Rewarding Learning

Centre Number

71

Candidate Number

General Certificate of Secondary Education
January 2015

Mathematics

Unit T4

(With calculator)

Higher Tier

[GMT41]

MV18

FRIDAY 9 JANUARY 9.15 am–11.15 am

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 eighteen** 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 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 **Question 8**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on pages 4–5.

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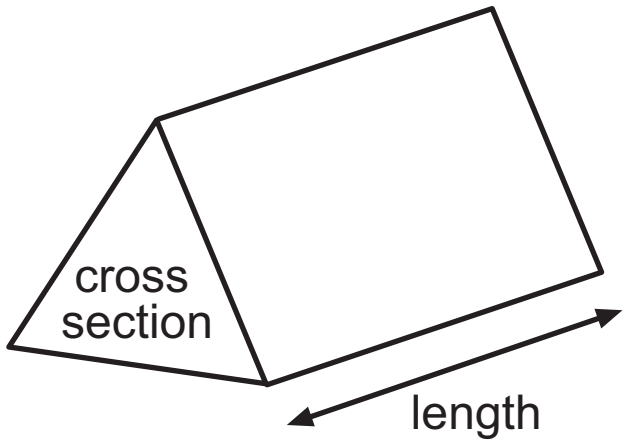
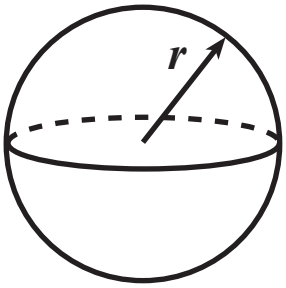
Formula Sheet

Volume of prism = area of cross section × length



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

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



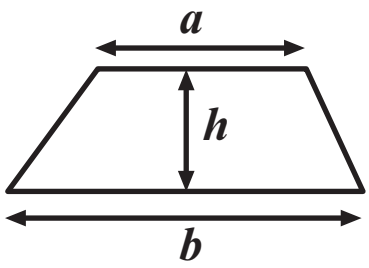
Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$, are given by

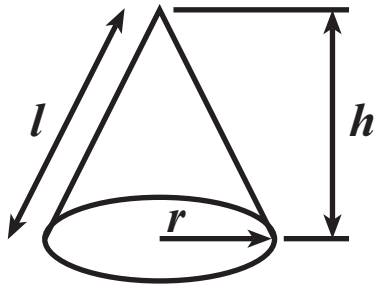
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

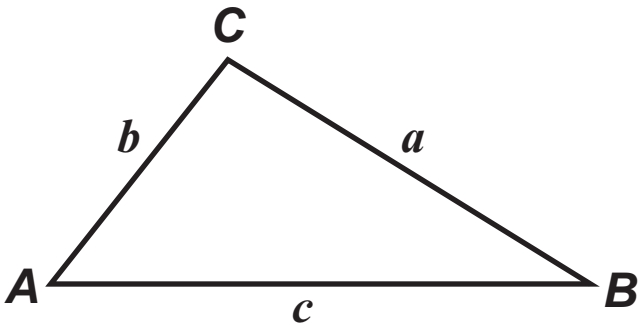


Volume of cone $= \frac{1}{3}\pi r^2 h$

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

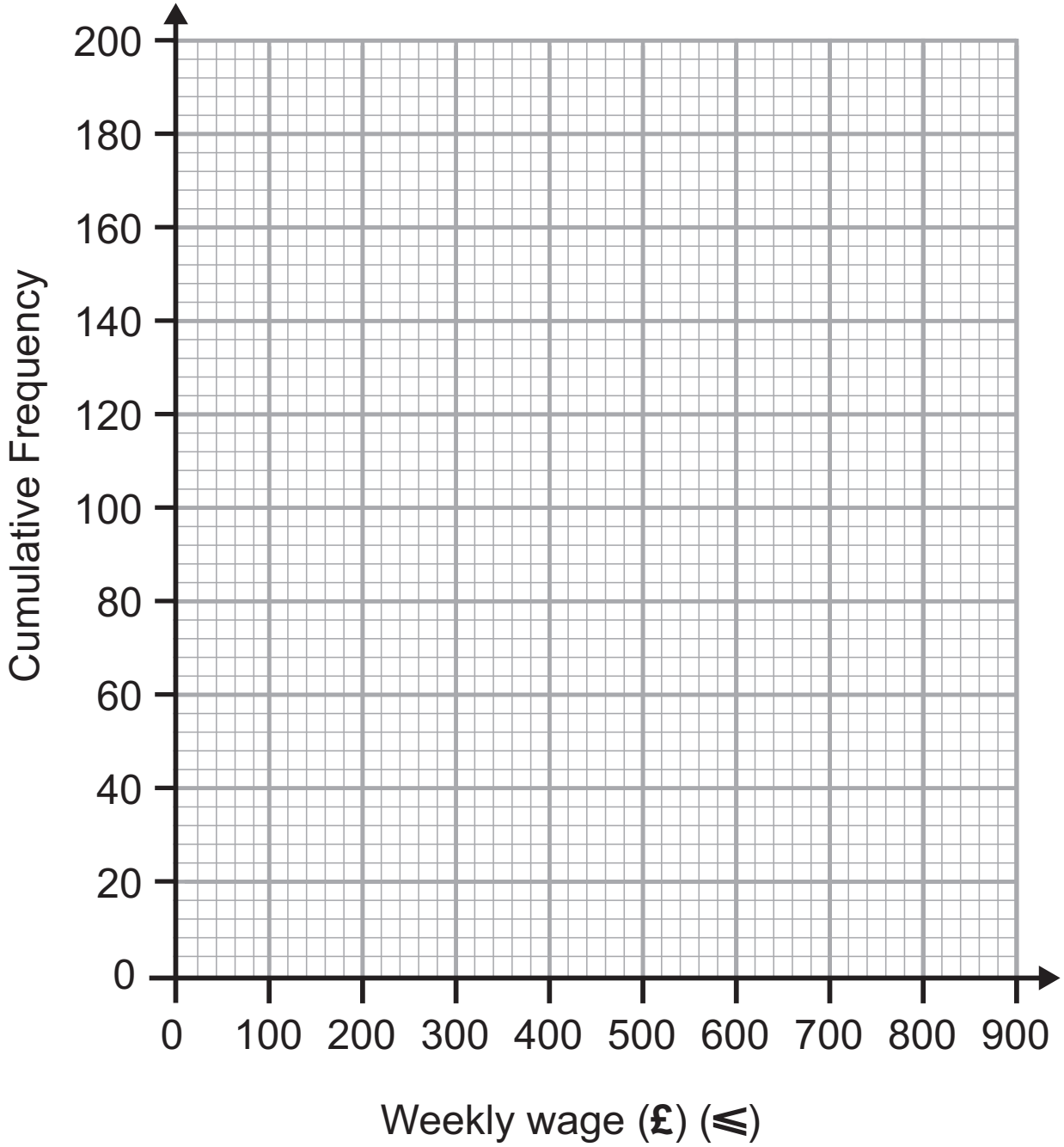
Area of triangle $= \frac{1}{2}ab \sin C$

1 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]



(c) Use your graph on page 7 to estimate

(i) the median, [1 mark]

Answer **£** _____

(ii) the inter-quartile range, [2 marks]

Answer **£** _____

(iii) the percentage of people who earn at least **£**640 per week. [2 marks]

Answer _____ **%**

2 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 **£** _____

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

Answer _____

4 **(a)** Solve the simultaneous equations [3 marks]

$9x + 4y = 51$
$5x + y = 32$

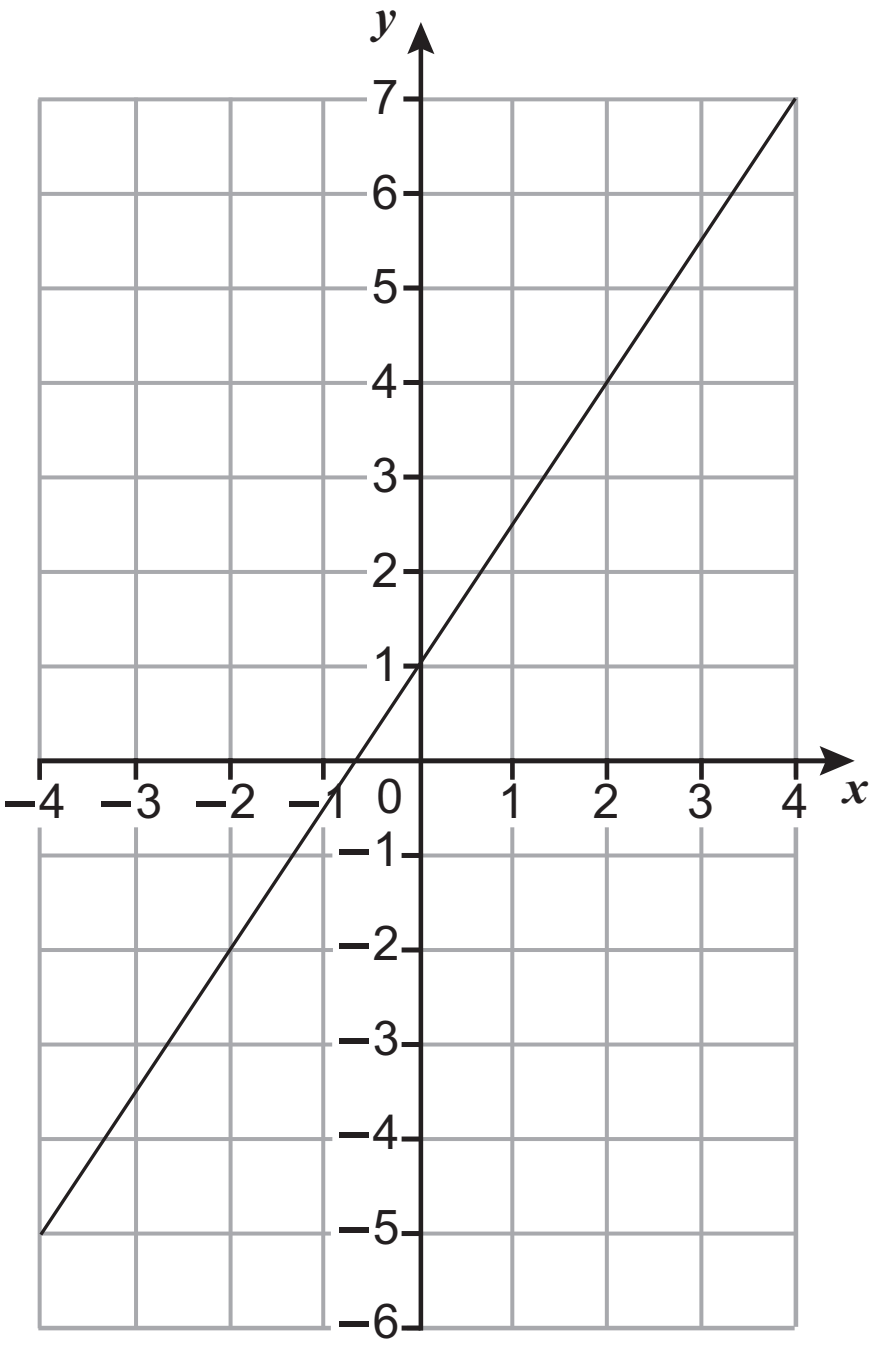
Show all working. A solution by trial and improvement will not be accepted.

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

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

Answer $x =$ _____

5



(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 _____

6

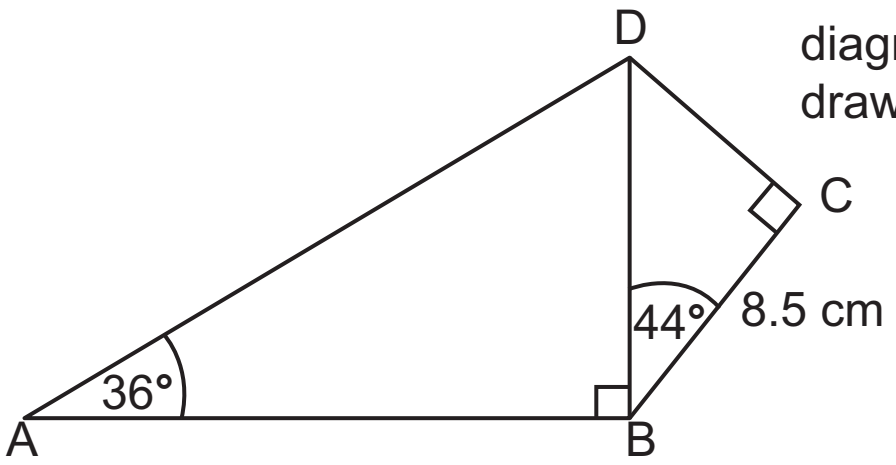


diagram not drawn accurately

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

Angle DBC = 44° Angle DAB = 36°

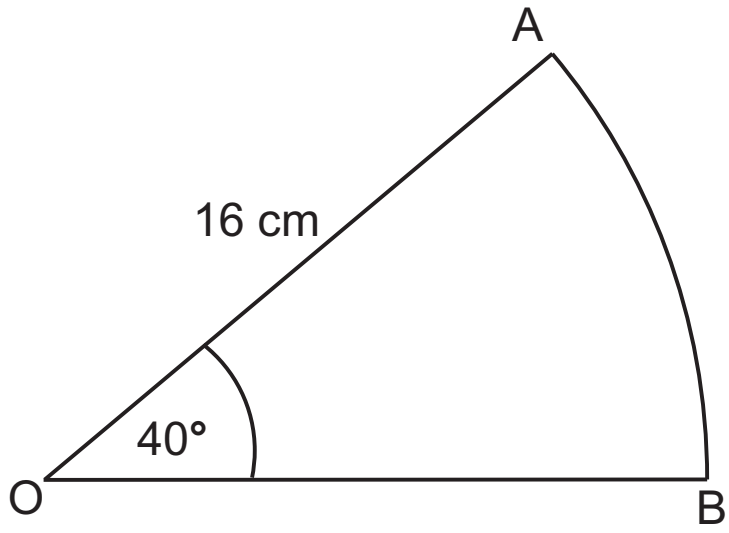
BC = 8.5 cm.

Calculate the length of AD. [6 marks]

Answer _____ cm

7 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

Quality of written communication will be assessed in this question.

8 16 buckets each hold 8 litres, to the nearest litre.
Find the largest and smallest total volume of the 16 buckets.
Explain your reasoning clearly. [3 marks]

9 **(a)** Expand and simplify $(5x + 2)(4x - 3)$ [2 marks]

Answer _____

(b) Simplify $\dfrac{x^2 + 4x}{x^2 - 16}$ [3 marks]

Answer _____

(c) Factorise $8ax^2 - 26axy + 15ay^2$ [3 marks]

Answer _____

10 Find the equation of the line through (0, –5) which is perpendicular to the line $y = 4x + 9$ [2 marks]

Answer _____

11 P is inversely proportional to the square of Q.
P = 6 when Q = 3

(a) Express P in terms of Q. [2 marks]

Answer _____

(b) Hence

(i) find the value of P when Q = 4 [1 mark]

Answer _____

(ii) find the value of Q when P = 24 [2 marks]

Answer _____

12 Solve $3y^2 - 8y + 2 = 0$, correct to 2 decimal places.
[3 marks]

Answer _____

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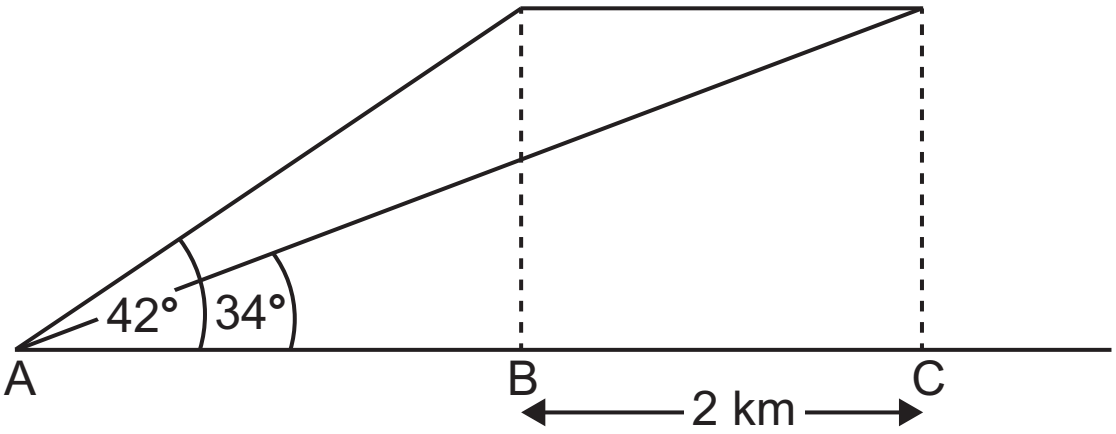
(Questions continue overleaf)

13 A, B, C are three points in a straight horizontal line.
A plane is flying horizontally directly above ABC.
When the plane passes over the point B, the angle of elevation from A is 42°.
When the plane passes over the point C, the angle of elevation from A is 34°.
The horizontal distance between B and C is 2 km.

Find the height of the plane above ABC to the nearest km.
[6 marks]



Answer _____ km

14 **(a)** Solve

(i) $7^x = 1$ [1 mark]

Answer $x =$ _____

(ii) $2^y = \frac{1}{32}$ [1 mark]

Answer $y =$ _____

(b) Evaluate $81^{-\frac{3}{4}}$ [1 mark]

Answer _____

(c) $(3^a)^{b+1} \times \frac{2^c}{4} = 3^{c+a} \times 2$

Find possible values of a, b and c. [3 marks]

Answer $a =$ _____ , $b =$ _____ , $c =$ _____

15 The lengths of times in minutes for a group of people to complete a task are shown.

Time t (mins)	Frequency
$0 < t \leqslant 5$	9
$5 < t \leqslant 8$	12
$8 < t \leqslant 12$	10
$12 < t \leqslant 18$	15
$18 < t \leqslant 23$	11
$23 < t \leqslant 30$	14
$30 < t \leqslant 35$	6

(a) Draw a histogram on the axes provided opposite to illustrate this data. [3 marks]

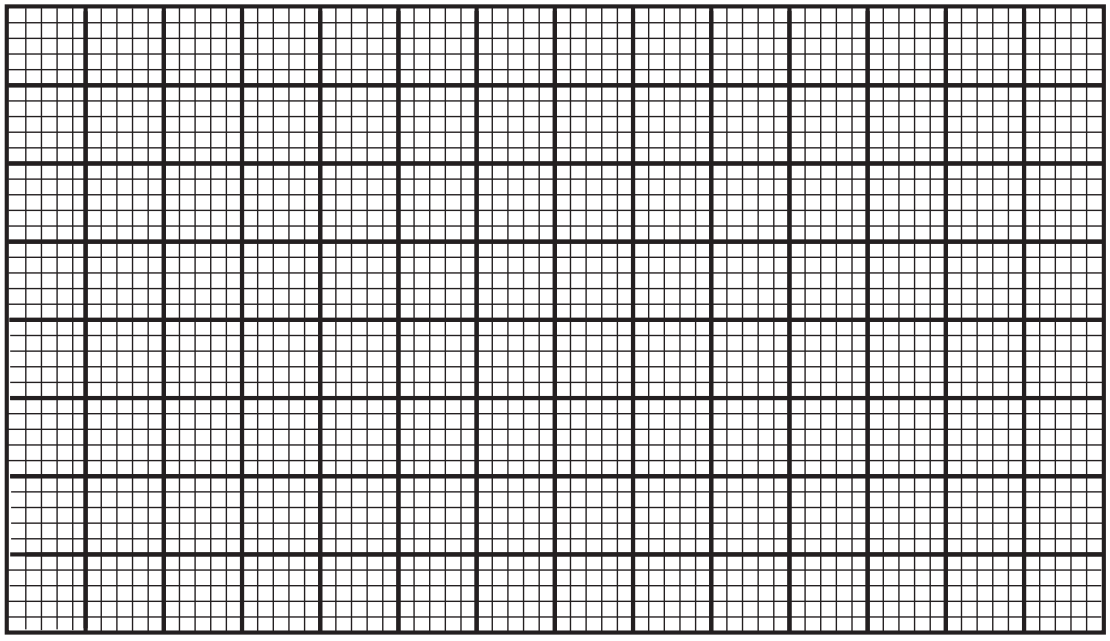
(b) Estimate the number of people who took more than 19 minutes to complete the task. [3 marks]

Answer _____

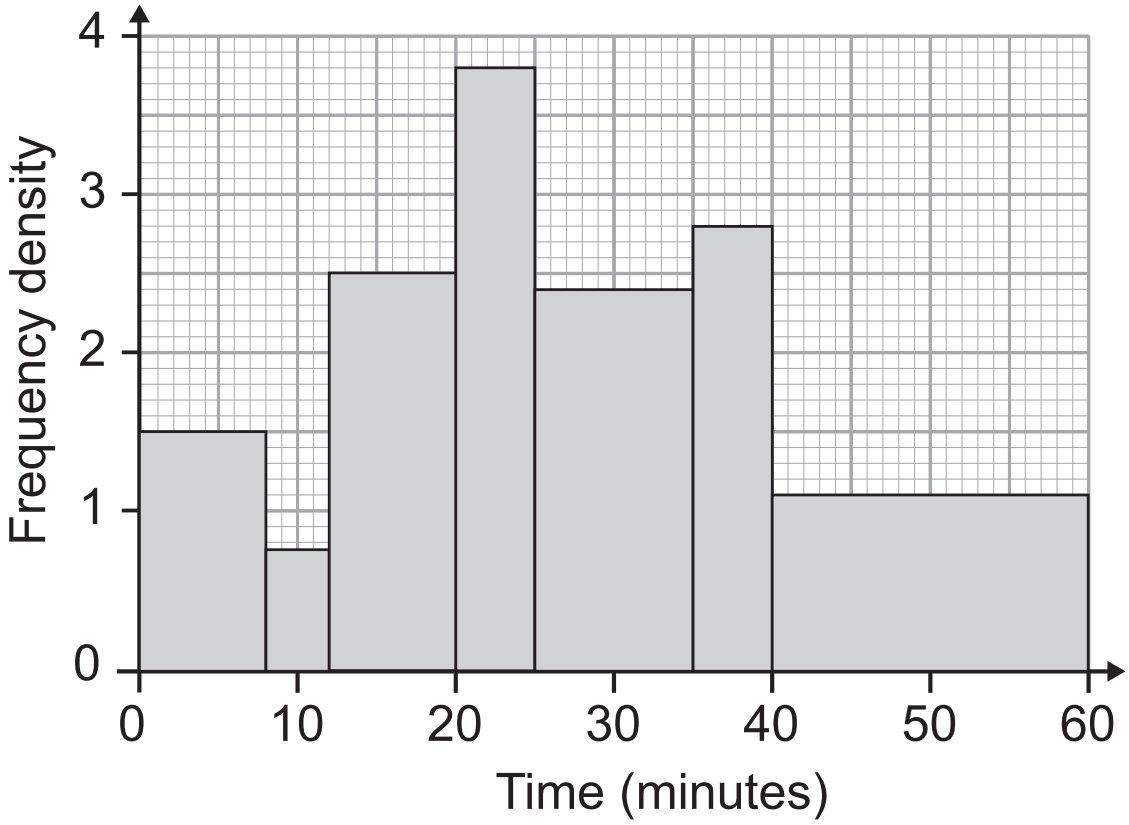
A stratified sample of 24 people is selected from those who took less than 20 minutes to complete the task.

(c) Estimate how many of this sample took less than 10 minutes. [2 marks]

Answer _____



The times for a second group of people are shown in the histogram below.



(d) Estimate the mean time for this second group. [4 marks]

Answer _____ minutes

(e) Estimate the median time for this second group.
[3 marks]

Answer _____ minutes

16 In a sporting competition 55% of the total prize money went to the winner, competitor A.

$\frac{3}{5}$ of the remaining money went to the runner-up, competitor B, and the rest of the money was split between competitors C, D and E who came 3rd, 4th and 5th respectively. C got 3 times as much as E and D got twice as much as E.

If competitor D received £1200, how much did the winner receive? [4 marks]

Answer £ _____

17 Solve the simultaneous equations [7 marks]

$y = 3x - 1$
$3x^2 + 2y^2 = 35$

Answer _____

18 Two cars are travelling away from a crossroads on two straight roads.

At noon, one car is at A, 100 m from the crossroads, C, and the other is at B, 80 m from C. The distance AB is 82.3 m. A short time later the first car has travelled 200 m from A to D. The second car has travelled 250 m from B to E.

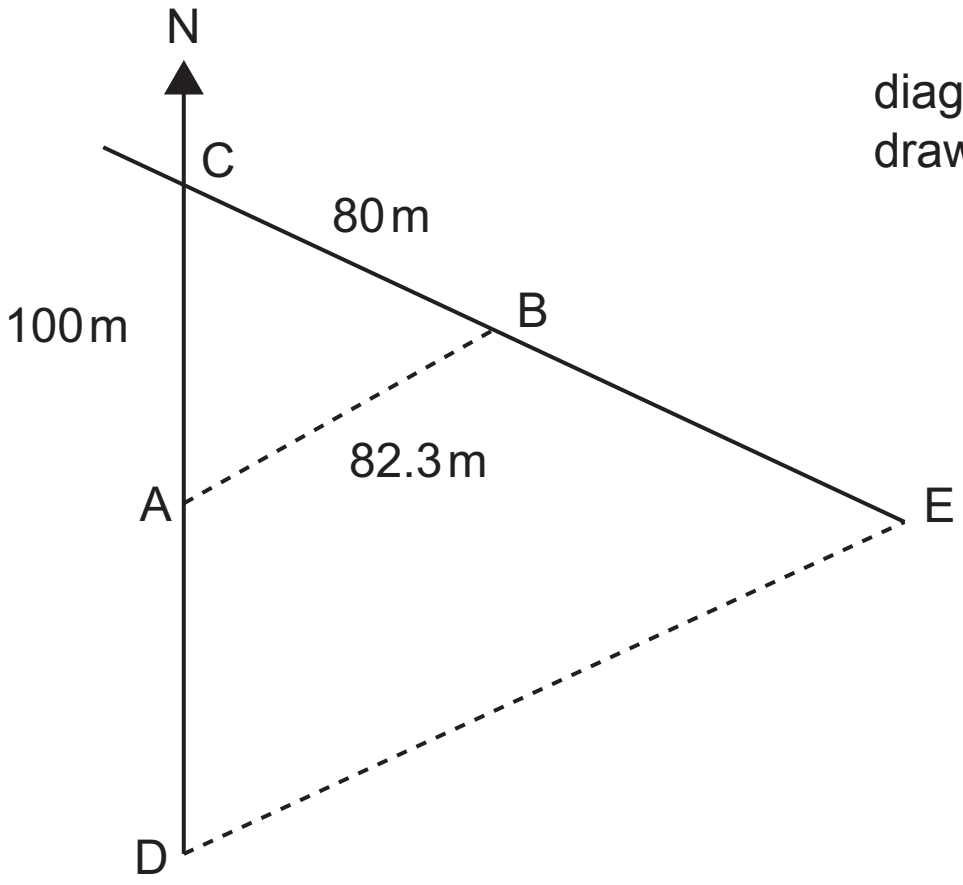


diagram not drawn accurately

(a) Find the distance, DE, between the two cars. [5 marks]

Answer _____ **m**

(b) Find the bearing of E from D. [3 marks]

Answer _____ °

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	**Marks**
1	
2	
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Total Marks	

Examiner Number