



Rewarding Learning

General Certificate of Secondary Education
2024

Centre Number

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Candidate Number

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Mathematics

Unit M4

(With calculator)

Higher Tier



MV24

[GMC41]

THURSDAY 16 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.

Do not write on blank pages.

Complete in black ink only.

Answer **all twenty-three** questions.

All working should be clearly shown in the spaces provided. 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.

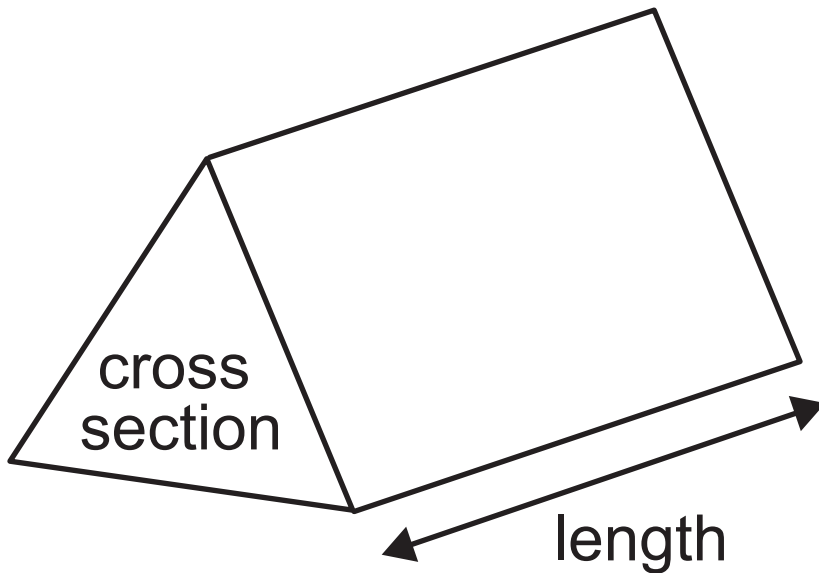
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

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

The Formula Sheet is on pages 3, 4 and 5.

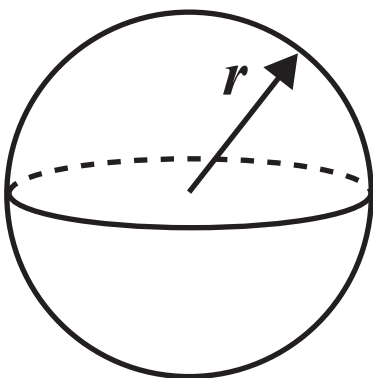
Formula Sheet

Volume of prism = area of cross section \times length



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

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



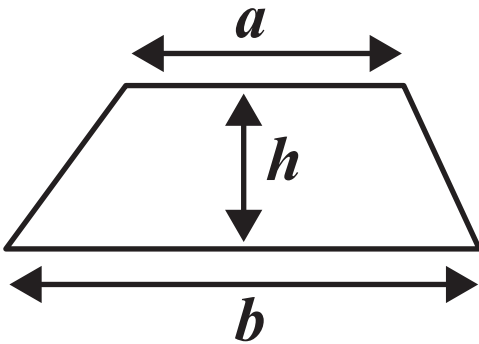
Quadratic Equation

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

where $a \neq 0$, are given by

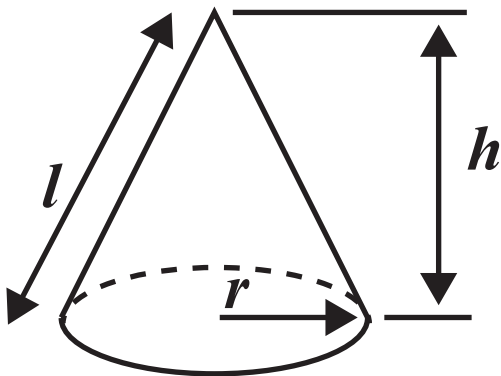
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

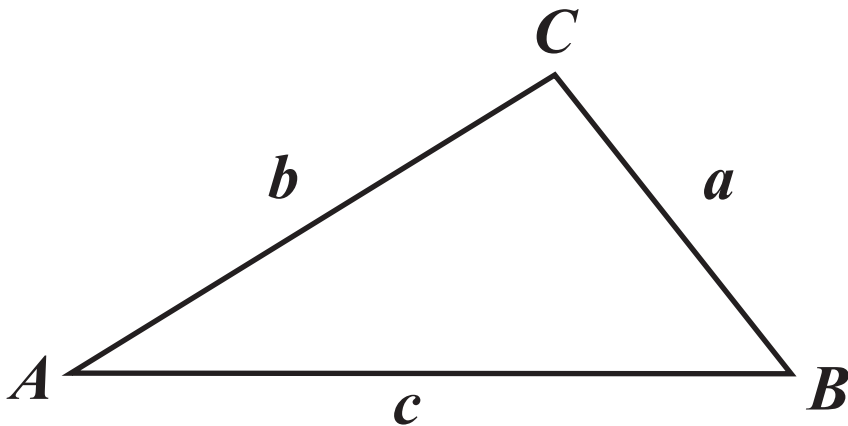


Volume of cone = $\frac{1}{3} \pi r^2 h$

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



In any triangle ABC



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

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

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

1 ABC is a right-angled triangle.

$$AC = 15 \text{ cm.}$$

$$BC = 7.5 \text{ cm.}$$

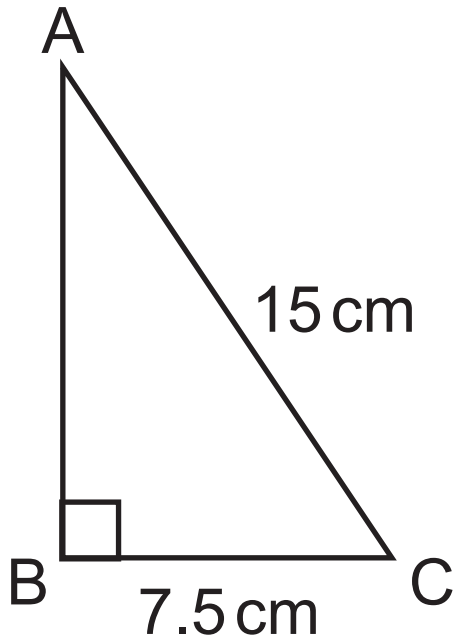
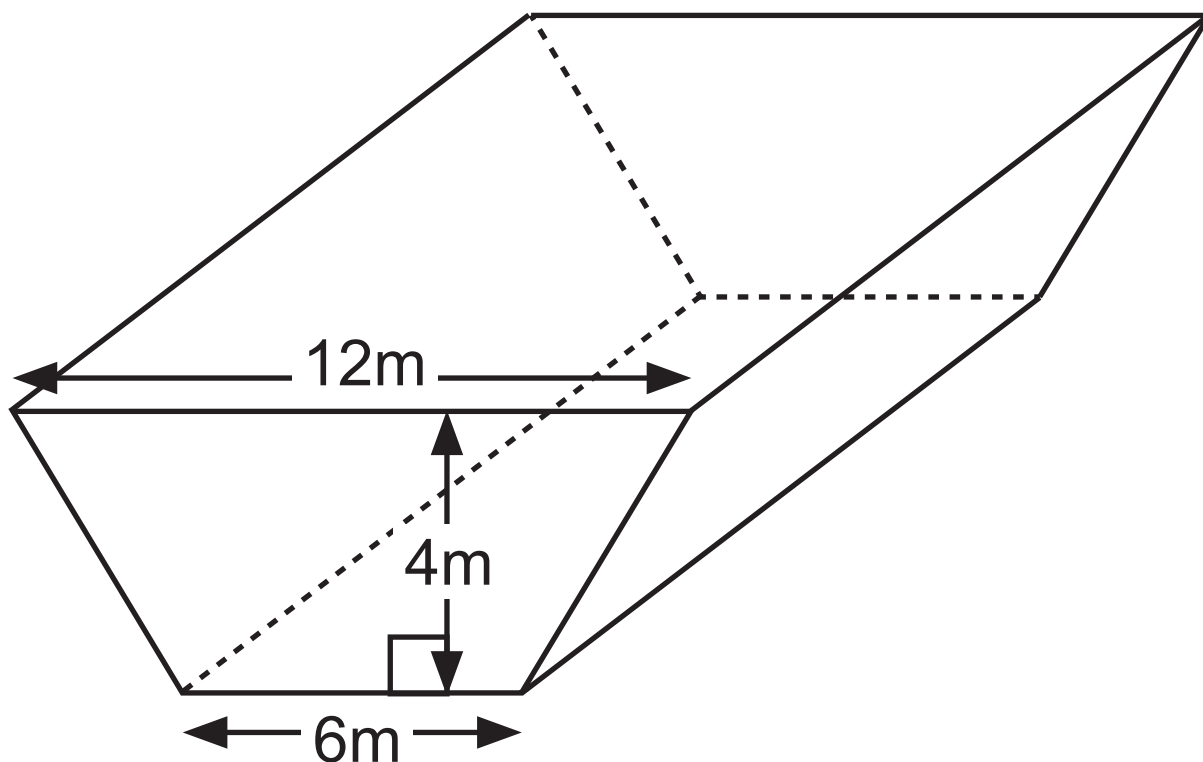


diagram not
drawn accurately

Work out the length of AB. [3 marks]

Answer _____ cm

2 A water tank has the dimensions as shown.



The cross-section is a trapezium.

The volume of the tank is 522 m^3

Calculate the length of the tank. [3 marks]

Answer _____ m

- 3** The heights, in metres, of a number of trees is recorded for a science experiment.

The results are shown in the table below.

Height h (m)	Frequency
$100 \leq h < 110$	6
$110 \leq h < 120$	13
$120 \leq h < 130$	12
$130 \leq h < 140$	15
$140 \leq h < 150$	3
$150 \leq h < 160$	1

(a) Calculate an estimate for the mean height. [4 marks]

Answer _____ m

(b) In which class interval does the median lie? [1 mark]

Answer _____

4 Alan wants to invest £2400 for 2 years.

He sees the following offers for compound interest.

Bank A	Bank B
3% for the first year 1% for each extra year	4% for the first year 0.5% for each extra year

Calculate, for each bank, the value of the investment after 2 years. [4 marks]

Answer **Bank A:** £ _____

Bank B: £ _____

5 (a) Write 126 as a product of its prime factors. [2 marks]

Answer _____

(b) Find the HCF of 126 and 90 [2 marks]

Answer _____

6 A rectangular basketball court is x metres wide.

The length of the court is 13 metres longer than its width.

The perimeter of the court is 86 metres.

Form and solve an equation to find the value of x . [3 marks]

Answer $x =$ _____ m

7 (2, 5) is the midpoint of the line joining (a, b) and $(3a, 3)$.

Find the values of a and b . [3 marks]

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

- 8 A stepladder with sides of 2.3 m is opened so that the feet are 1.4 m apart.

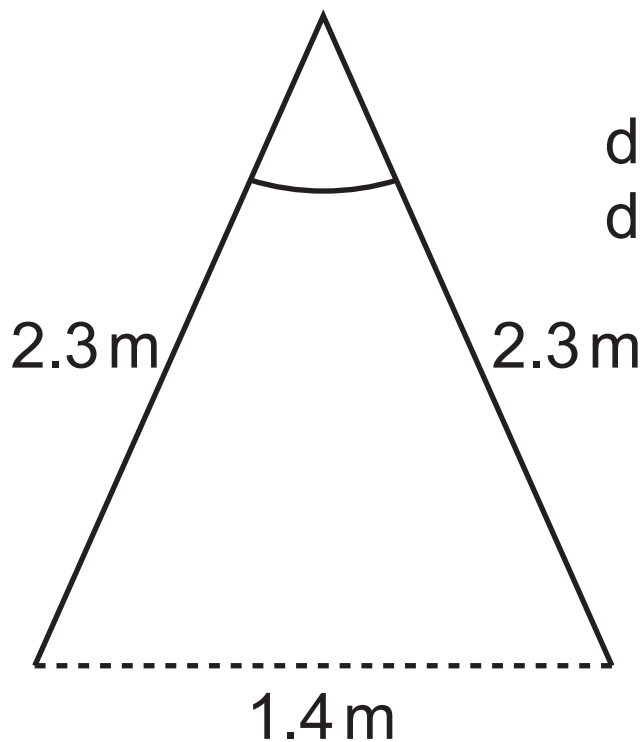


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Calculate the angle to which the stepladder has been opened. [4 marks]

Answer _____ °

9 A cylindrical flask has diameter 12 cm and height 25 cm.

The flask is full of coffee.

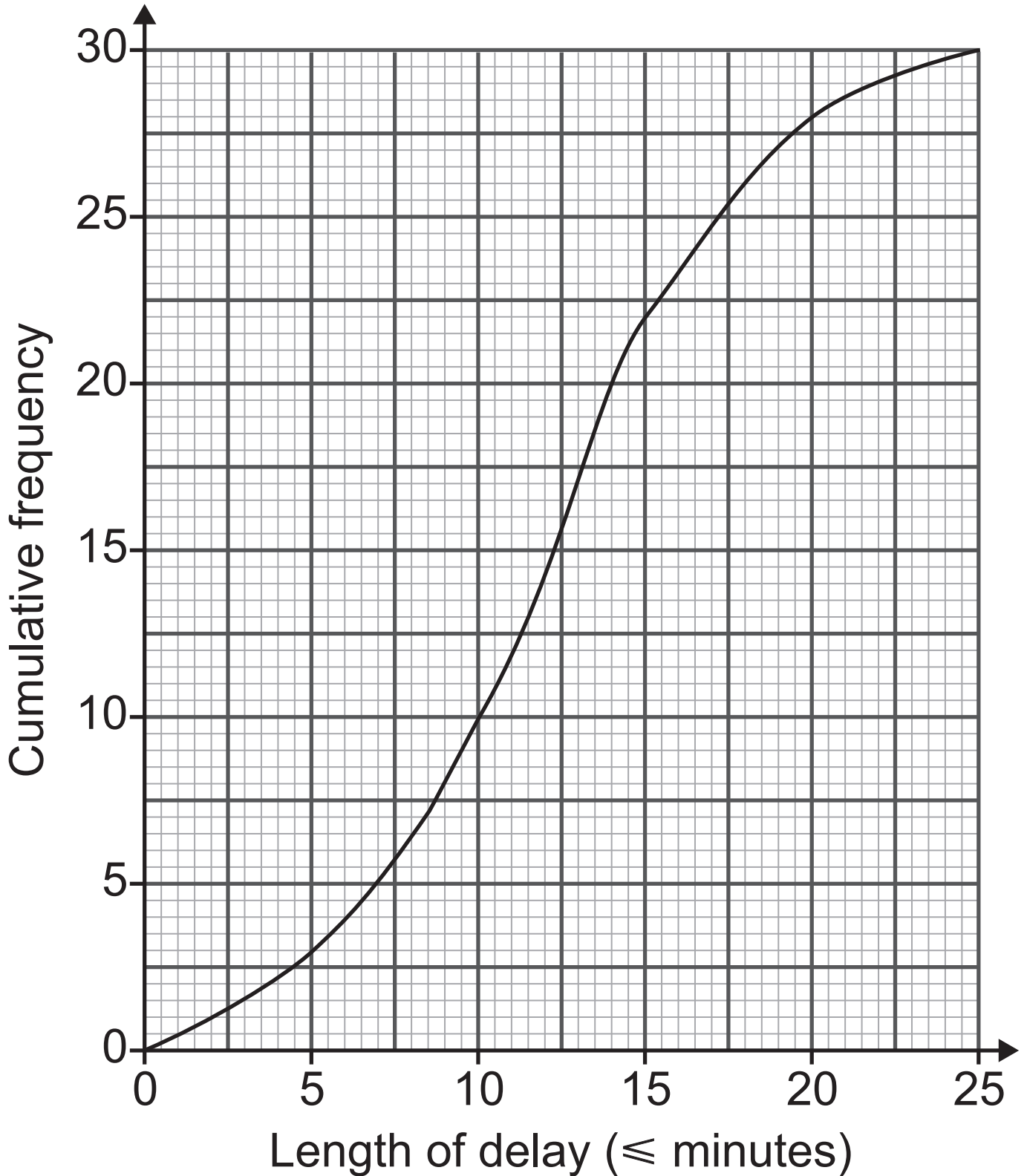
A coffee cup is a hemisphere of diameter 9 cm.

Each coffee cup is filled to 90% capacity.

How many cups of coffee can be poured from the flask? [5 marks]

Answer _____ cups

10 (a) The cumulative frequency diagram illustrates the lengths of delays to trains at Northside Station.



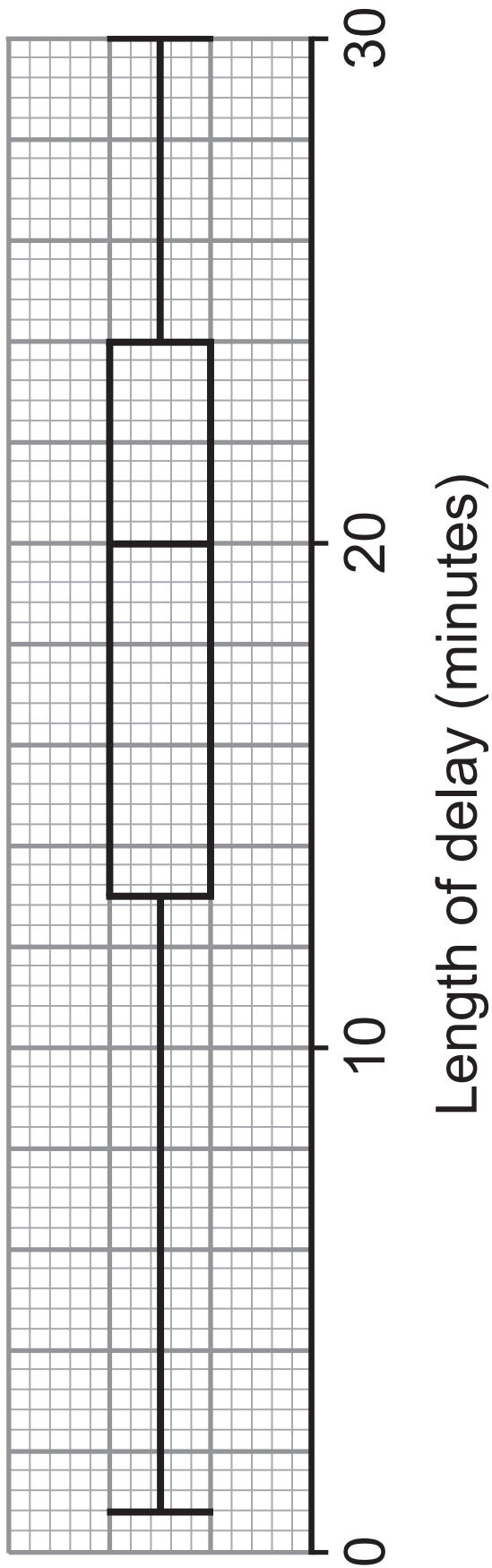
(i) Find the median. [1 mark]

Answer _____ minutes

(ii) Find the interquartile range.
[2 marks]

Answer _____ minutes

(b) The box plot illustrates the lengths of delays to trains at Southend Station.



Make two comparisons between the lengths of delays at Northside Station to those at Southend Station. [2 marks]

1st comparison _____

2nd comparison _____

11 The price for 900 litres of oil increased by 28%

The new price for 900 litres of oil is **£736**

How much did 900 litres of oil cost before the increase? [3 marks]

Answer **£** _____

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(Questions continue overleaf)

12 (a) The diagonal of a rectangle is 26 cm.

The width of the rectangle is x cm.

The length of the rectangle is $(34 - x)$ cm.

Show that $x^2 - 34x + 240 = 0$
[4 marks]

(b) Solve the equation to find the possible values of x . [2 marks]

Answer $x =$ _____

13 A rectangle has length $(4x - 5)$ and width $(3x + 4)$.

What is the quadratic expression for its area? [2 marks]

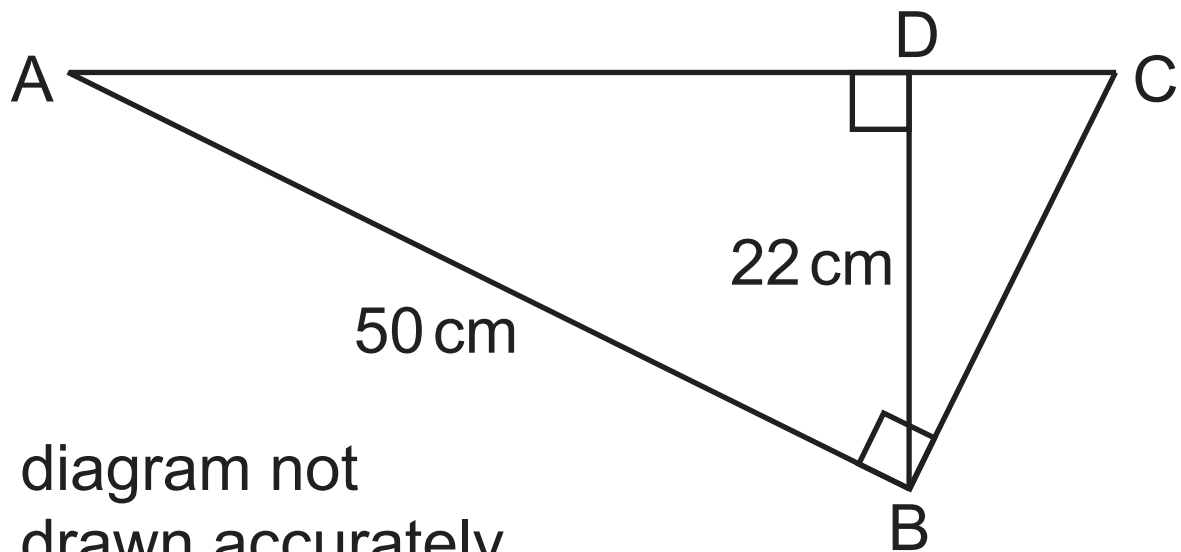
Answer _____

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(Questions continue overleaf)

14 In the triangle below, angle $ABC = 90^\circ$

$AB = 50 \text{ cm.}$ $BD = 22 \text{ cm.}$



Calculate the length of AC. [5 marks]

Answer _____ cm

15 A sample of 16 squirrels was taken from a forest.

Each squirrel was marked with a dye and released back into the forest.

A year later a sample of 20 squirrels was taken from the same forest.

3 of the squirrels in this sample were found to be marked with the dye.

(a) Calculate an estimate of the population of squirrels in the forest. [2 marks]

Answer _____

(b) State one fault with the sampling method used and suggest how it could be improved. [2 marks]

Fault _____

Improvement _____

16 The formula for h is

$$h = \frac{u^2}{2a}$$

Given that

$u = 21.34$ correct to 4 significant figures,

$a = 9.8$ correct to 1 decimal place,

calculate the upper bound of h . [3 marks]

Answer _____

17 Find the equation of the straight line that passes through the point $(-2, 6)$ and is perpendicular to the straight line $3x + 2y = 7$ [4 marks]

Answer _____

18 (a) Factorise $50a^2x^2 - 18y^2$ [3 marks]

Answer _____

(b) Write as a single fraction and simplify
[4 marks]

$$2 + \frac{4}{2x-1} - \frac{3}{x+2}$$

Answer _____

19 (a) O is the centre of a circle.

A, B, C and D are points on the circumference of the circle.

Angle BOD = 114°

On the diagram below mark clearly an angle that is 57° [1 mark]

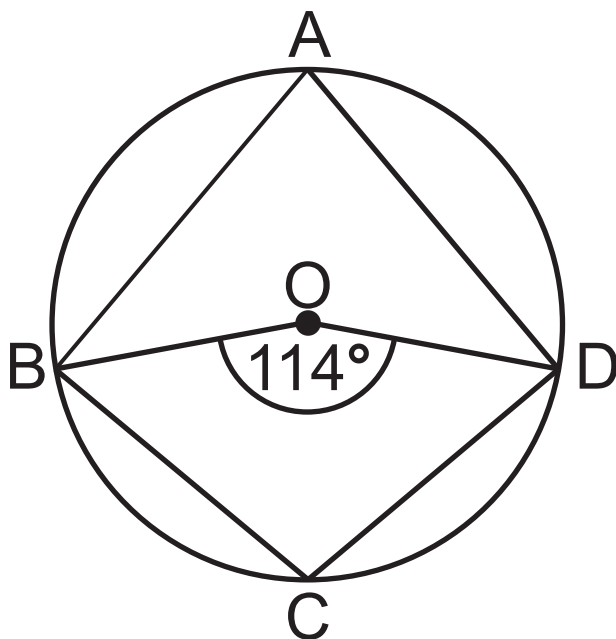


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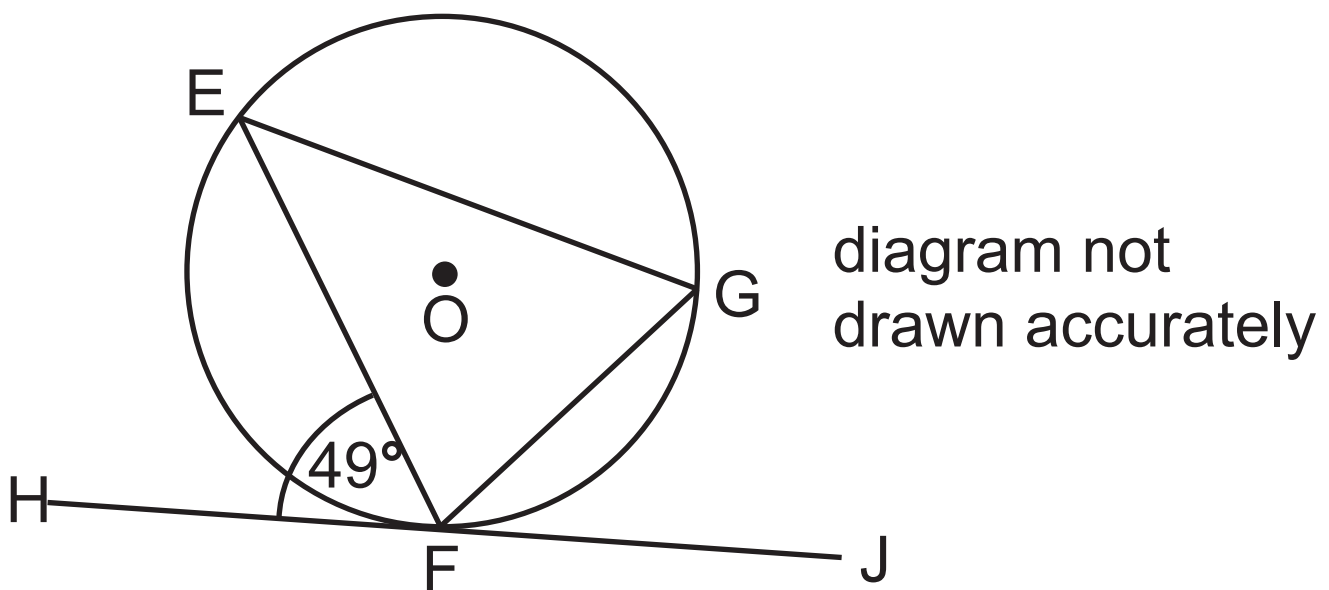
(b) O is the centre of a circle.

E, F and G are points on the circumference of the circle.

HFJ is a tangent to the circle at the point F.

Angle HFE = 49°

On the diagram below mark clearly another angle that is 49° [1 mark]



(c) L, M and N are three points on the circumference of a circle.

LP and NP are tangents to the circle.

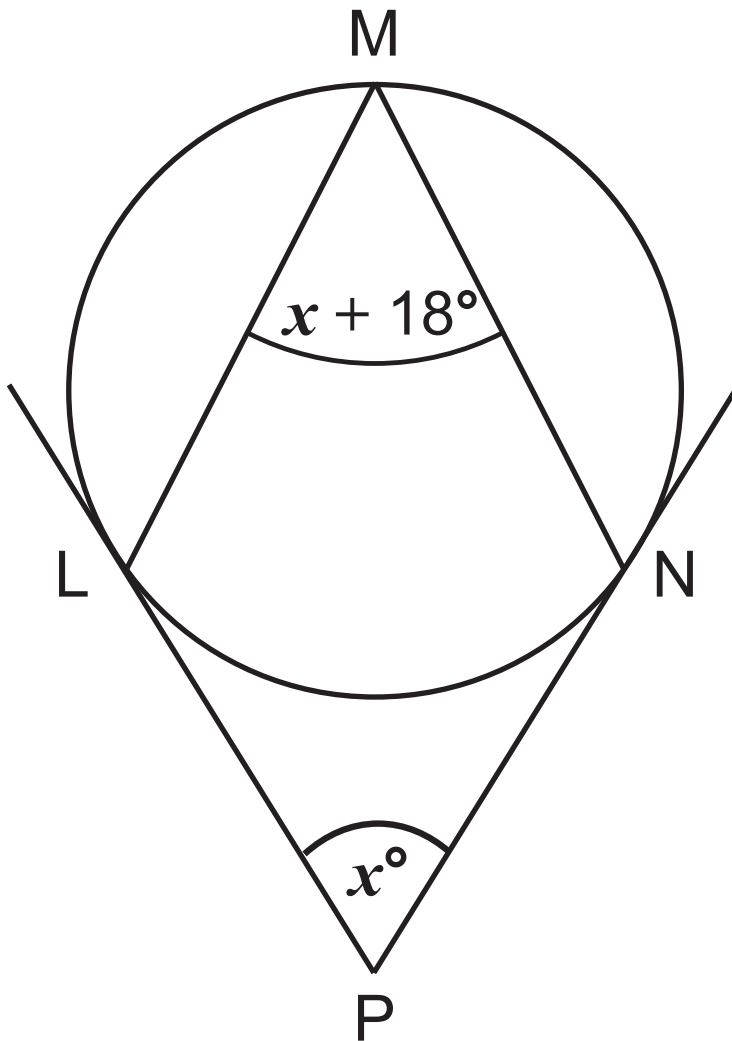


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Work out the value of x . [4 marks]

Show each step of your working clearly.

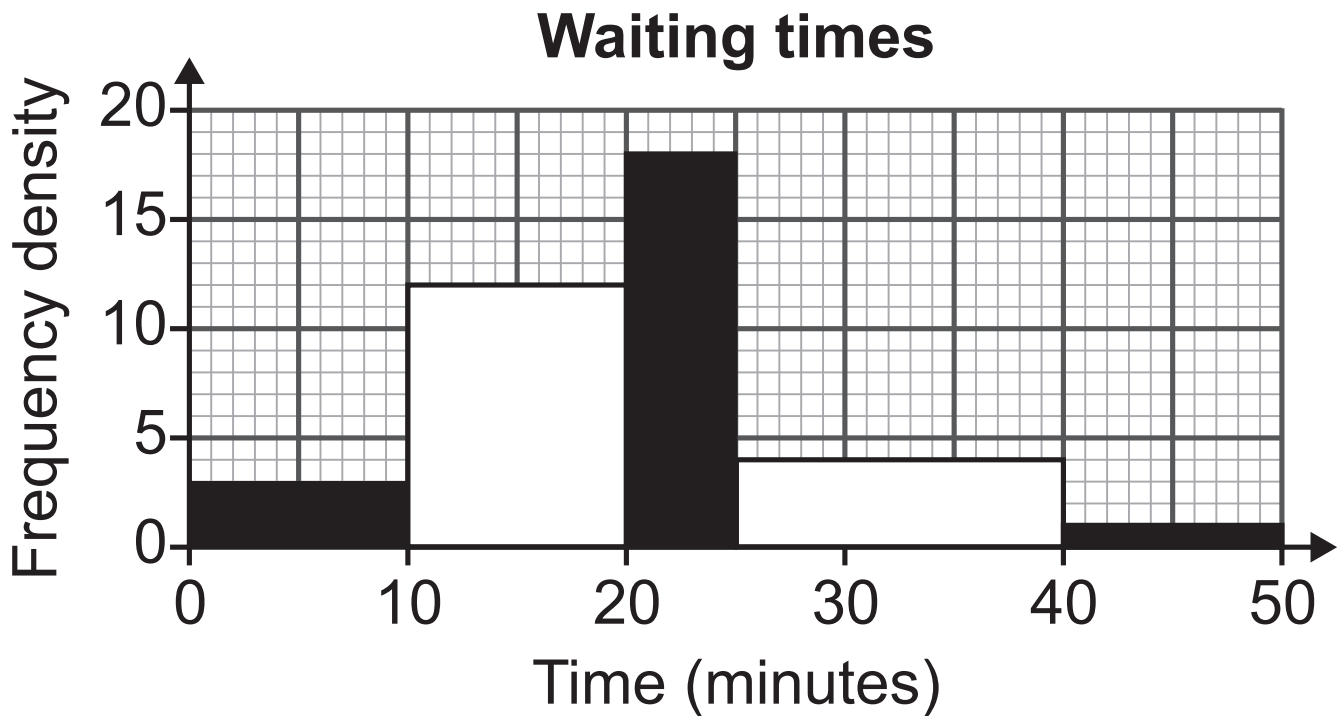
Answer $x =$ _____

20 Prove that a sphere of radius r and a cube of side r can never have the same surface area. [2 marks]

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(Questions continue overleaf)

21 (a) The histogram shows patient waiting times in a hospital clinic during one week.



The hospital target is for 50% of patients to have to wait less than 20 minutes.

Has the hospital target been met?
[3 marks]

Explain your answer clearly.

Answer _____ because _____

(b) 38 patients waited longer than T minutes.

Work out an estimate for the value of T.
[3 marks]

Answer _____ minutes

22 The diagram shows a square of side $(3x - 1)$ cm and a trapezium with base length $(5x - 3)$ cm and perpendicular height 4 cm.

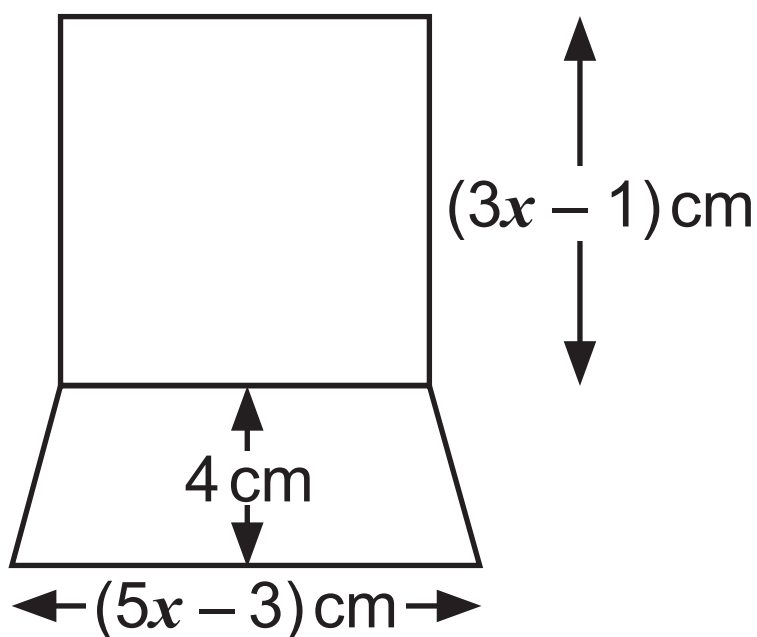


diagram not
drawn accurately

The area of the square is one and a half times the area of the trapezium.

By setting up and solving a quadratic equation, find the value of x , to 2 decimal places. [6 marks]

Answer $x =$ _____

23 Solve the equation [7 marks]

$$\frac{1}{2} - \frac{3}{3x+1} = \frac{5}{5x-9}$$

Answer $x =$ _____

**This is the end of the
question paper**

SOURCES

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Question Number	Marks
1	
2	
3	
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Examiner Number

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