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Rewarding Learning

**General Certificate of Secondary Education
2014**

Mathematics

Unit T4

(With calculator)

Higher Tier

MV18

[GMT41]

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-three** 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.

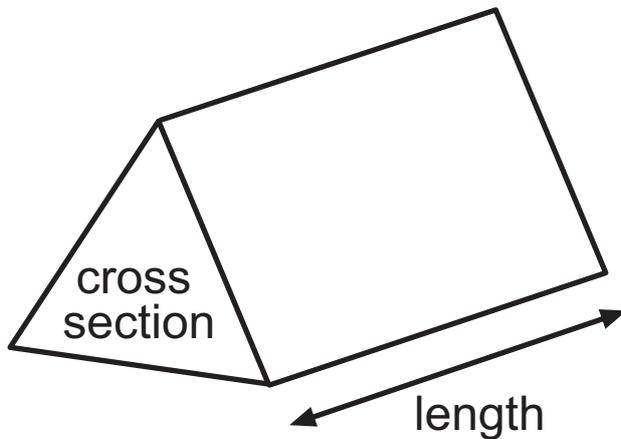Quality of written communication will be assessed in **Questions 6 and 12**.

You should have a calculator, ruler, compasses and a protractor.
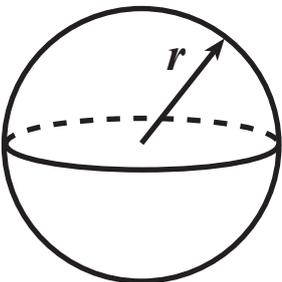
The Formula Sheet is on pages 3 and 4.

Formula Sheet

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

Volume of sphere = $\frac{4}{3}\pi r^3$
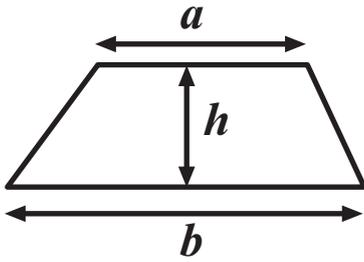
Surface area of sphere = $4\pi r^2$

Quadratic Equation

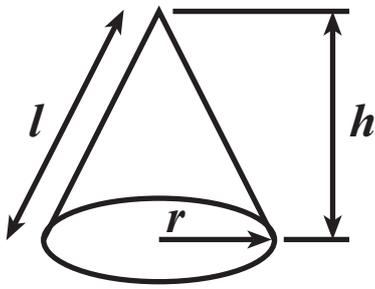The solutions of $ax^2 + bx + c = 0$

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 $= \pi r l$

In any triangle *ABC*
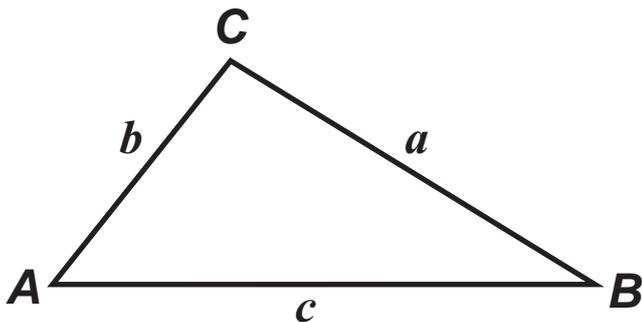
Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

1 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]

Time (minutes)

5
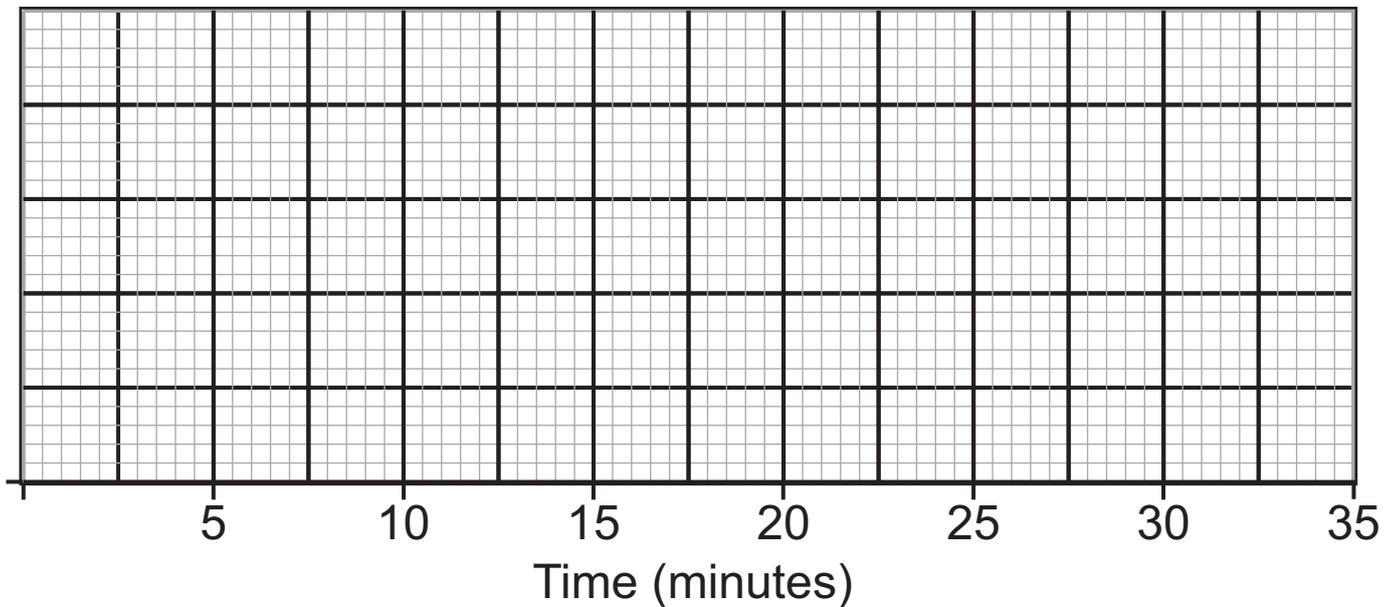
2 The time taken by a number of adults to complete a survey was recorded.
The cumulative frequency graph for the results is shown.

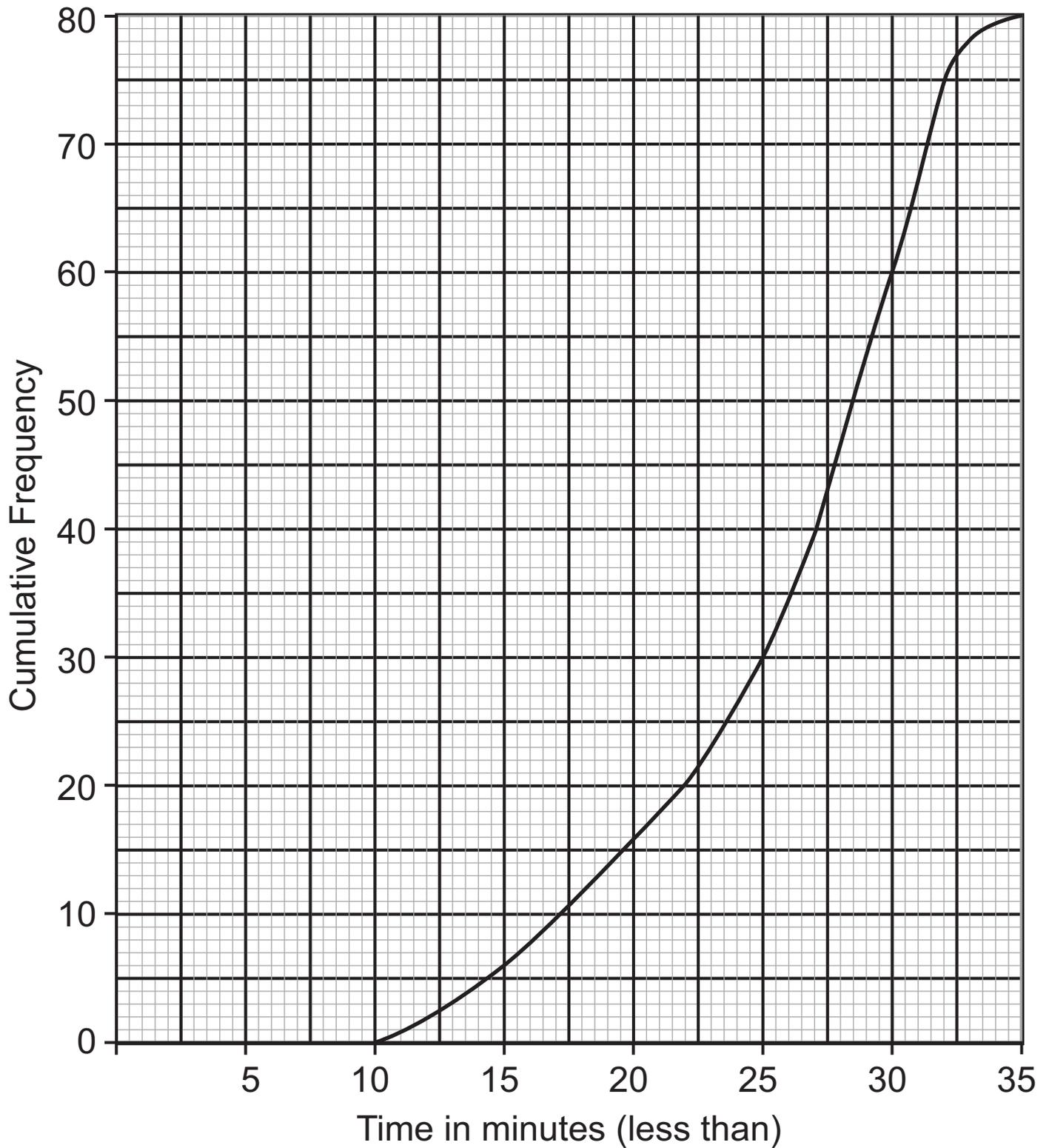Use the graph to estimate

(a) (i) the median, [1 mark]

Answer _____ minutes

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

Answer _____ minutes

(b) What percentage of the adults took more than 25 minutes to complete the survey? [2 marks]

Answer _____ %

7

[Turn over

3   The diagram shows a trapezium, EFGH.

diagram not
drawn accurately
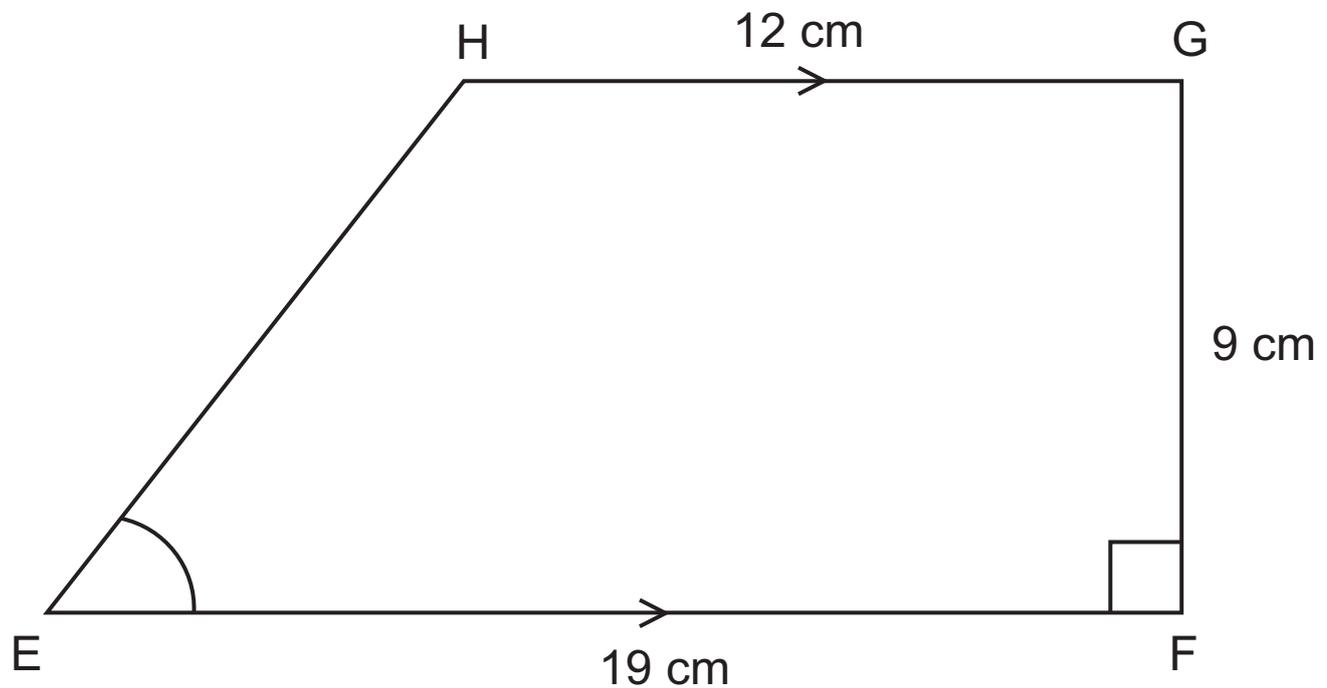
EF is parallel to HG. Angle EFG = 90°
EF = 19 cm, FG = 9 cm and HG = 12 cm.
Calculate the size of angle HEF. Give your answer correct to
1 decimal place. [3 marks]

Answer _____°

4 **(a)** Solve the simultaneous equations $\qquad$ $4p + q = 7$
    You must show your working. $\qquad$ $2p - 5q = 20$
    A solution by trial and improvement
    will not be accepted. [3 marks]

Answer $p =$ _____ , $q =$ _____

(b) Factorise fully $\qquad$ $3xy - 9y^2$ $\qquad$ [2 marks]

Answer _____

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

Answer $p =$ _____

10

5 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 _____

Quality of written communication will be assessed in this question.

6 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 _____

_____

_____

7 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 _____

8 A straight line cuts the x axis at the point (6, 0) and the y axis at the point (0, 12).
Find the equation of the line. [3 marks]

Answer _____

9 **(a)** Factorise $x^2 + x - 20$ [2 marks]

Answer _____

(b) Expand and simplify $(3x - 2)(3x + 7)$ [2 marks]

Answer _____

(c) Factorise fully $x^3 - 4x$ [2 marks]

Answer _____

10 y varies inversely as x^2

When $x = 2$, $y = \dfrac{3}{4}$

Find the formula connecting y and x. [3 marks]

Answer _____

11 A square garden of side p metres is surrounded completely by a path of width q metres whose outer boundary also forms a square.

Find and express in its simplest terms an expression for the area of the path in square metres. [4 marks]

Answer _____ m²

Quality of written communication will be assessed in this question.

12 There are 200 Year 8 pupils in Northfield High School. There are 100 girls and 100 boys. A survey is to be carried out to assess how they have settled in to their new school. Forty pupils from Year 8 are needed for this survey.

(a) From an alphabetical list of Year 8 pupils' names, every third pupil is selected until there are 40 pupils.

Explain why this may not produce a fair sample, giving two reasons.

Reason 1 [1 mark] _____

_____

_____

Reason 2 [1 mark] _____

_____

_____

(b) Suggest a more suitable way of choosing a sample. [2 marks]

Answer _____

_____

_____

13 Ten girls and thirty boys took part in a penalty kick competition. The mean score for the girls was 7.5 and the mean score for the boys was 8.5

What was the mean score for the 40 competitors?
[3 marks]

Answer _____

14 A teacher has fourteen players of equal ability keen to play on the school netball team. She decides to select the tallest seven players.
Which measure of central tendency (average) could help her select the players?
Give a reason for your answer. [2 marks]

Answer _____ because _____

_____

_____

15 (a) Evaluate each of the following without using your calculator.
Show all your working.

(i) $27^{\frac{2}{3}}$ [1 mark]

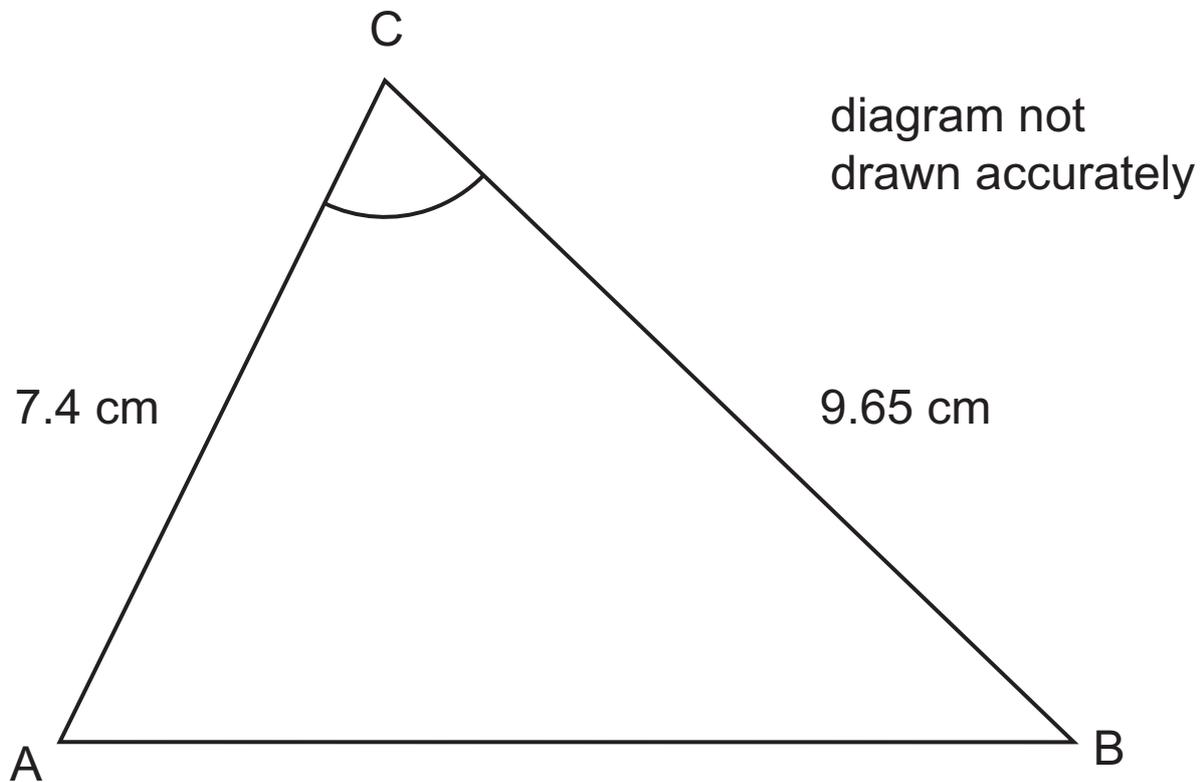Answer _____

(ii) $9^{0.5} \div 36^{-\frac{1}{2}}$ [2 marks]

Answer _____

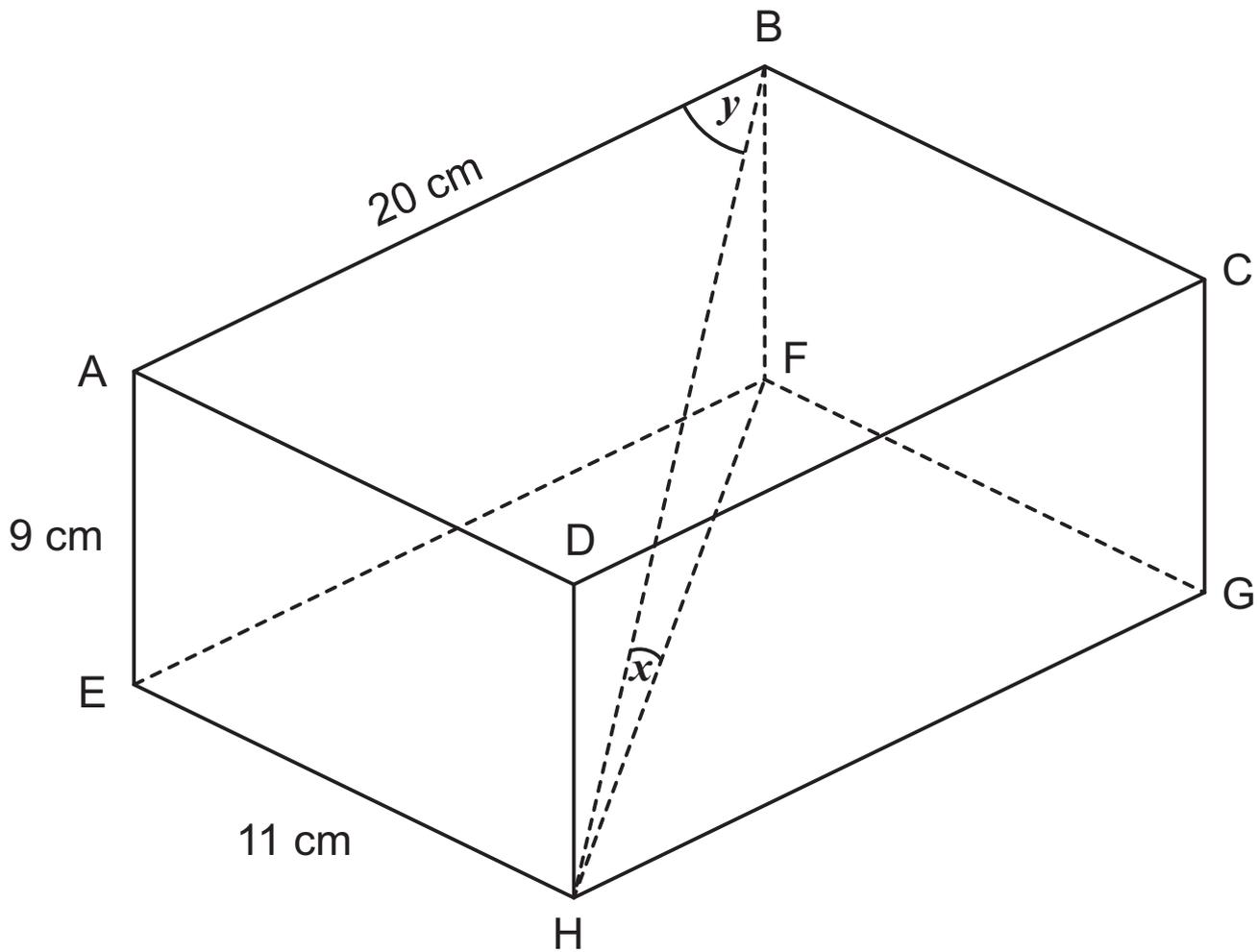**(b)** Find the value of x when [2 marks]
$16^x = 32$

Answer _____

20

16

diagram not drawn accurately

In the triangle ABC above, AC = 7.4 cm, BC = 9.65 cm and angle ACB = 72°

Calculate the length of AB. [3 marks]

Answer _____ cm

8800.04 **MV18**   **21**   **[Turn over**

17 The diagram below shows a cuboid.
AB = 20 cm, AE = 9 cm and EH = 11 cm.

(a) Find the length of the space diagonal BH. [2 marks]

Answer BH = _____ cm

(b) The angle between BH and HF is x.
The angle between BH and AB is y.
Which angle is bigger, x or y?
You must show your working to justify your answer.
[4 marks]

Answer _____

18 The table shows the time taken by men to complete a race.

Time (t minutes)	Frequency
$50 \leqslant t < 60$	15
$60 \leqslant t < 63$	21
$63 \leqslant t < 65$	30
$65 \leqslant t < 67$	25
$67 \leqslant t < 70$	9

(a) Illustrate the data by drawing a histogram on the graph paper opposite. [3 marks]
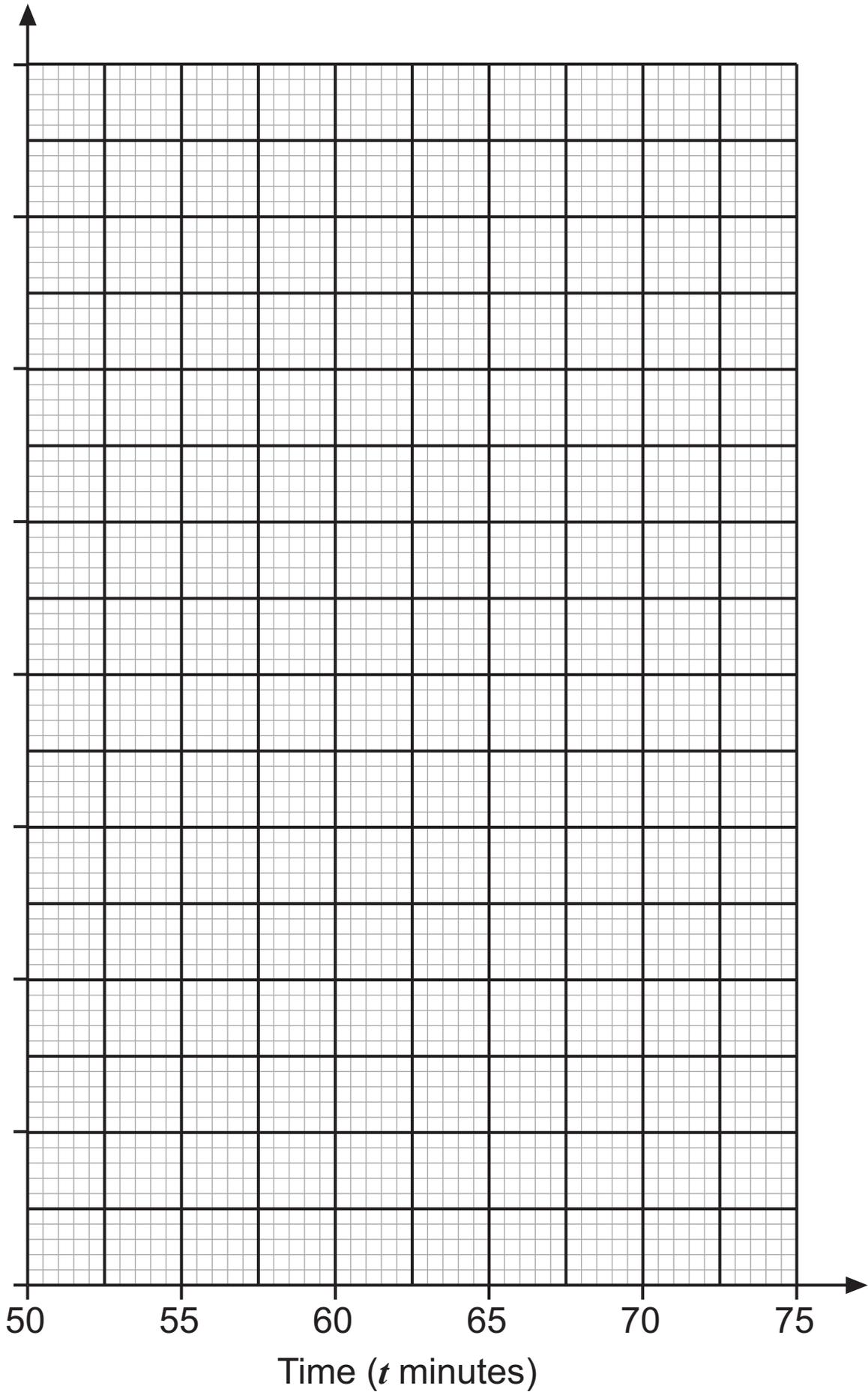
(b) A stratified sample of 25 men was taken from those whose time was less than 65 minutes.

  (i) How many of the sample were taken from the class interval $60 \leqslant t < 63$?　　[2 marks]
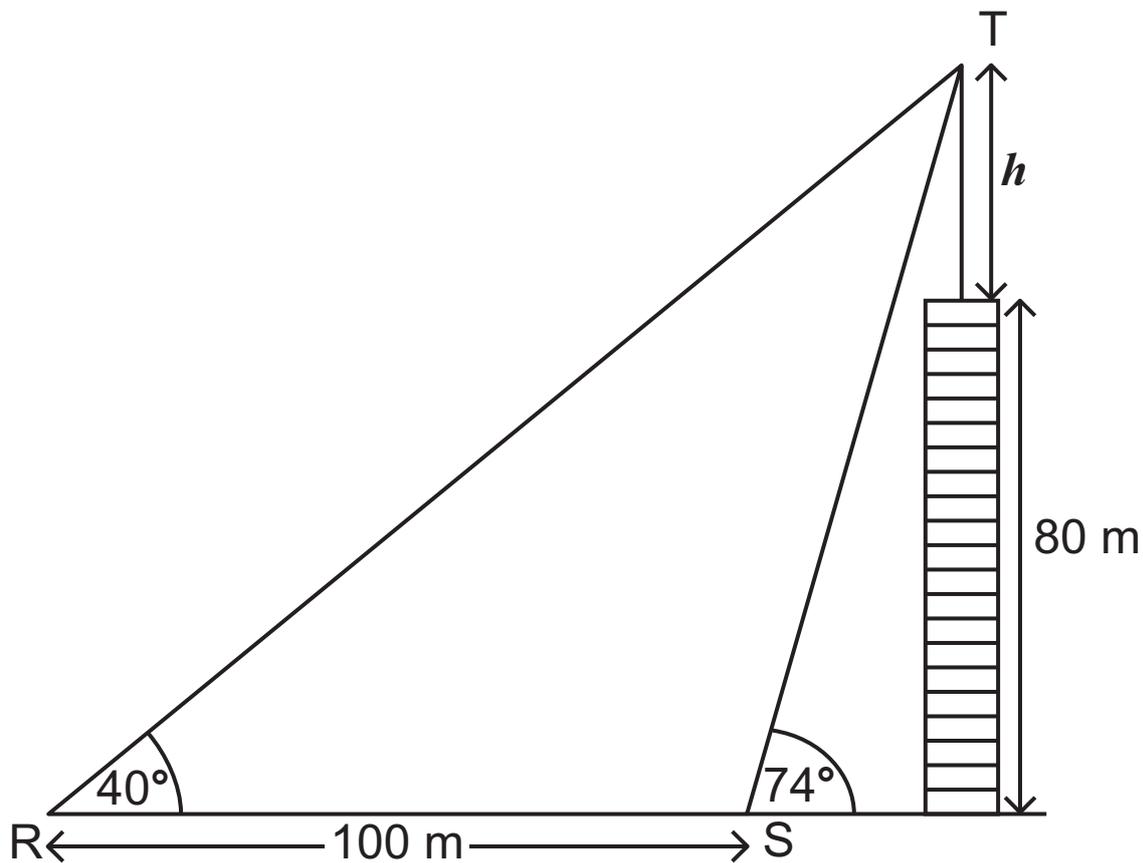
      Answer _____

  (ii) In this stratified sample 40% of the times were less than 62 minutes. Estimate how many of all the original times were 62 minutes or more. [2 marks]

      Answer _____

Time (*t* minutes)

25

[Turn over

19

A tower block has a TV transmitter on top of it as shown above.
From a point R on the ground the angle of elevation of the top of the TV transmitter, T, is 40°
From a point S which is 100 metres horizontally closer to the tower block, the angle of elevation of T is 74°
The height of the tower block is 80 metres.
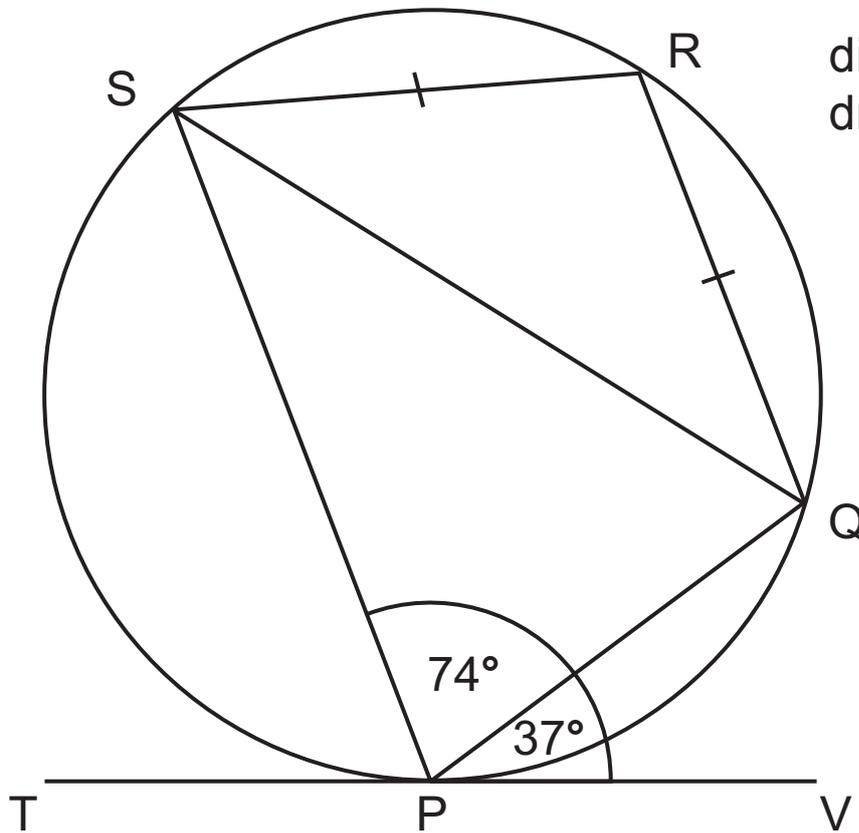Calculate the height, h, of the TV transmitter. [5 marks]

Answer _____ metres

20

diagram not drawn accurately

PQRS is a cyclic quadrilateral.
TV is a tangent to the circle at P.
SR = RQ.
Angle QPV = 37° and angle SPQ = 74°
Show that SP is parallel to RQ.
You must give reasons to justify any angles that you calculate. [4 marks]

21 (a) Write $\dfrac{1}{\sqrt{x^3}}$ in the form x^P [2 marks]

Answer _____

(b) Show that $(0.36)^{\frac{3}{2}} = \dfrac{27}{125}$ without using a calculator.
[2 marks]

22 Solve the simultaneous equations [6 marks]

$$y = 3x - 2$$
$$6x^2 + x = y^2$$

Answer _____

23 Find three consecutive positive odd integers such that 5 times the square of the middle integer exceeds the product of the other two by 488

Candidates should use an algebraic method.

A solution by trial and improvement will not be accepted.

[5 marks]

Answer _____

THIS IS THE END OF THE QUESTION PAPER

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

Examiner Number [ ]

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