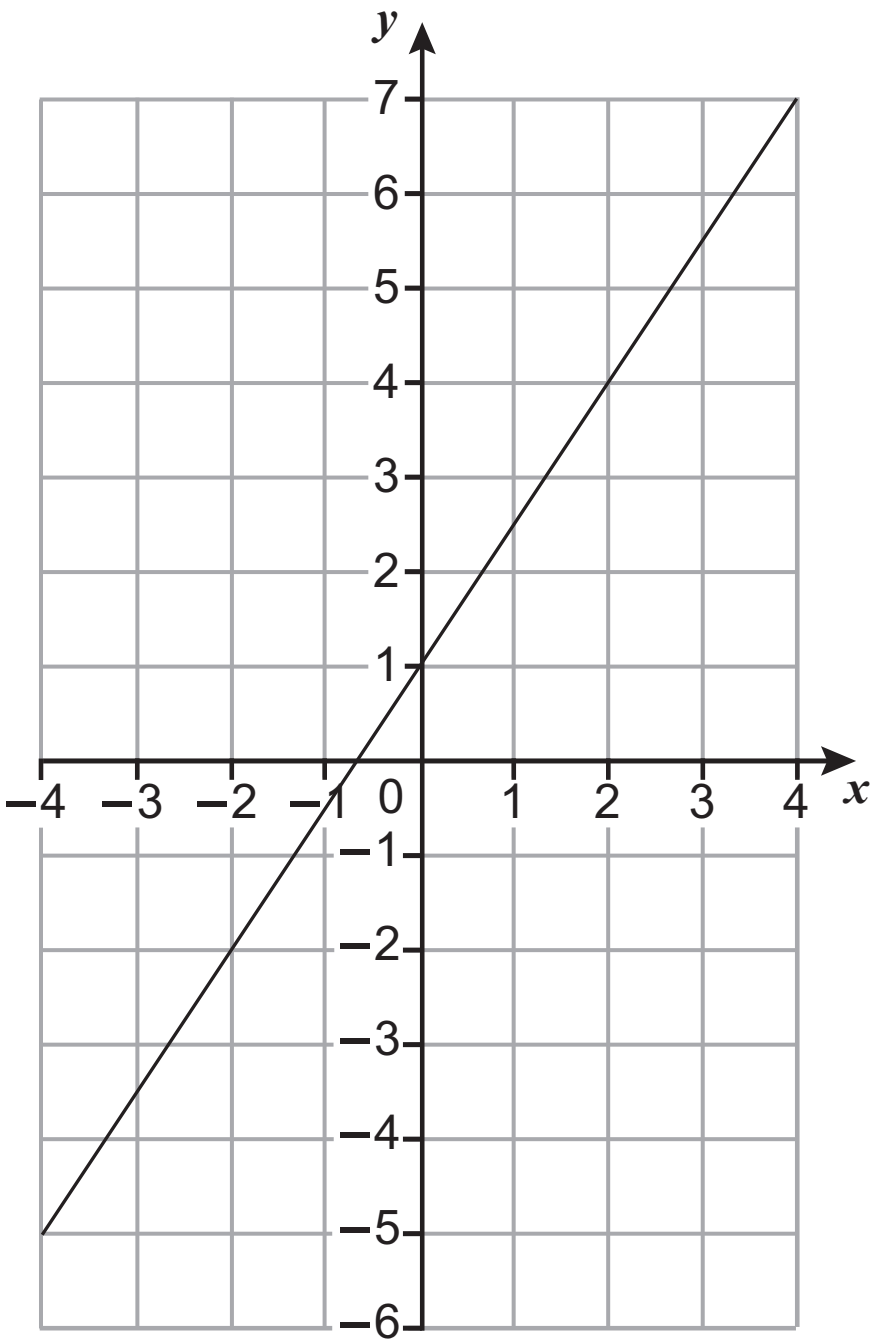
25



(a) Write down the gradient of the line drawn above. [1 mark]

Answer _____

(b) Hence write down the equation of this line. [2 marks]

Answer _____

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26

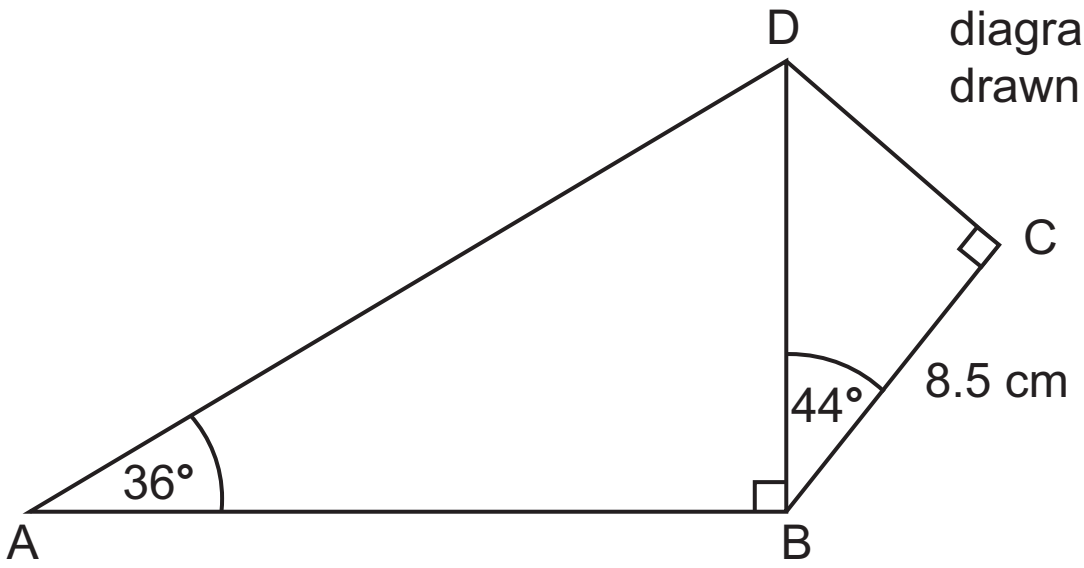

diagram not drawn accurately

ABCD is a quadrilateral. Angles ABD and BCD are both right angles.

Angle DBC = 44° Angle DAB = 36°

BC = 8.5 cm.

Calculate the length of AD. [6 marks]

Answer _____ cm

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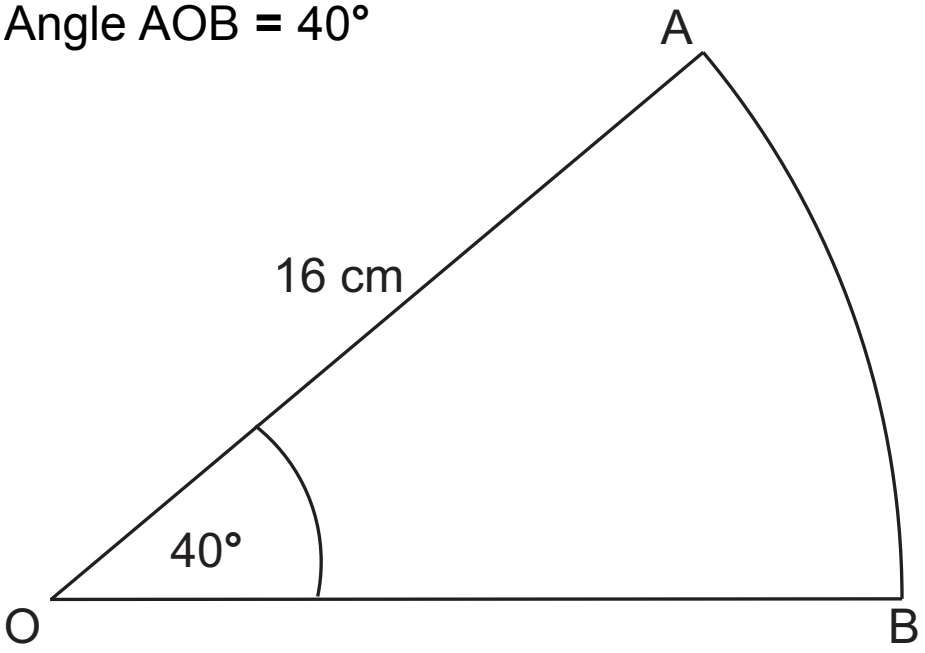
27 AOB is a sector of a circle, radius 16 cm.

Angle AOB = 40°



Work out the perimeter of the sector AOB. [3 marks]

Answer _____ cm

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Question Number	**Marks**
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Examiner Number

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