



Centre Number

71

Candidate Number

General Certificate of Secondary Education
2014

Mathematics

Unit T3

(With calculator)

Higher Tier

[GMT31]



MV18

TUESDAY 27 MAY, 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-nine** 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

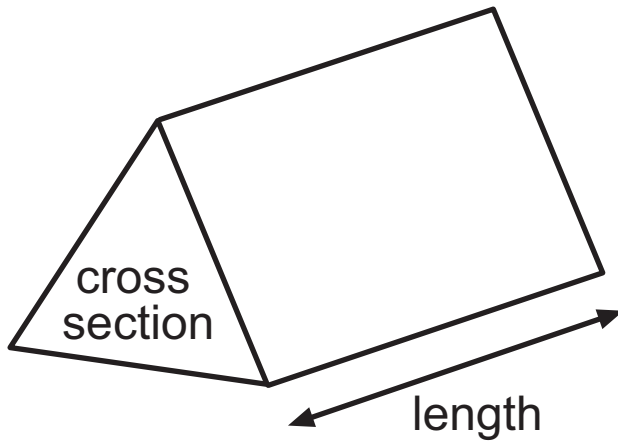
questions 19 and 24.

You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on pages 3 and 4.

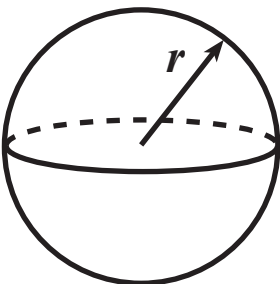
Formula Sheet

Volume of prism = area of cross section \times length



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

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



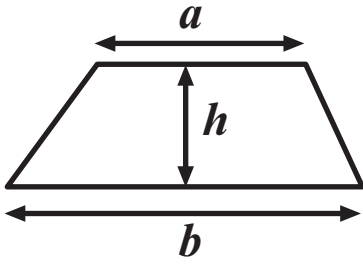
Quadratic Equation

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

where $a \neq 0$, are given by

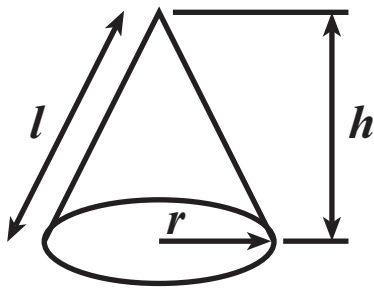
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

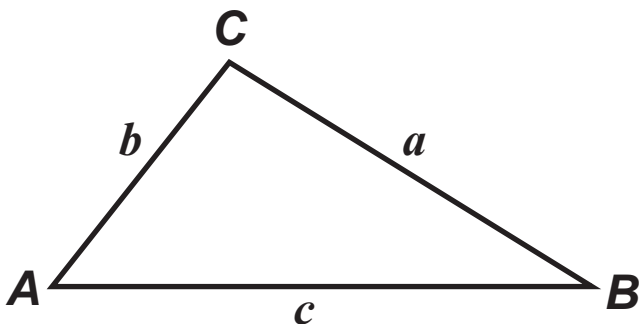


$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Curved surface area of cone} = \pi r l$$



In any triangle ABC



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

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

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

- 1 The petrol tank of a type of lawnmower holds $\frac{2}{3}$ of a litre.

How many tanks of this type of lawnmower can be completely filled from a 5 litre can? [2 marks]

Answer _____

- 2 There are 150 Year 8 pupils in St. Kilda's Secondary School.

$\frac{3}{5}$ of these pupils come to school by bus.

24% walk. The remainder come by car.

How many Year 8 pupils come to school by car? [3 marks]

Answer _____

3 Bill has two options on how to pay for a car.

Option 1. Cash Price £9695

Option 2. A deposit of £1899 + 35 monthly payments of £146 + a final payment of £3785

Calculate which option is cheaper for Bill and by how much.
[3 marks]

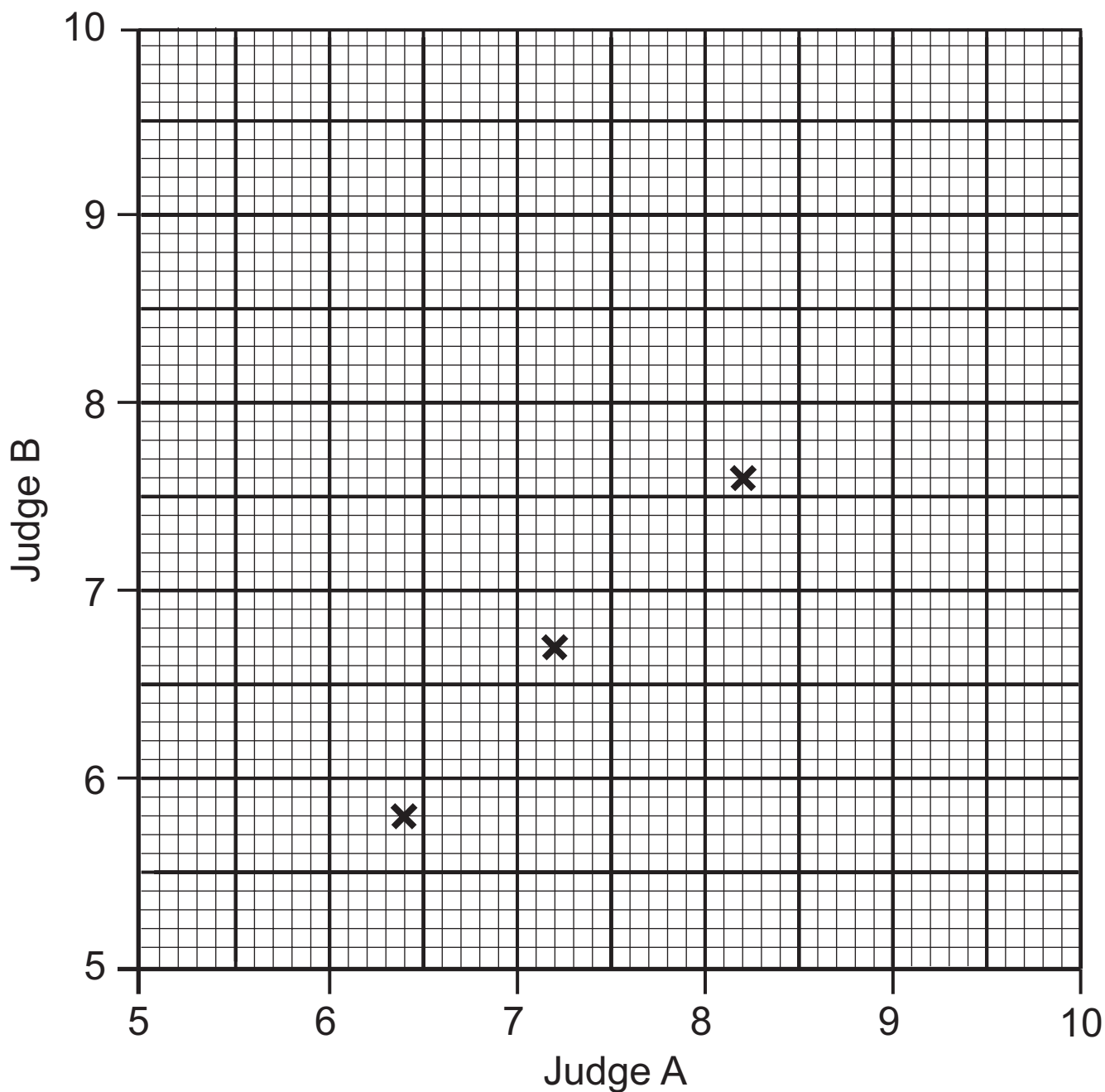
Answer Option _____ is cheaper by £ _____

- 4 The average match attendance for Bidford United last week was 2350
This week the match attendance fell by 640
To the nearest whole number, what was the percentage fall on the match attendance? [2 marks]

Answer _____ %

- 5 The table shows the marks awarded by two judges to the first seven competitors in a dancing competition.

Judge A	8.2	6.4	7.2	6.8	5.6	8.2	9.0
Judge B	7.6	5.8	6.7	6.8	5.2	8.6	9.2



(a) The first three points have already been plotted.
Use the data to complete the scatter graph. [2 marks]

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

(c) Another competitor was awarded 7.7 marks by Judge A.
Estimate the marks awarded to this competitor by
Judge B. [1 mark]

Answer _____

(d) What type of correlation does your graph show? [1 mark]

Answer _____

6 The increase in height of 100 children over a period of time was recorded.

Increase in height (h cm)	$0 < h \leq 2$	$2 < h \leq 4$	$4 < h \leq 6$	$6 < h \leq 8$	$8 < h \leq 10$
Frequency	12	34	42	10	2

(a) Show this information on a bar chart. [3 marks]



(b) Write down the modal class interval. [1 mark]

Answer _____

(c) Describe how you would construct a frequency polygon for the data. [2 marks]

7 Donna wants to investigate the hypothesis

‘Children play more computer games than adults.’

She surveys 10 girls in her class and their parents.

Give two reasons why her sample is unsuitable.

Reason 1 [1 mark] _____

Reason 2 [1 mark] _____

- 8 A window cleaning firm is employed to clean the windows of an office block.

The firm charges a basic fee of £50 plus £4 for each window they clean.

They clean w windows and charge £230

- (a) Write an **equation** in terms of w using this information.

[2 marks]

Answer _____

- (b) Solve this equation to find the number of windows cleaned. [2 marks]

Answer _____ windows

9 (a) Expand and simplify $(x - 2)(x - 7)$ [2 marks]

Answer _____

(b) Simplify $\frac{2a}{5} - \frac{a}{4}$ [3 marks]

Answer _____

(c) Solve $3p + 1 = 13 - p$ [3 marks]

Answer $p =$ _____

10 Factorise **fully**

(a) $8 - 4x$ [1 mark]

Answer _____

(b) $x^2 + 3x$ [1 mark]

Answer _____

(c) $3x^2 - x$ [1 mark]

Answer _____

11 The diagram shows a triangle ABC and a straight line CD.

AB is parallel to CD.

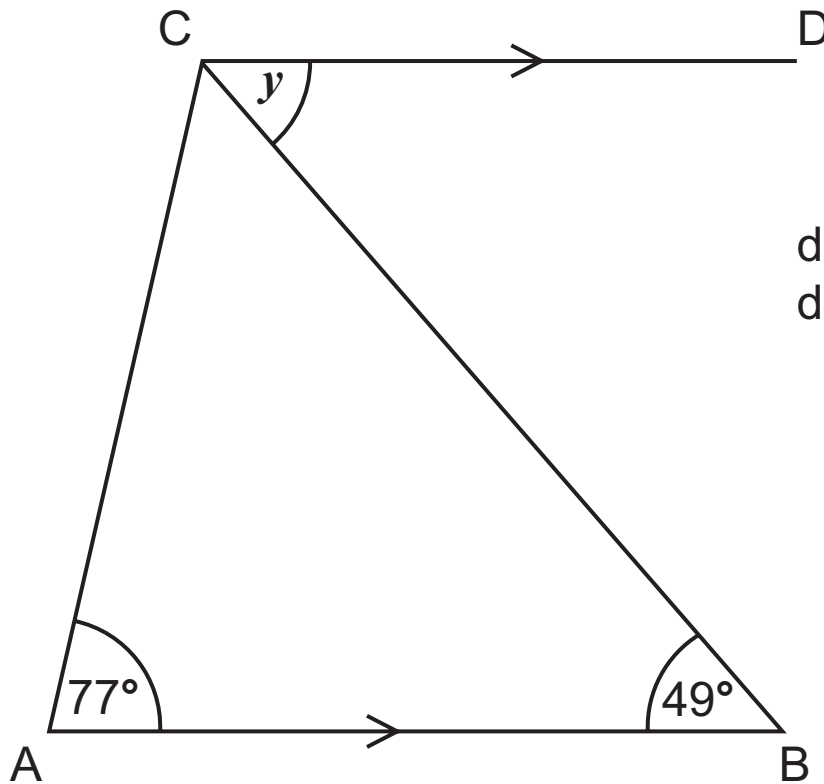


diagram not
drawn accurately

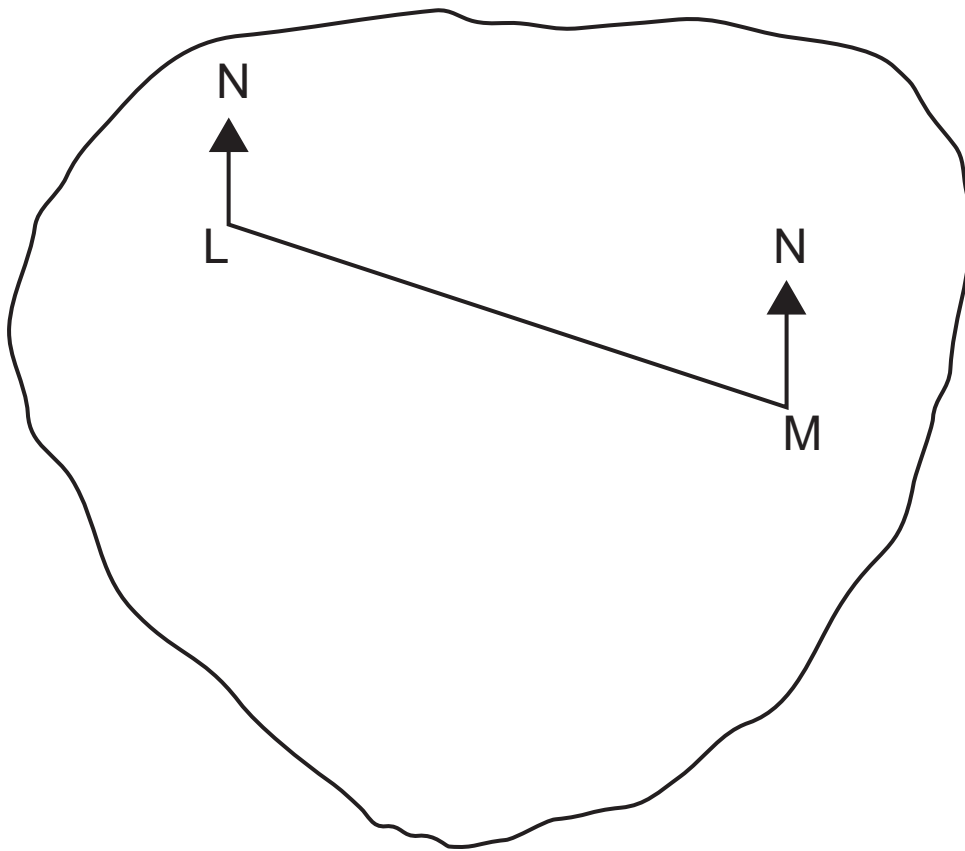
(a) Write down the size of the angle marked y [1 mark]

Answer $y =$ _____ $^{\circ}$

(b) Give a reason for your answer. [1 mark]

Reason _____

- 12** The map of an island is shown below.
L and M are the positions of two houses on the island.



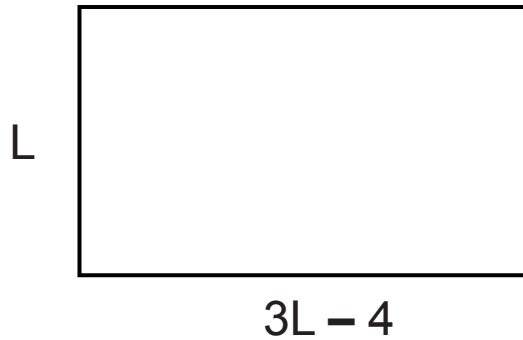
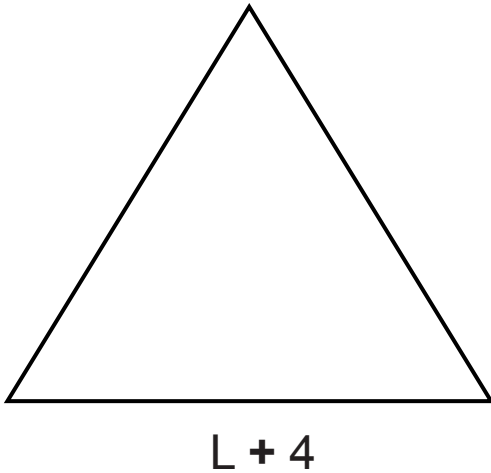
A third house, H, is on a bearing of 130° from L and on a bearing of 225° from M.
Mark the position of H on the diagram above. [3 marks]

13 Calculate the area of a circle with a diameter of 11 cm.
[3 marks]

Answer _____

- 14 An equilateral triangle has sides of length $(L + 4)$ and a rectangle has sides of length L and $(3L - 4)$ as shown.

diagrams not
drawn accurately



The **perimeters** of the triangle and the rectangle are equal.
Set up and solve an equation to find the value of L .

[3 marks]

A solution by trial and improvement will not be accepted.

Answer $L =$ _____

15 Half of the chimpanzees in a zoo weigh less than 45 kg.

$\frac{4}{5}$ of the chimpanzees weigh less than 55 kg.

No chimpanzees weigh exactly 45 kg.

What fraction of the chimpanzees weigh between 45 kg and 55 kg? [3 marks]

Answer _____

16 Sammy borrows £400 for nine months.

He is charged 12.5% per annum simple interest.

How much does he have to pay back? [3 marks]

Answer £ _____

17 The interior angle of a regular polygon is 144°

Work out the number of sides of the polygon. [3 marks]

Show your working.

Answer _____ sides

18

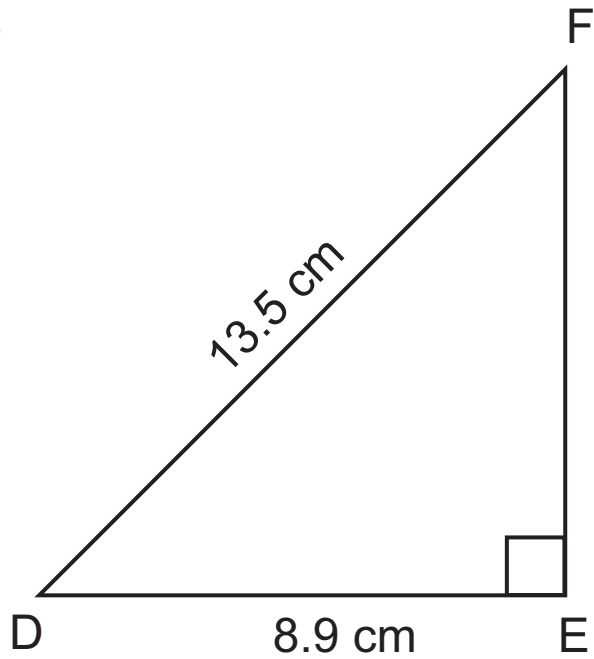


diagram not
drawn accurately

DEF is a right-angled triangle.

$DF = 13.5 \text{ cm}$ and $DE = 8.9 \text{ cm}$.

Calculate the length of EF. [3 marks]

Answer EF = _____

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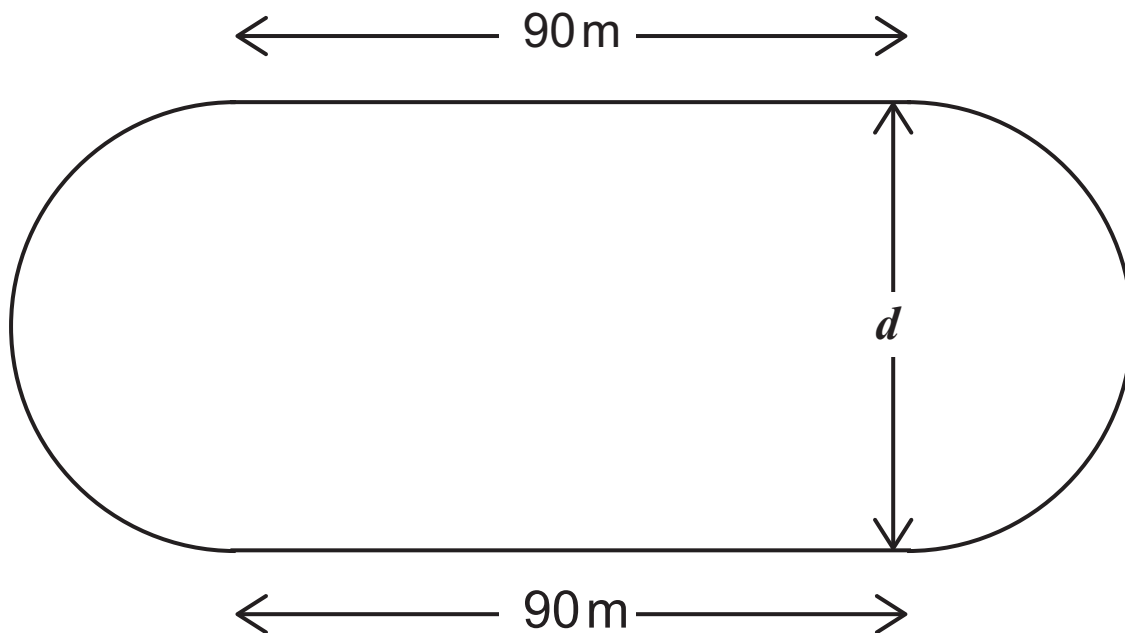
Quality of written communication will be assessed in this question.

19 The diagram below represents a running track.

It consists of two parallel straight lines and two semicircles.

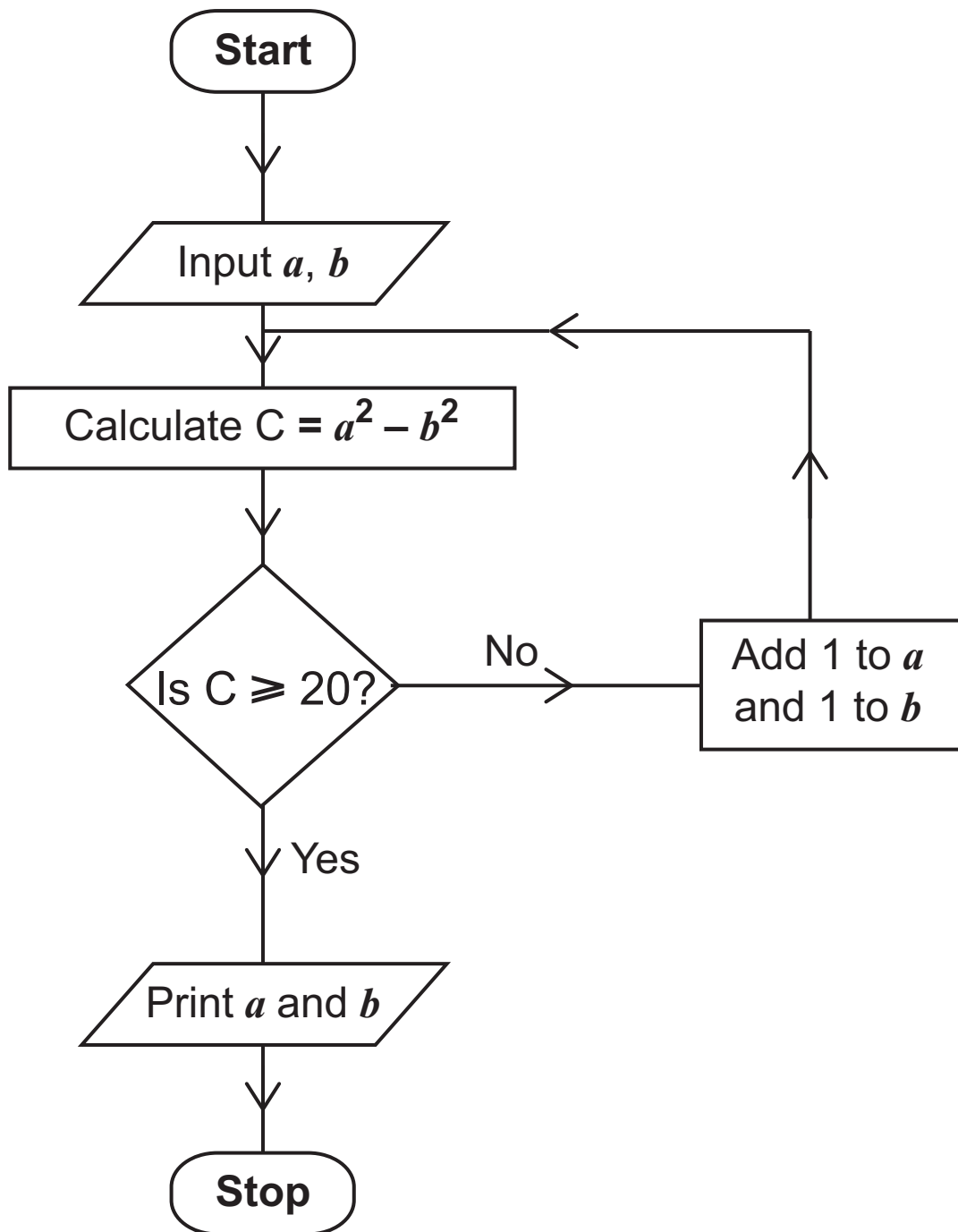
The straight lines are each 90 metres in length.

The running track has a total perimeter of 400 metres.



Calculate the distance, d , between the two straight lines.
[4 marks]

Answer $d =$ _____ metres



Starting with $a = 8$ and $b = 7$ use the flow chart to find the values printed. [3 marks]

a	b	C
8	7	

Answer $a =$ _____ $b =$ _____

- 21** Jill asked a number of students in her year group how much they paid for their mobile phone. The results are shown in the frequency table.

Price (£P)	Frequency
$0 < P \leq 40$	4
$40 < P \leq 80$	14
$80 < P \leq 120$	65
$120 < P \leq 160$	64
$160 < P \leq 200$	33

Write down the class interval which contains the median price. [1 mark]

Answer _____

22 The number of customer complaints received by an airline during a year was 1148
This was 18% down on the previous year.
How many customer complaints did the airline receive during the previous year? [3 marks]

Answer _____

23 Jack looked at the pile of books on the floor.

“You must have at least one hundred books there” said his sister Katie.

“Not quite” said Jack, “but I do have a problem in packing them into boxes. If I pack them away with 6 in a box, I am one book short of filling the last box and the same happens if I try to pack them with 8 in a box. If however I pack them with 5 in a box, I have one book left over. I’m not sure what to do!”

How many books are there in the pile on the floor?

[3 marks]

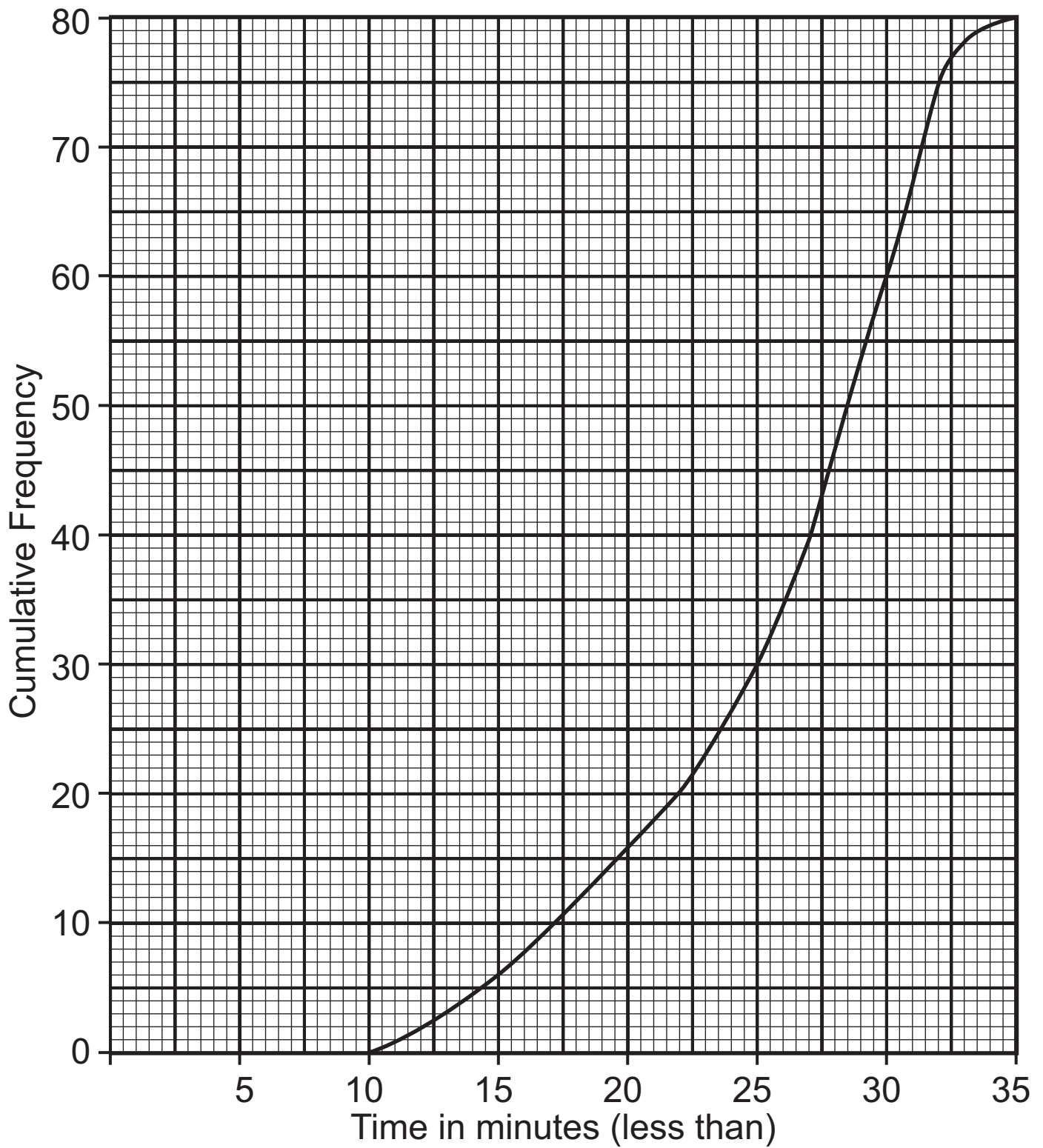
Answer _____

Quality of written communication will be assessed in this question.

24 A company decreases its debt by 18% each month.
At the start of January the debt is £12 500
The target is to reduce the debt to half its value by the end of March.
Will the target be achieved? Explain your answer. [3 marks]

Answer _____ because _____

25 The time taken by a number of adults to complete a survey was recorded.
The cumulative frequency graph for the results is shown.



Use the graph to estimate

(a) the median, [1 mark]

Answer _____ minutes

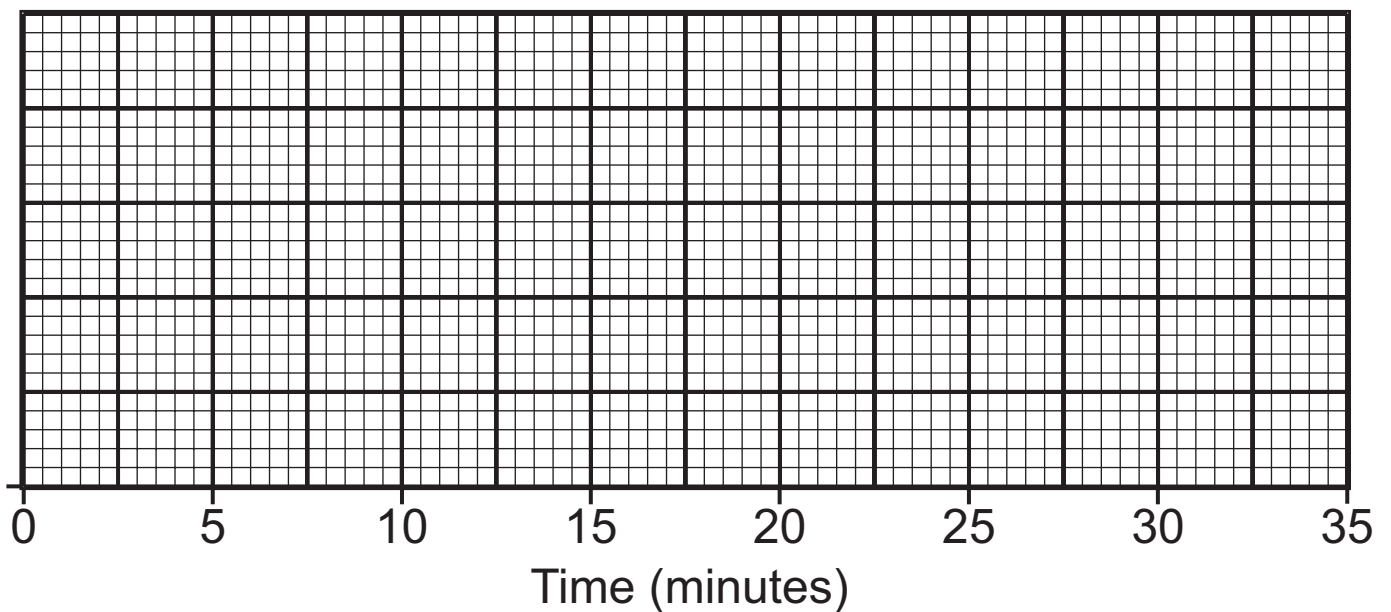
(b) the inter-quartile range. [2 marks]

Answer _____ minutes

26 The times, in minutes, taken by 19 pupils to do a homework are listed in order below.

6, 9, 11, 14, 15, 16, 17, 18, 18, 18, 19, 21, 21, 23, 24, 25, 27, 29, 31

Draw a box plot for this data on the grid below. [3 marks]



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(Questions continue overleaf)

27 (a) Solve the simultaneous equations
You must show your working.
A solution by trial and improvement
will not be accepted. [3 marks]

$$4p + q = 7$$
$$2p - 5q = 20$$

Answer $p =$ _____ $q =$ _____

(b) Factorise $x^2 + x - 20$ [2 marks]

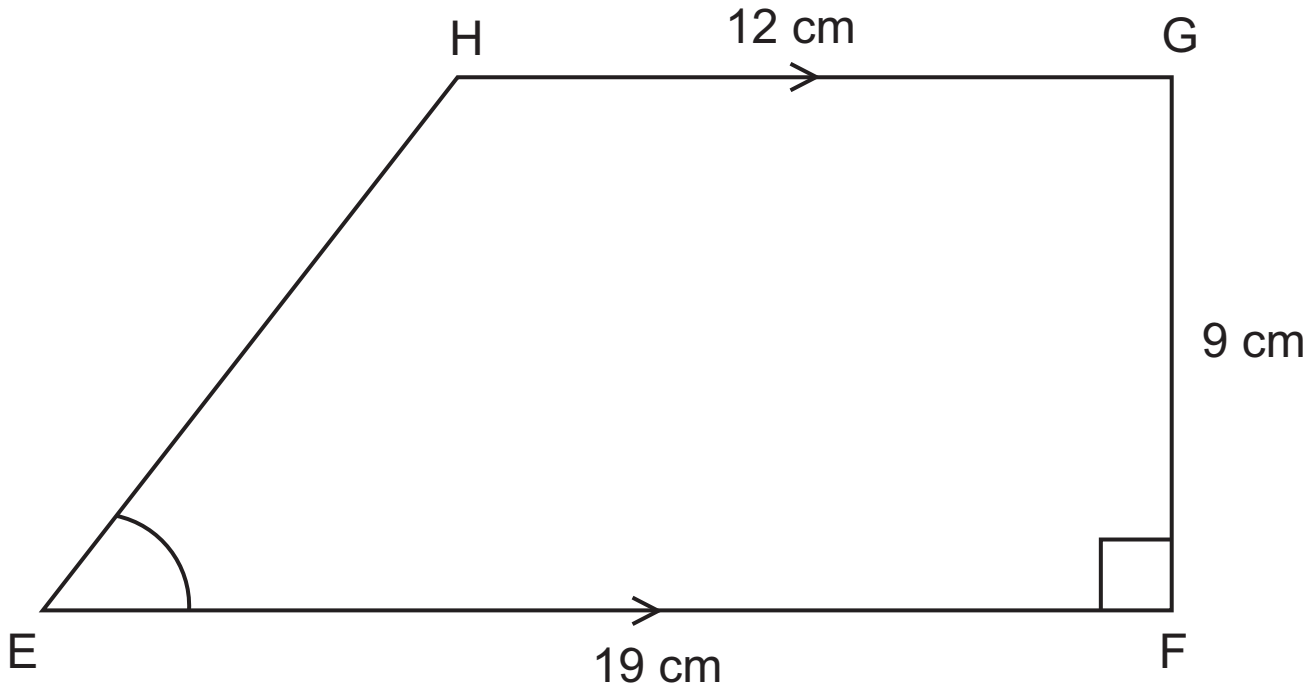
Answer _____

(c) Solve $\frac{2p+5}{6} = \frac{p}{4} + 2$ [4 marks]

Answer $p =$ _____

28 The diagram shows a trapezium, EFGH.

diagram not
drawn accurately



EF is parallel to HG. Angle EFG = 90°

EF = 19 cm, FG = 9 cm and HG = 12 cm.

Calculate the size of angle HEF. Give your answer correct to 1 decimal place. [3 marks]

Answer _____ $^\circ$

29 To the nearest centimetre, $p = 13$ cm and $q = 8$ cm.

(a) Calculate the least value of pq [2 marks]

Answer _____

(b) Calculate the greatest value of $\frac{q}{p}$ [2 marks]

Answer _____

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	Marks
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Total Marks	

Examiner Number

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