Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2012

Mathematics

Unit T3
(With calculator)
Higher Tier

[GMT31]

GMT31

WEDNESDAY 6 JUNE 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.
Write your answers in the spaces provided in this question paper.
Complete in blue or black ink only. **Do not write in pencil or with a gel pen.**
Answer **all nineteen** 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.

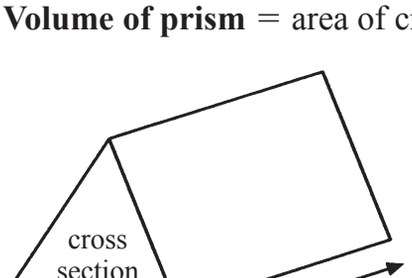
INFORMATION FOR CANDIDATES

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 4 and 16**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is overleaf.

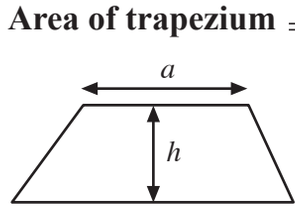
7416

Formula Sheet

Volume of prism = area of cross section × length

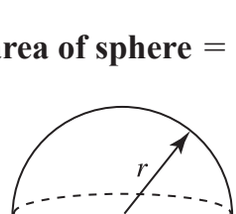


Area of trapezium $= \frac{1}{2}(a+b)h$



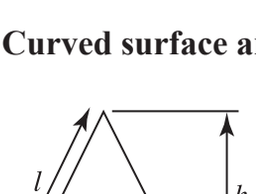
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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

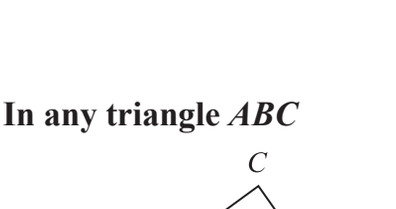


Quadratic Equation

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

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

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

1 One week a money exchange bureau discovered that 15% of the £20 notes they changed were fake. If they changed £5,600 worth of £20 notes, how many of these £20 notes were fake?

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 1	

[Turn over

2 **(a)** Write the ratio 12 : 27 in its simplest form.

Answer _____ [1]

(b) The heights of three flower pots are 45 cm, 30 cm and 10 cm.

Write the ratio of their heights in simplest form.

Answer _____ [1]

(c) Complete the following:

The recurring decimal 0.280280280… can be written using dot notation as _____ [1]

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

$$\frac{1}{\square} + \frac{1}{4} = \frac{9}{20}$$ [2]

Examiner Only	
Marks	Remark
Total Question 2	

3 **(a)** Solve the equations:

(i) $3(2x - 5) = 4$

Answer $x =$ _____ [3]

(ii) $\frac{12-5x}{4} = 1$

Answer $x =$ _____ [3]

(b) Liz buys x markers at 90p each and 3 books at £1.20 each. The total cost is £13.50

Write down an equation and solve it to find x.

Equation _____

Answer $x =$ _____ [4]

Examiner Only	
Marks	Remark
Total Question 3	

[Turn over

Quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

4 **(a)** Jacob wants to investigate the hypothesis

"Children watch more television than adults."

He surveys 8 boys in his class and 8 teachers in his school.

Give **two** reasons why his sample is unsuitable.

Reason 1 _____

_____ [1]

Reason 2 _____

_____ [1]

(b) Twenty pupils were asked to estimate the length of a line in cm.

Their responses are listed below.

12.6	13.0	9.8	8.5	10.3
12.1	11.3	10.0	9.5	12.6
8.7	9.1	10.6	12.1	12.2
9.7	11.1	9.0	8.9	8.0

Construct a stem and leaf diagram to illustrate this data.

[3]

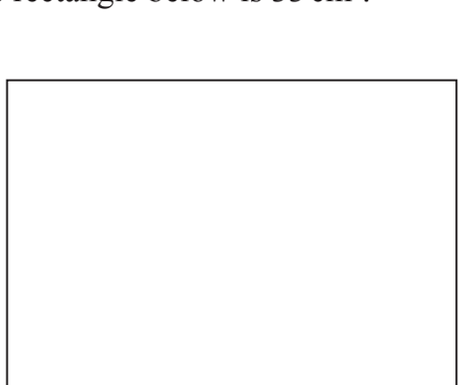
Examiner Only	
Marks	Remark
Total Question 4	

5 **(a)** Calculate the circumference of a circular garden with radius 5.4 m.

Examiner Only	
Marks	Remark

Answer _____ m [2]

(b) The area of the rectangle below is 33 cm^2.



Change 33 cm^2 into mm^2.

Answer _____ mm^2 [2]

(c) Find the area of a triangle with base 9 cm and perpendicular height 6 cm.

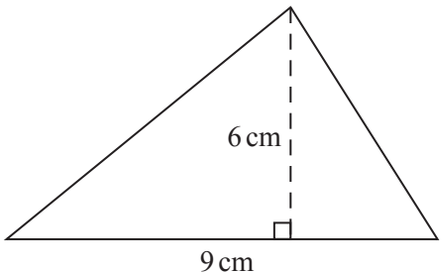


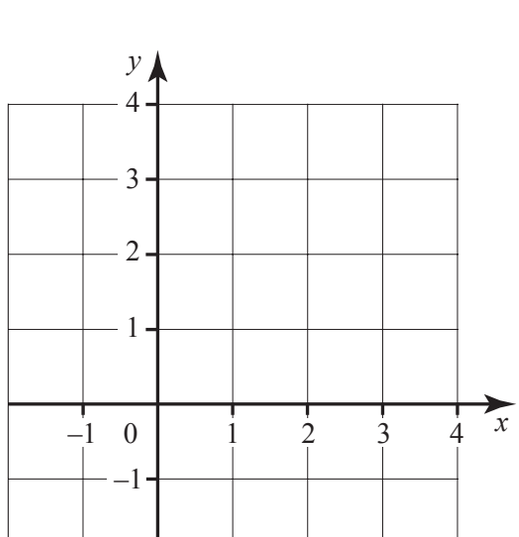
Diagram not drawn accurately

Answer _____ [3]

Examiner Only	
Marks	Remark
Total Question 5	

[Turn over

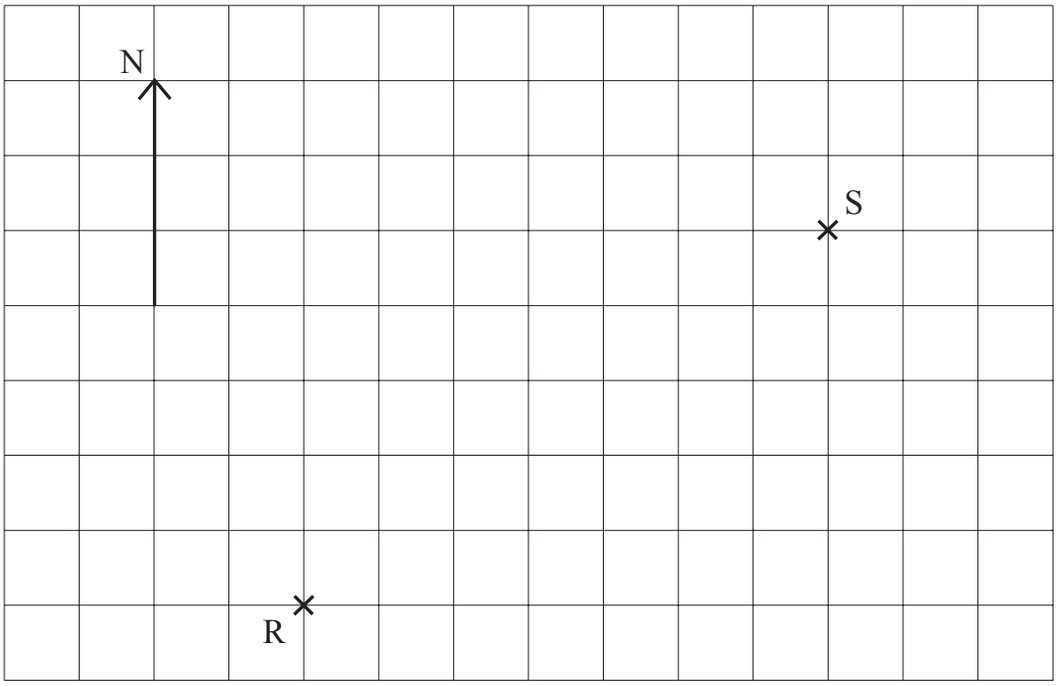
6 Draw the graph of $3x + 4y = 12$ [3]



Examiner Only	
Marks	Remark
Total Question 6	

7 **(a)** Two lighthouses are at the points R and S on the diagram.

Examiner Only	
Marks	Remark



What is the bearing of R from S?

Answer _____° [1]

[Turn over

(b) The lines EF and GH are parallel.

Calculate the size of angles a and b.

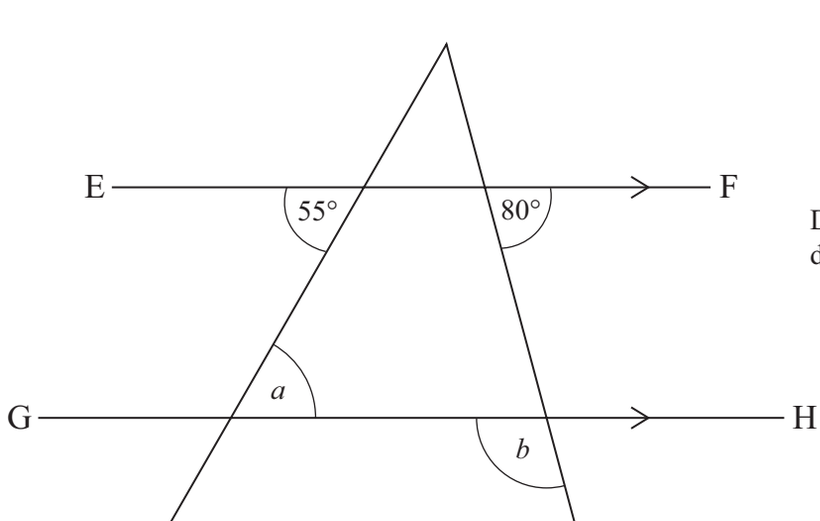


Diagram not drawn accurately

Answer a = _____°

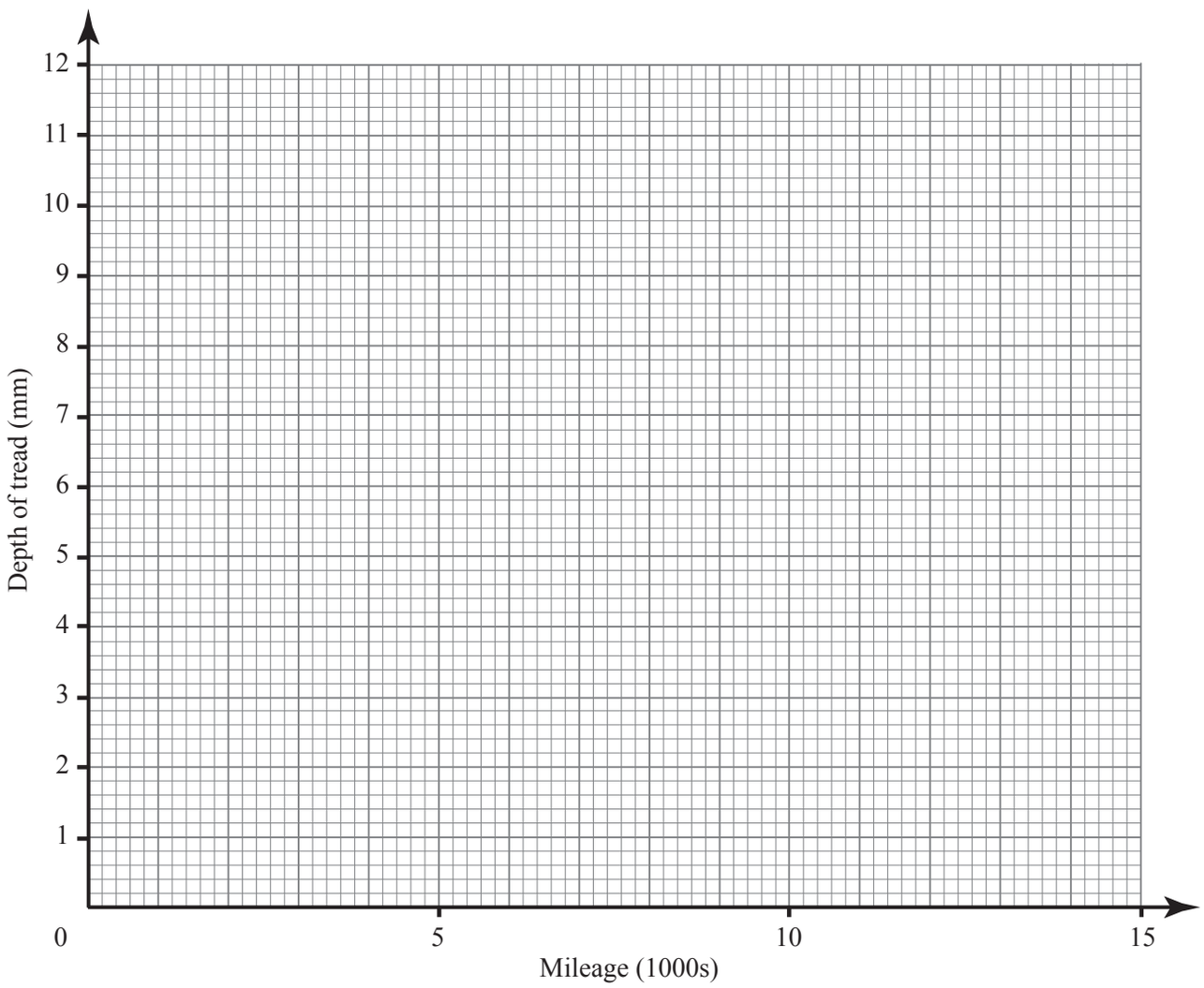
b = _____° [2]

Examiner Only	
Marks	Remark
Total Question 7	

8 The mileage on seven cars (in 1000s of miles) and the depth of tread on the tyres (in mm) were recorded. The table shows the results.

Mileage (1000s)	3	8	12.5	9	6	15	4.5
Depth of tread (mm)	9.4	7.7	10.6	7.4	8.4	4.9	8.7

(a) Draw a scatter graph for this data.



[2]

Examiner Only	
Marks	Remark

[Turn over

(b) One of the points seems unusual. Circle this point and suggest a possible reason for it.

Answer _____

_____ [1]

(c) Describe the type of correlation of the other points and explain what this means.

Answer _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 8	

9 **(a)** Complete the following to write 252 as a product of prime factors.

$252 = 2 \times 2 \times 3 \times \_\_\_\_\_ \times \_\_\_\_\_$ [1]

(b) Write 297 as a product of prime factors.

Answer _____ [1]

(c) A floor measuring 252 cm by 297 cm is to be covered **completely** by identical square tiles.

What is the **length** of side of the largest square tile that can be used?

Answer _____ cm [2]

Examiner Only	
Marks	Remark
Total Question 9	

10 **(a)** Paul's car insurance is due and the company quote him a price of £228.

Another company make him an offer which is 35% cheaper and he decides to take up their offer. How much does he pay?

Answer £ _____ [2]

(b) Steve invests £8,400 at 1.8% per annum compound interest for 3 years.

Calculate the amount at the end of 3 years.

Answer £ _____ [3]

Examiner Only	
Marks	Remark
Total Question 10	

11 Two sides of a triangle are 6 cm and 8 cm.

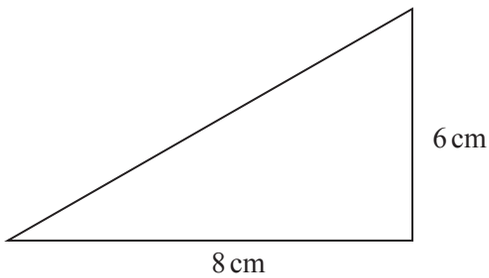


Diagram not drawn accurately

(a) **If** the third side is 10 cm, show why the triangle **must** be right-angled.

[1]

(b) **If** the triangle is **not** right-angled write down a possible length that the third side could have.

Answer _____ cm [1]

Examiner Only	
Marks	Remark
Total Question 11	

[Turn over

12 The table shows the ages of people visiting the town library one Saturday morning.

Age	Frequency		
$0 < A \leqslant 10$	7		
$10 < A \leqslant 20$	4		
$20 < A \leqslant 30$	5		
$30 < A \leqslant 40$	4		
$40 < A \leqslant 50$	18		
$50 < A \leqslant 60$	20		
$60 < A \leqslant 70$	22		

(a) Calculate an estimate for the mean age of the library users.

Answer _____ [4]

(b) Write down the class interval which contains the median age.

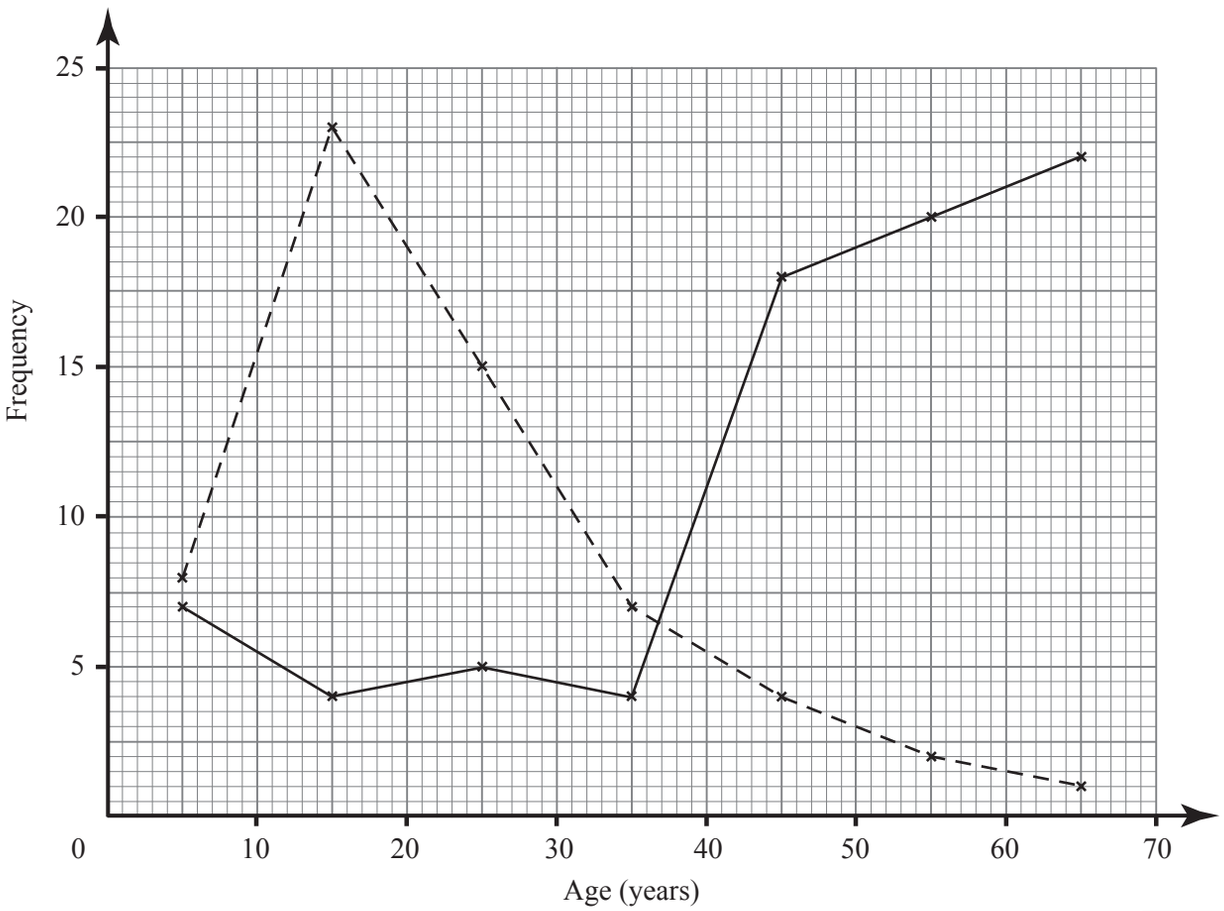
Answer _____ [1]

Examiner Only	
Marks	Remark

(c) The frequency polygon below (solid line) illustrates the data recorded at the library.

A second frequency polygon (broken line) illustrates the ages of people visiting a different place in the same town on the Saturday morning.

By considering the polygons suggest what the second place might be. Give a reason for your answer.



Answer _____ because _____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 12	

13 **(a)** P is the point (1, 4). Q is the point (7, −2). Find the co-ordinates of the midpoint of PQ.

Answer (_____ , _____) [2]

(b) Calculate the size of the interior angle of a regular nonagon (nine-sided polygon).

Answer _____ ° [2]

(c) Calculate the area of a semi-circle with diameter 6 cm.

Answer _____ cm^2 [2]

Examiner Only	
Marks	Remark
Total Question 13	

14 Use the method of trial and improvement to solve the equation

$$x^3 + 2x = 60$$

giving the answer correct to one decimal place.

Show all your working.

Answer $x =$ _____ [4]

Examiner Only	
Marks	Remark
Total Question 14	

[Turn over

15 **(a)** Expand and simplify $(2a + 3)(3a - 2)$

Answer _____ [2]

(b) Factorise fully

(i) $9xy - 12y^2$

Answer _____ [2]

(ii) $y^2 - 9$

Answer _____ [1]

Examiner Only	
Marks	Remark
Total Question 15	

Quality of written communication will be assessed in this question.

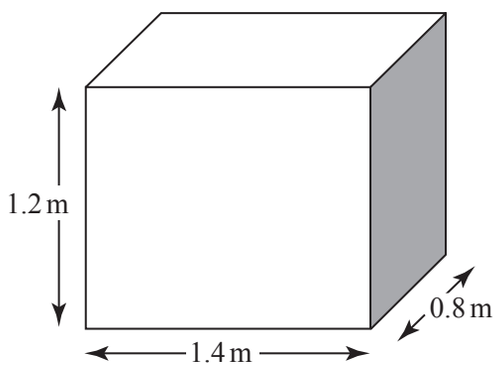
Show your working.

Examiner Only	
Marks	Remark

16 (a) In a housing estate $\frac{5}{6}$ of the houses have a garage.
In three out of every four garages there is a car parked.
There are 15 cars in total parked in a garage. Find the number of houses that have no garage.

Answer _____ [3]

(b) An empty tank is in the shape of a cuboid as shown with measurements 1.4 m, 1.2 m and 0.8 m all to the nearest 0.1 m.
What is the smallest possible volume of the tank?



Answer _____ m^3 [3]

Total Question 16

17 120 employees in a warehouse were asked how far they travelled to work each day. The table shows their responses.

Distance (km)	Frequency (number of people)	Distance ($\leqslant$)	Cumulative frequency
$0 < d \leqslant 5$	5	5	5
$5 < d \leqslant 10$	12	10	17
$10 < d \leqslant 15$	16		
$15 < d \leqslant 20$	21		
$20 < d \leqslant 25$	27		
$25 < d \leqslant 30$	14		
$30 < d \leqslant 35$	12		
$35 < d \leqslant 40$	8		
$40 < d \leqslant 45$	5		

(a) Complete the cumulative frequency table above. [1]

(b) Draw the cumulative frequency graph on the grid opposite. [3]

(c) Use your graph to find

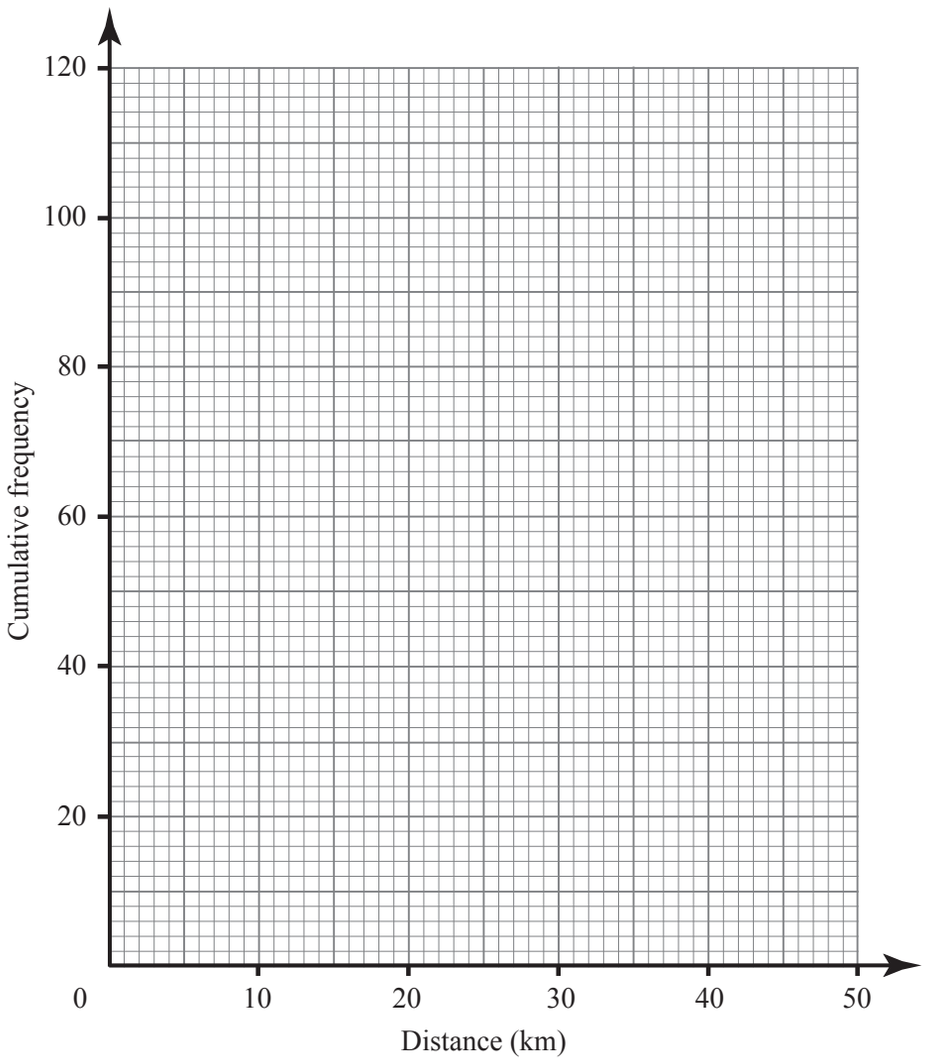
(i) the median,

Answer _____ km [1]

Examiner Only	
Marks	Remark

(ii) the **percentage** of employees who travel more than 18 km to work each day.

Answer _____ % [2]



Examiner Only	
Marks	Remark
Total Question 17	

18 **(a)** M is the point $(-1, 4)$. N is the point $(5, 8)$.

Find the length of MN correct to 2 decimal places.

Answer _____ [3]

(b) Calculate the angle DCE in the triangle below.

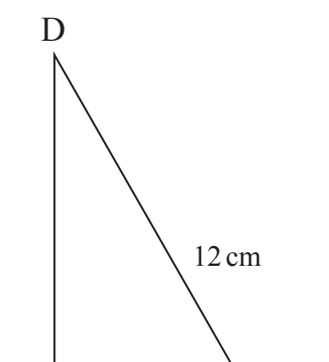


Diagram not drawn accurately

Answer _____ ° [3]

Examiner Only	
Marks	Remark
Total Question 18	

19 **(a)** Solve the simultaneous equations

$$5x + 2y = 13$$
$$2x - 3y = 9$$

A solution by trial and improvement will not be accepted.

Answer $x =$ _____

$y =$ _____ [4]

(b) Find the equation of the line through the points (0, 1) and (3, 13)

Answer _____ [3]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark
Total Question 19	

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For Examiner's use only	
Question Number	**Marks**
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