Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014

# Mathematics

Unit T3

**(With calculator)**

Higher Tier

**[GMT31]**

*GMT31*

**TUESDAY 27 MAY, 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 box, around each page, on blank pages or tracing paper**.
Complete in blue or black ink only. **Do not write with a gel pen**.
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.

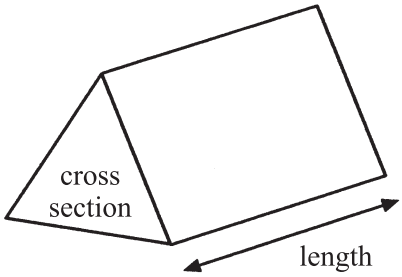
**INFORMATION FOR CANDIDATES**

The total mark for this paper is 100.
Figures in brackets printed 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 or 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 page 2.

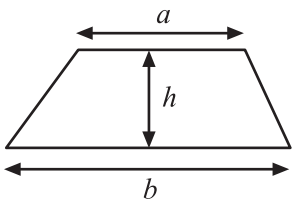
8799

# Formula Sheet

**Volume of prism** = area of cross section × length

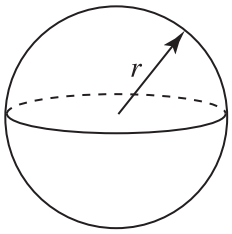



**Area of trapezium** = $\frac{1}{2}(a+b)h$



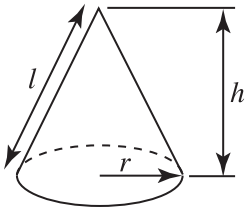

**Volume of sphere** = $\frac{4}{3}\pi r^3$

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




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

**Curved surface area of cone** = $\pi rl$

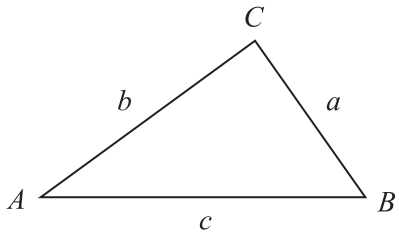



**Quadratic Equation**

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

8799

| Examiner Only | |
|---|---|
| Marks | Remark |

**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?

Answer _____ [2]

Total Question 1

**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?

Answer _____ [3]

Total Question 2

| Examiner Only | |
|---|---|
| Marks | Remark |

**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.

Answer Option _____ is cheaper by £ _____ [3]

Total Question 3

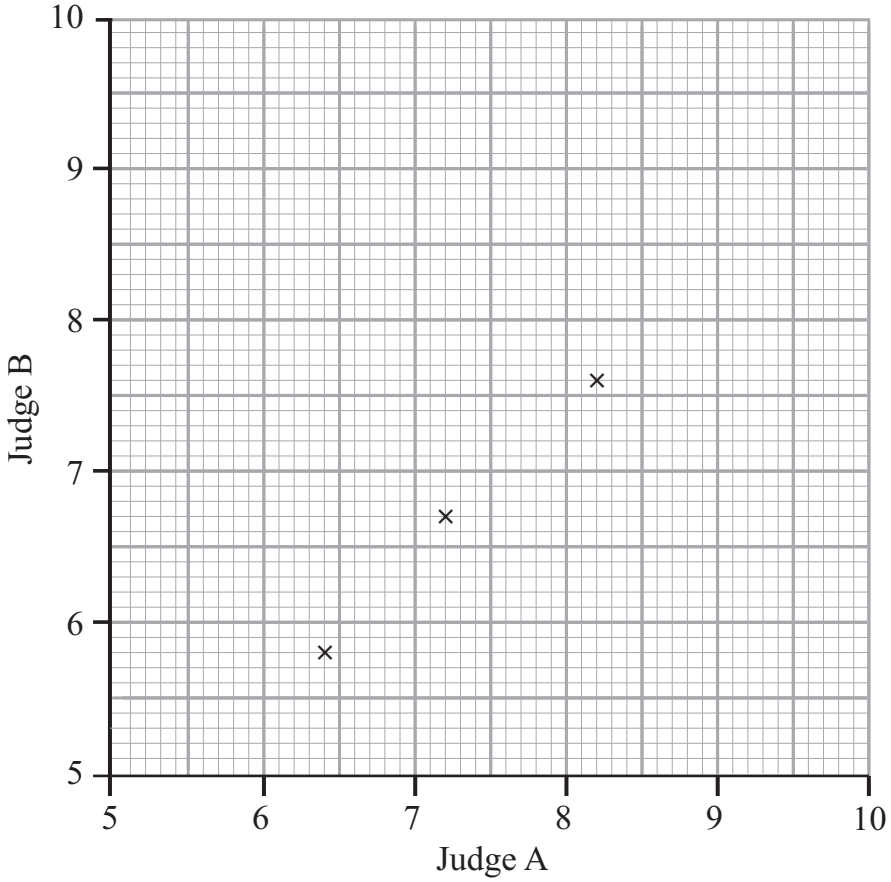
**4** The average match attendance for Bidford United last week was 2350
This week the match attendance fell by 640
To the nearest whole number, what was the percentage fall on the match attendance?

Answer _____ % [2]

Total Question 4

**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]

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

**(c)** Another competitor was awarded 7.7 marks by Judge A.
Estimate the marks awarded to this competitor by Judge B.

Answer _____ [1]

**(d)** What type of correlation does your graph show?

Answer _____ [1]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 5 | |

**[Turn over**

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

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

**(a)** Show this information on a bar chart.

[3]

**(b)** Write down the modal class interval.

Answer _____ [1]

**(c)** Describe how you would construct a frequency polygon for the data.

_____

_____ [2]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 6 | |

| Examiner Only | |
|---|---|
| Marks | Remark |

**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]

Reason 2 _____

_____ [1]

Total Question 7

**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.

Answer _____ [2]

**(b)** Solve this equation to find the number of windows cleaned.

Answer _____ windows [2]

Total Question 8



**[Turn over**

**9** **(a)** Expand and simplify $(x - 2)(x - 7)$

Answer _____ [2]

**(b)** Simplify $\frac{2a}{5} - \frac{a}{4}$

Answer _____ [3]

**(c)** Solve $3p + 1 = 13 - p$

Answer $p$ = _____ [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 9 | |

**10** Factorise **fully**

| Examiner Only | |
|---|---|
| Marks | Remark |

**(a)** $8 - 4x$

Answer _____ [1]

**(b)** $x^2 + 3x$

Answer _____ [1]

**(c)** $3x^2 - x$

Answer _____ [1]

Total Question 10



**[Turn over**

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

AB is parallel to CD.

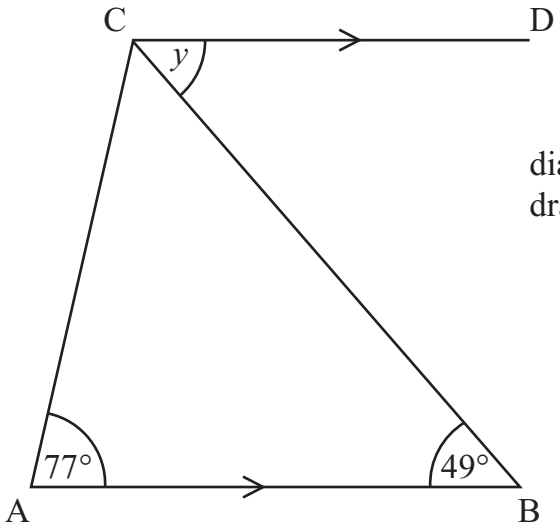



diagram not drawn accurately

**(a)** Write down the size of the angle marked $y$

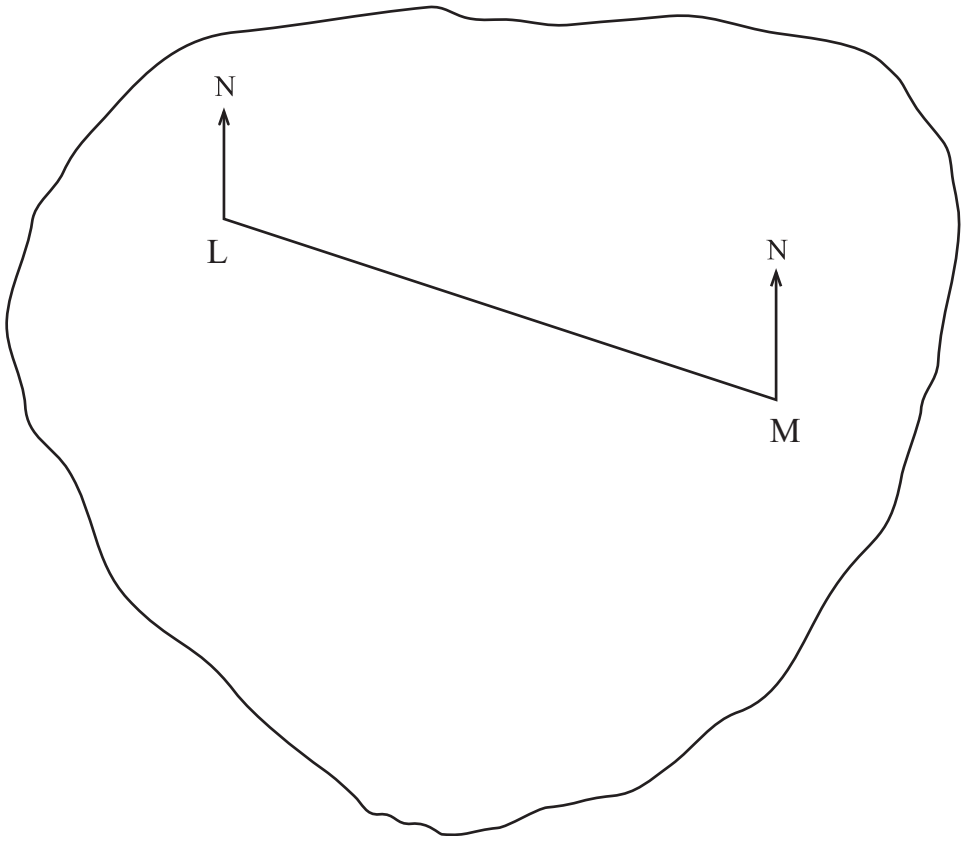
Answer $y =$ _____ ° [1]

**(b)** Give a reason for your answer.

Reason _____ [1]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 11 | |

**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]

Examiner Only

| Marks | Remark |
|---|---|
| | |

Total Question 12

**13** Calculate the area of a circle with a diameter of 11 cm.

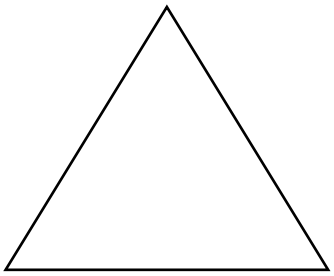
Answer _____ [3]

Total Question 13



**[Turn over**

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



L + 4


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.
**A solution by trial and improvement will not be accepted.**

Answer L = _____ [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 14 | |

**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?

Answer _____ [3]

| Total Question 15 | |
|---|---|
| | |



**16** Sammy borrows £400 for nine months.

He is charged 12.5% per annum simple interest.

How much does he have to pay back?

Answer £ _____ [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 16 | |

**17** The interior angle of a regular polygon is 144°

Work out the number of sides of the polygon.

**Show your working.**

Answer _____ sides [3]

| | |
|---|---|
| | |
| Total Question 17 | |



**[Turn over**

**18**

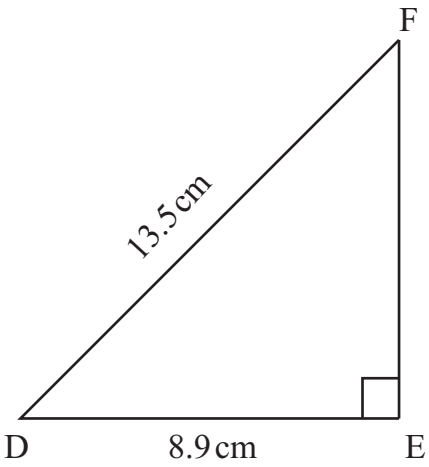



diagram not
drawn accurately

DEF is a right-angled triangle.

DF = 13.5 cm and DE = 8.9 cm.

Calculate the length of EF.

Answer EF = _____ cm [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 18 | |

**Quality of written communication will be assessed in this question.**

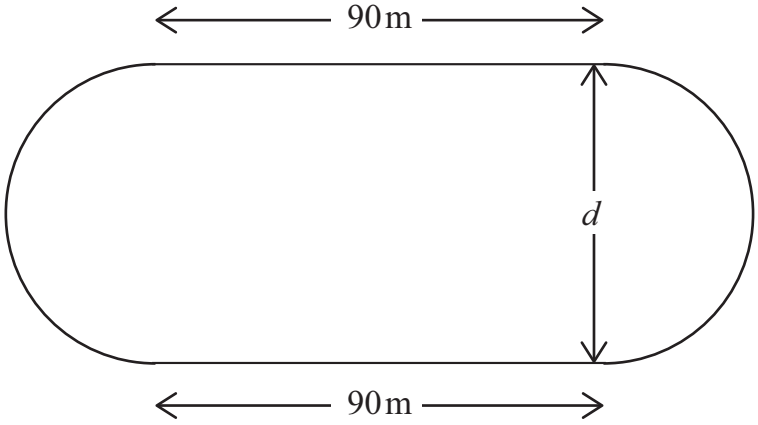
| Examiner Only | |
|---|---|
| Marks | Remark |

**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.

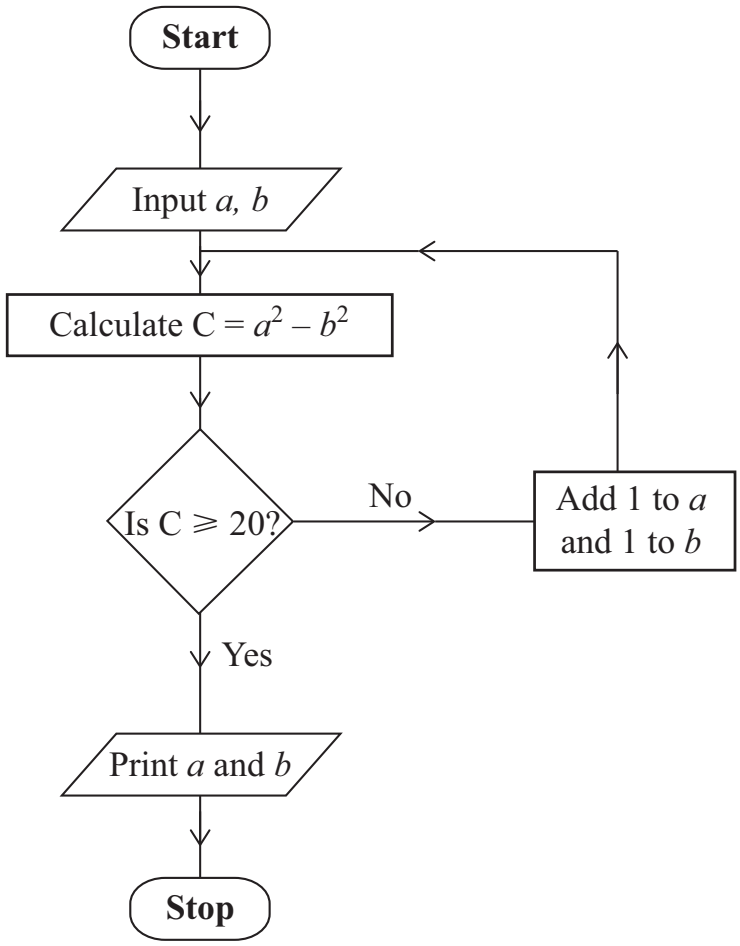



Calculate the distance, $d$, between the two straight lines.

Answer $d$ = _____ metres [4]

Total Question 19

**20**




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

| $a$ | $b$ | C |
|---|---|---|
| 8 | 7 | |
| | | |
| | | |

Answer $a =$ _____ $b =$ _____ [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 20 | |

**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 |
|---|---|
| $0 < P \leqslant 40$ | 4 |
| $40 < P \leqslant 80$ | 14 |
| $80 < P \leqslant 120$ | 65 |
| $120 < P \leqslant 160$ | 64 |
| $160 < P \leqslant 200$ | 33 |

Write down the class interval which contains the median price.

Answer _____ [1]

Total Question 21

**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?

Answer _____ [3]

Total Question 22

Examiner Only
Marks | Remark

**[Turn over**

**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?

Answer _____ [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 23 | |

**Quality of written communication will be assessed in this question.**

| Examiner Only | |
|---|---|
| Marks | Remark |

**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.

Answer _____ because _____

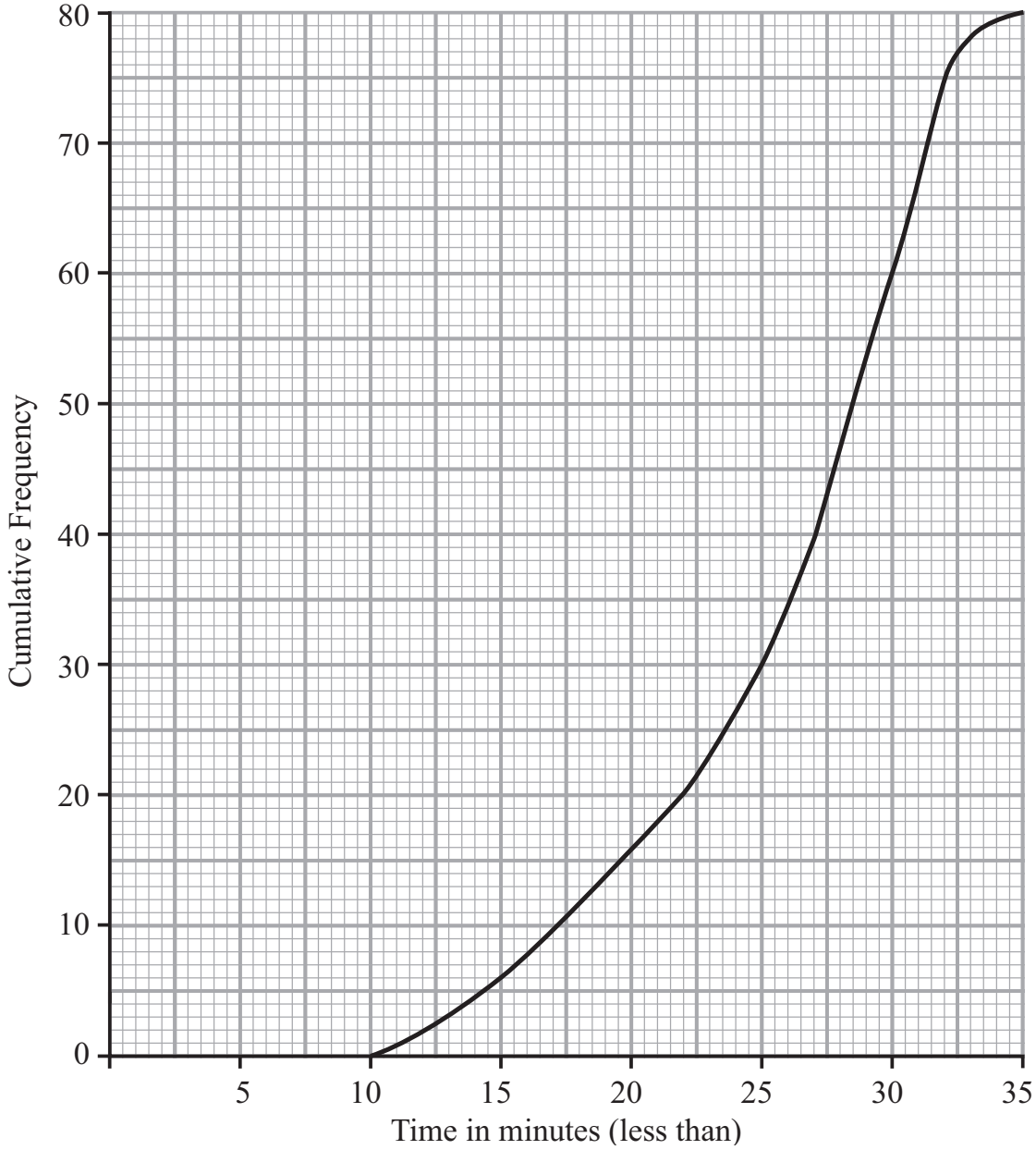
_____ [3]

| Total Question 24 | |
|---|---|
| | |



**[Turn over**

**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,

Answer _____ minutes [1]

**(b)** the inter-quartile range.

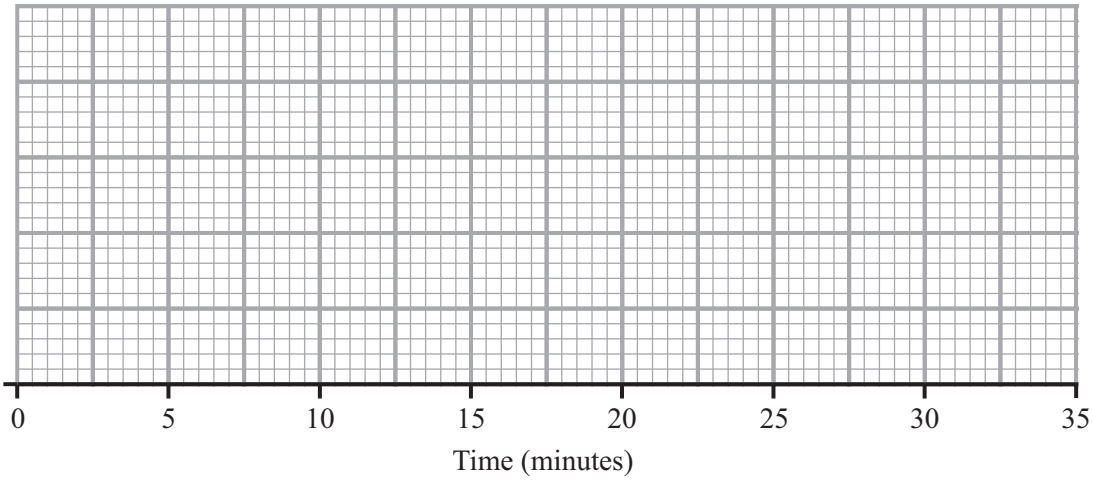
Answer _____ minutes [2]

| Examiner Only | |
|---|---|
| Marks | Remark |
| Total Question 25 | |

**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]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 26 | |

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

$4p + q = 7$

$2p - 5q = 20$

**You must show your working.**
**A solution by trial and improvement will not be accepted.**

Answer $p =$ _____ $q =$ _____ [3]

**(b)** Factorise $x^2 + x - 20$

Answer _____ [2]

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

Answer $p =$ _____ [4]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 27 | |

**28** The diagram shows a trapezium, EFGH.

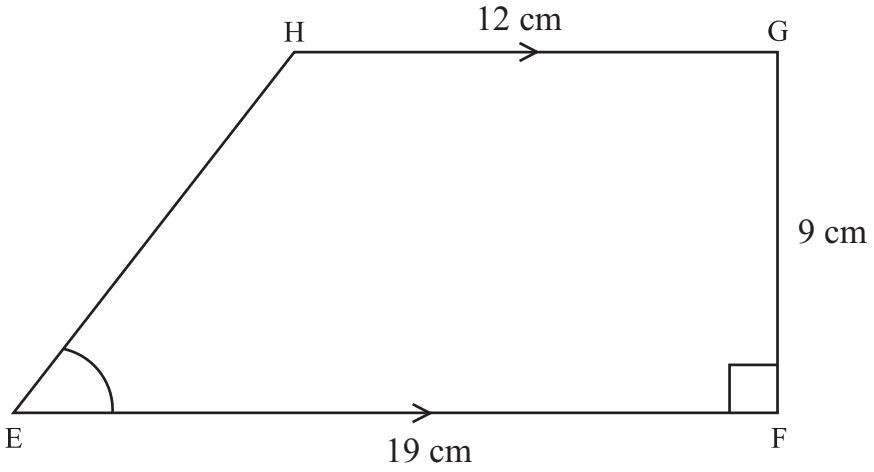



diagram not drawn accurately

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.

Answer _____° [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 28 | |

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

**(a)** Calculate the least value of $pq$

Answer _____ [2]

**(b)** Calculate the greatest value of $\frac{q}{p}$

Answer _____ [2]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |
| Total Question 29 | |
| | |

| For Examiner's use only | |
|---|---|
| Question Number | Marks |
| 1 | |
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| 3 | |
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| 5 | |
| 6 | |
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**Examiner Number**