



General Certificate of Secondary Education
2024

Centre Number

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Candidate Number

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Mathematics

Unit M3

(With calculator)

Higher Tier



MV24

[GMC31]

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-eight** 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.

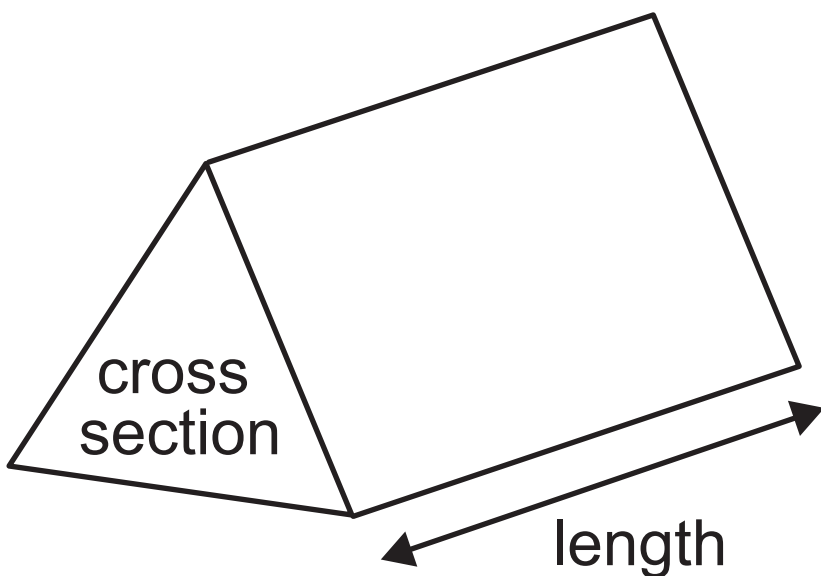
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

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

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

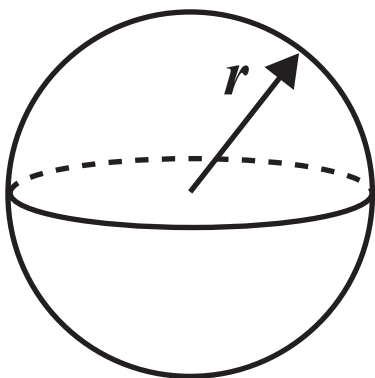
Formula Sheet

Volume of prism = area of cross section \times length



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

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



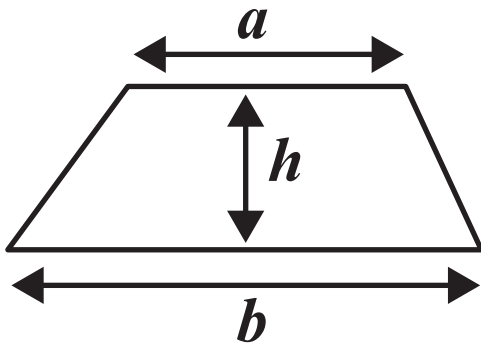
Quadratic Equation

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

where $a \neq 0$, are given by

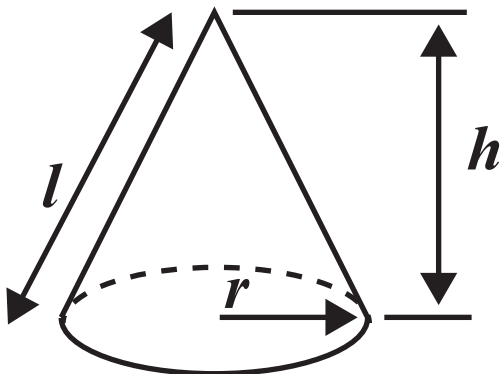
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

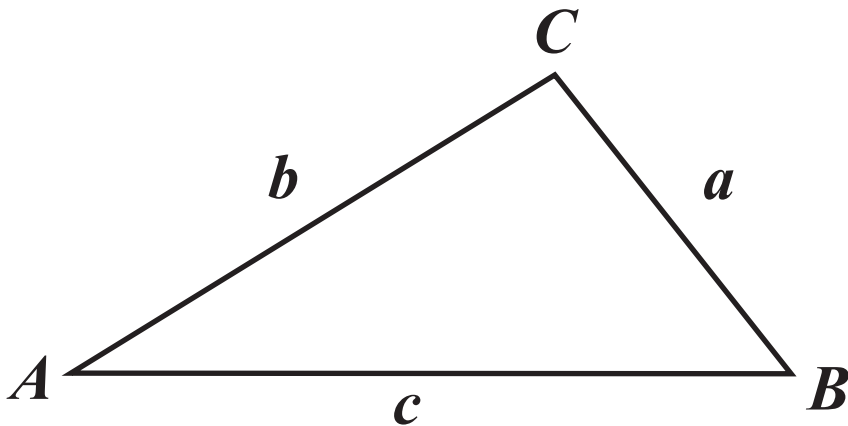


Volume of cone = $\frac{1}{3} \pi r^2 h$

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 Calculate [2 marks]

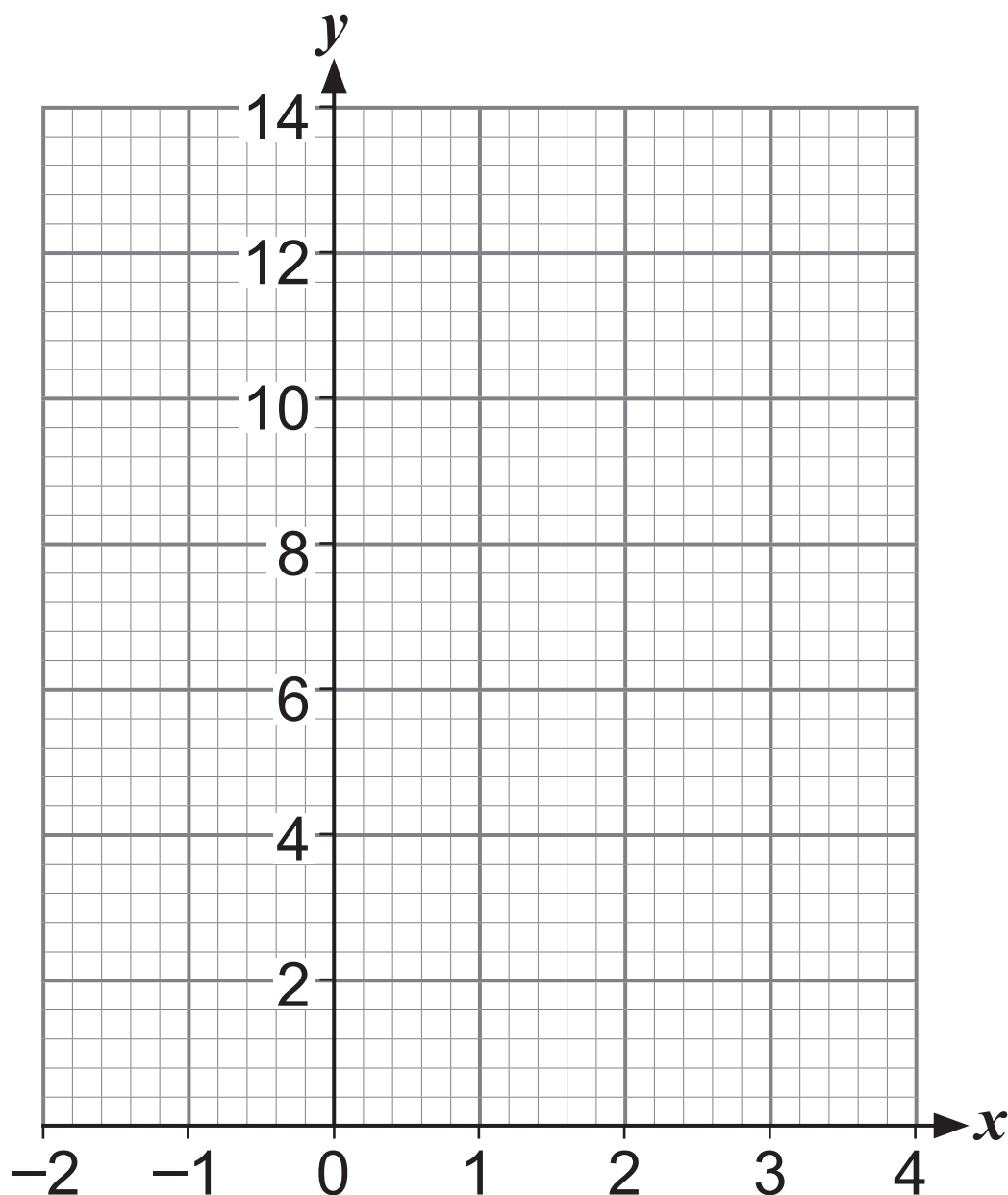
$$\frac{8.84 + 24.6}{9.2 - 4.8}$$

Answer _____

- 2 (a) Complete the table of values for the equation $y = 10 - 2x$ [1 mark]

x	-2	-1	0	1	2	3	4
$y = 10 - 2x$	14		10	8	6		2

- (b) Hence draw the graph of $y = 10 - 2x$ on the grid below. [2 marks]



3 Gavin ordered carpet for his living room and bedroom.

The living room carpet cost **£37.20** per square metre.

He ordered 24.5 square metres of living room carpet.

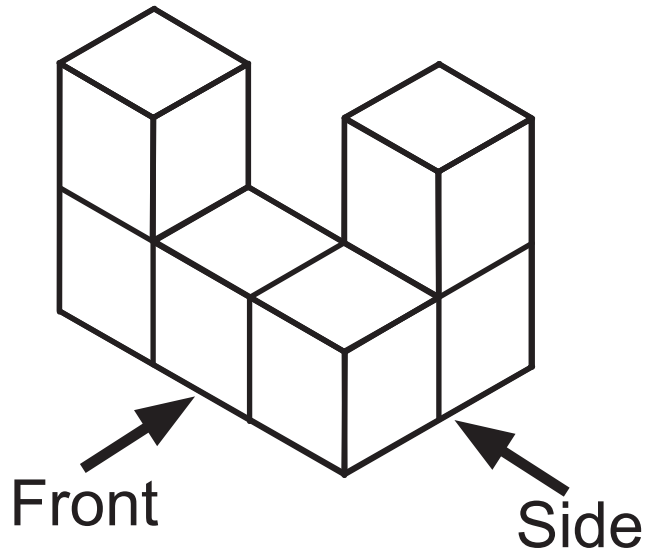
The bedroom carpet cost **£14.30** per square metre.

He paid a total price of **£1068.70**

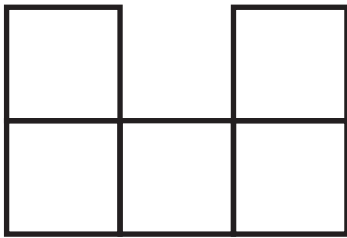
How much bedroom carpet did he order?
[4 marks]

Answer _____ square metres

4 A 3D shape is shown.



(a) Which elevation is drawn below?
[1 mark]



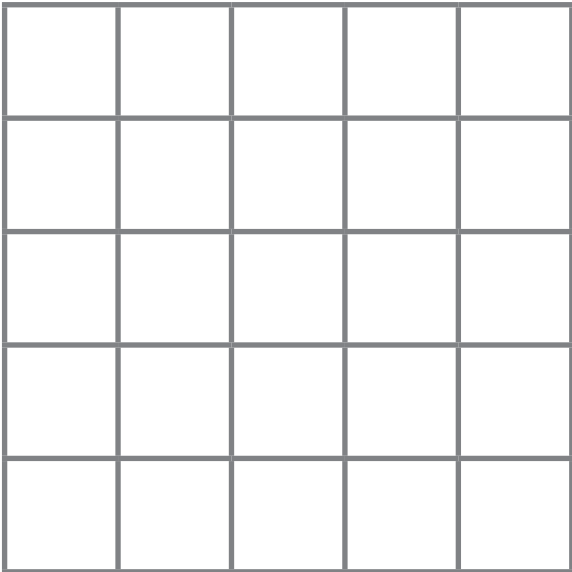
Circle the correct response.

side

front

neither

(b) Draw the **plan** of the 3D shape on the grid. [1 mark]



(c) Rosie is painting the outside of the 3D shape on page 10, including the base.

How many squares will Rosie have to paint? [1 mark]

Circle the correct response.

13

26

30

31

5 Calculate angle x . [3 marks]

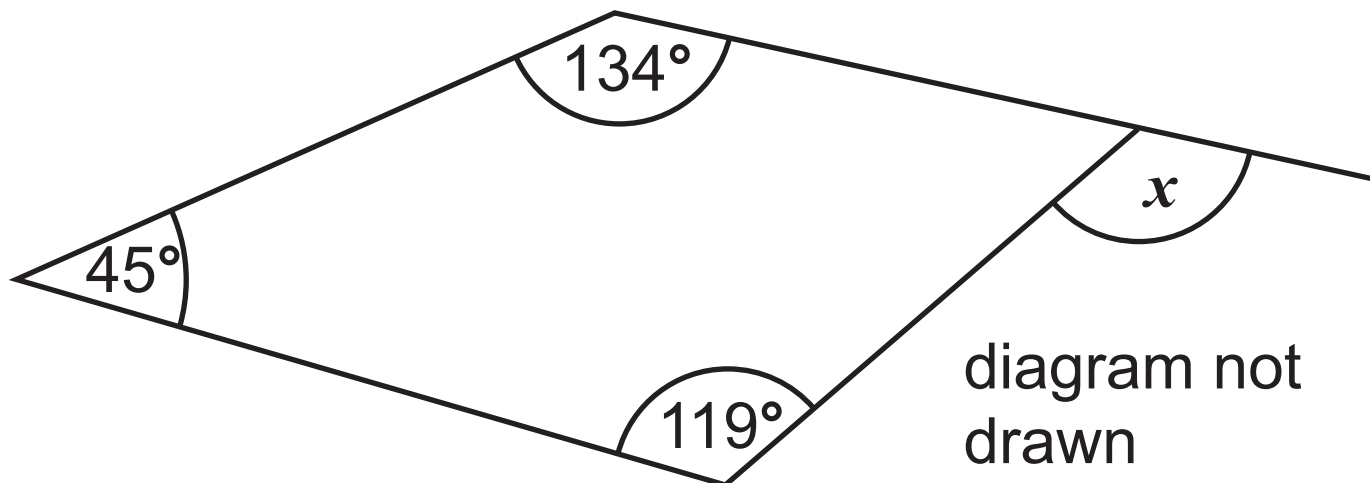


diagram not
drawn
accurately

Answer $x =$ _____ $^\circ$

- 6 Stacey is going to invite some friends round for a pizza party.

To work out how many pizzas to order, she uses the formula

$$p = \frac{ne}{s}$$

where

p = number of pizzas to order

n = number of people at the party

e = number of slices each person gets

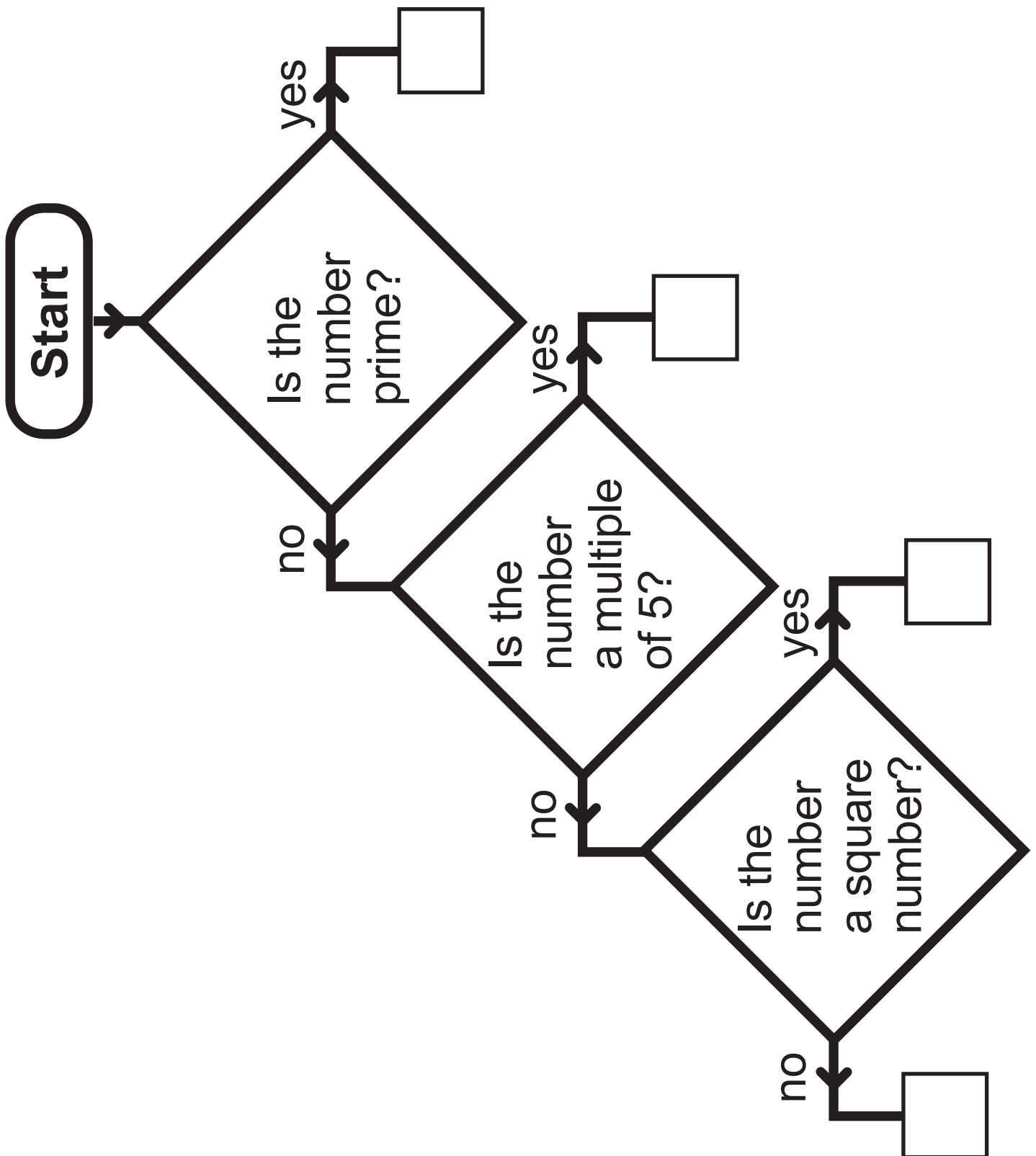
s = number of slices per pizza

How many pizzas, each with 8 slices, are needed if there are 16 people at the party and each person gets 3 slices? [3 marks]

Answer _____ pizzas

7 Look at the diagram below.

Place the numbers **80**, **81**, **82** and **83** in the correct boxes on the diagram. [2 marks]



Blank Page

(Questions continue overleaf)

8 (a) Two farmers grow apples.

Farmer Jack's apples have a mean weight of 116.85 g and a range of 19.1 g.

Farmer Brown weighs ten of his apples, picked at random.

Their weights, in grams (g), are

113.2

114.5

116.7

118.1

114.0

116.9

115.3

117.3

114.6

115.7

Whose apples are heavier on average?
[3 marks]

You must give a mathematical reason
with your answer.

Answer Farmer _____
because _____

(b) A supermarket prefers their apples to be similar in size.

Why might this supermarket prefer to buy Farmer Brown's apples? [1 mark]

Answer _____

9 Claire wants to buy a new watch.

She looks at special offers for this watch in two different shops.

Shop	Normal price	Special offer
Every Second	£135	15% discount
Minutes Matter	£174	$\frac{1}{3}$ off all prices

Which shop is now selling the watch at the cheapest price? [4 marks]

You must show working to explain your answer.

Answer _____

10 A car travels at an average speed of 30 miles per hour for one hour.

It then travels at an average speed of 54 miles per hour for half an hour.

Calculate the average speed for the **whole** journey. [3 marks]

Answer _____ miles per hour

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(Questions continue overleaf)

11 A wedding venue has circular tables of diameter 2 m.

The bride wants to put ribbon round the edge of each table.

There are 15 tables.

The ribbon is only sold in a **whole number of metres** and costs **£1.25** per metre.

What is the minimum total cost of the ribbon? [4 marks]

Answer £ _____

12 Steve bought a box of 200 hats for **£120**

He decided to sell them at a local market.

It cost him **£20** to hire a stall at the market.

Steve sold 70% of the hats at **£3** each.

He sold a quarter of the hats at **£2.50** each.

The remaining hats were sold at **£1** each.

How much profit did Steve make?
[5 marks]

Answer £ _____

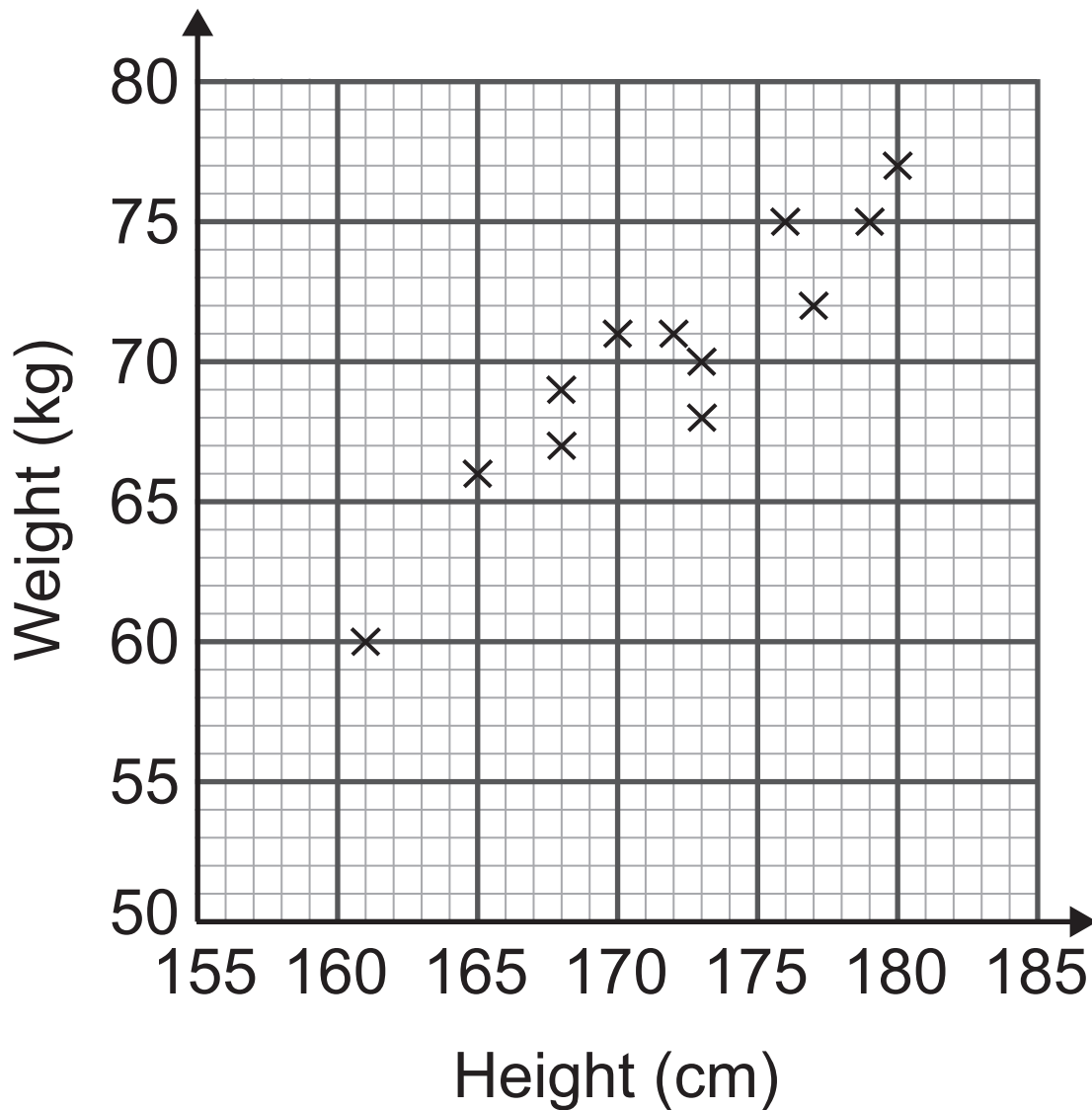
13 Solve the equation $5(2y + 3) = 79$
[3 marks]

Answer $y =$ _____

Blank Page

(Questions continue overleaf)

14 The scatter graph shows the heights and weights of players on a rugby squad.



(a) Describe the relationship between the heights and weights of the players.
[1 mark]

Answer _____

(b) Jack Morris joins the squad.

The manager records Jack's height as 178 cm.

The manager records Jack's weight as 60 kg.

Plot this information on the scatter graph opposite. [1 mark]

(c) The manager made an error in reading Jack's weight.

Use the scatter graph to say whether Jack's weight is likely to be lower or higher than 60 kg. [1 mark]

Answer _____

15 A primary school has a Choir (**C**) and a Drama Club (**D**).

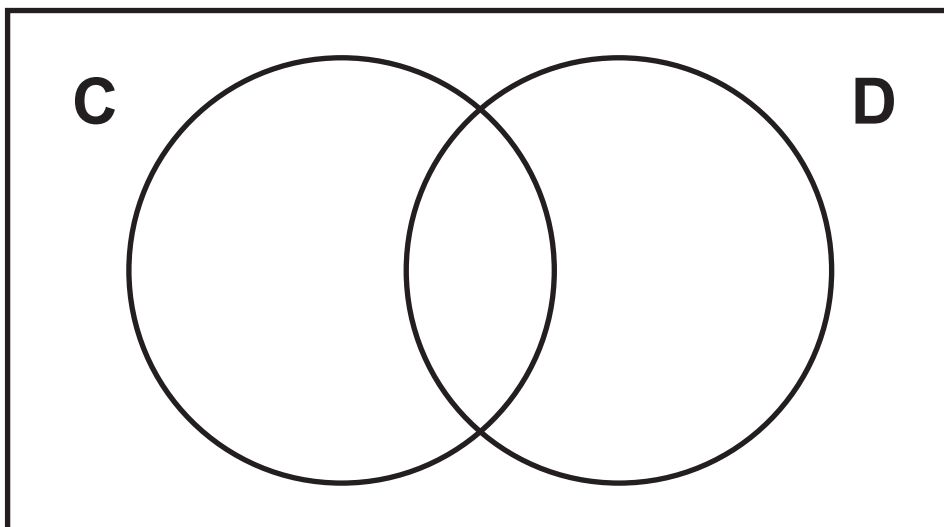
The school has 80 pupils.

45 pupils attend Choir.

30 pupils attend Drama.

15 pupils attend neither.

(a) Complete the Venn diagram using this information. [3 marks]



(b) What fraction of the pupils attend **only** the Drama Club? [1 mark]

Answer _____

16 ABC is a right-angled triangle.

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

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

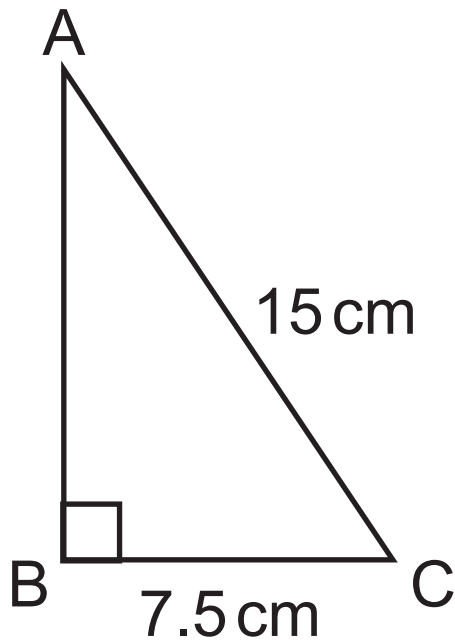
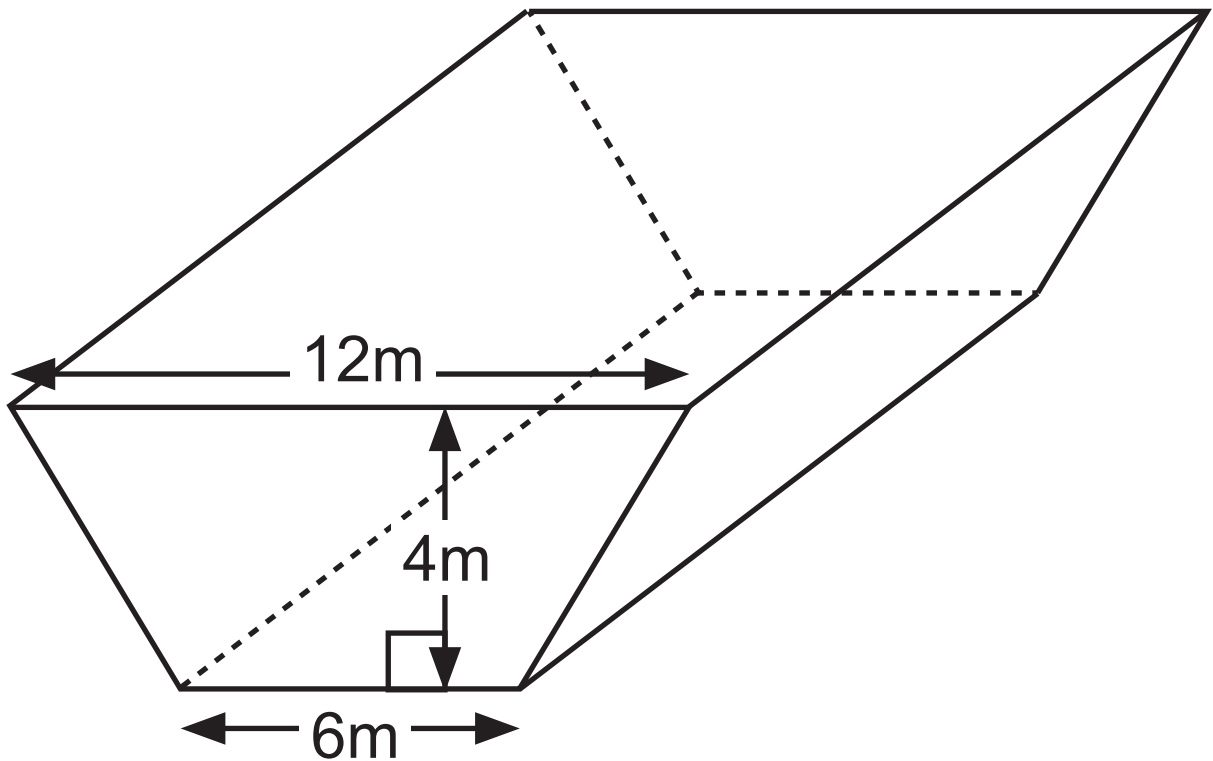


diagram not
drawn accurately

Work out the length of AB. [3 marks]

Answer _____ cm

17 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

18 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 _____

19 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: £ _____

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

Answer _____

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

Answer _____

21 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

22 $(2, 5)$ is the midpoint of the line joining (a, b) and $(3a, 3)$.

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

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

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

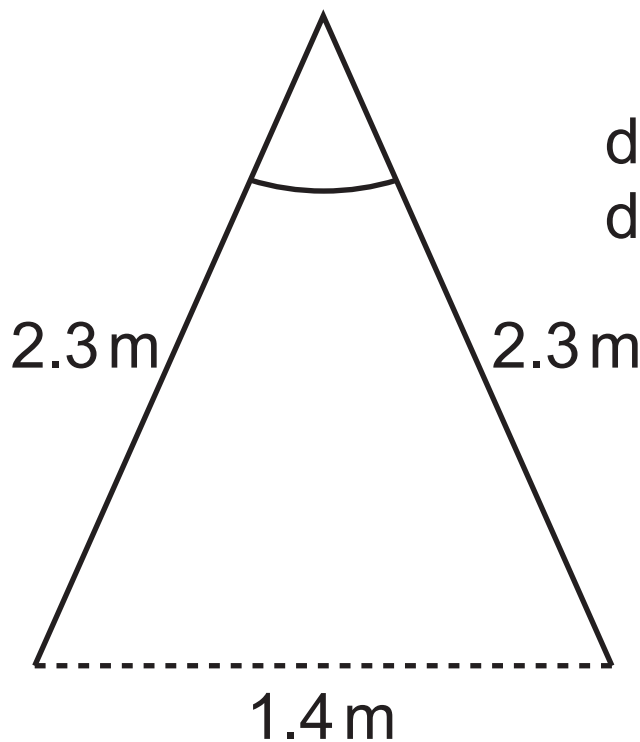


diagram not
drawn accurately

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

Answer _____ °

24 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

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

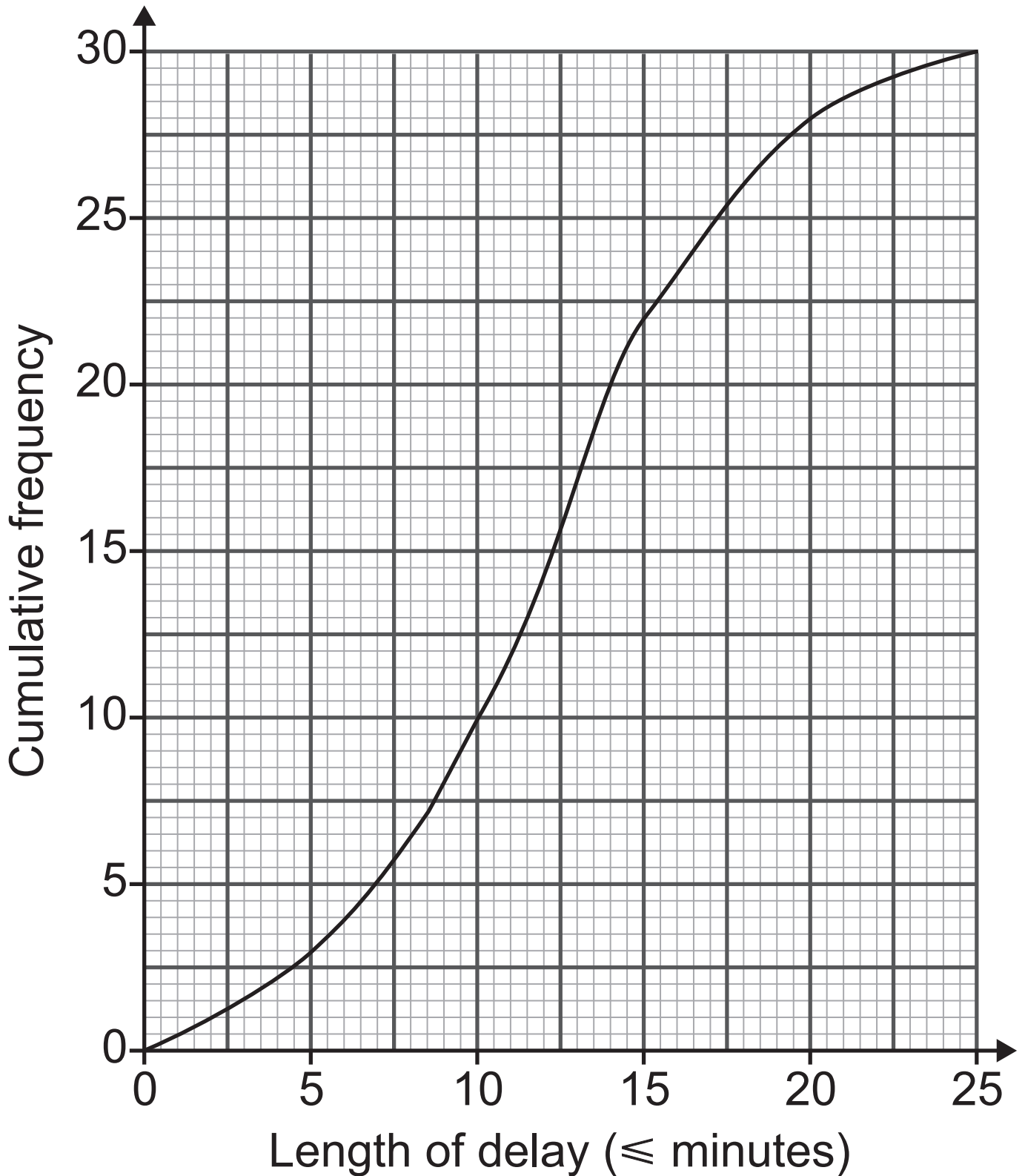
What is the quadratic expression for its area? [2 marks]

Answer _____

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(Questions continue overleaf)

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



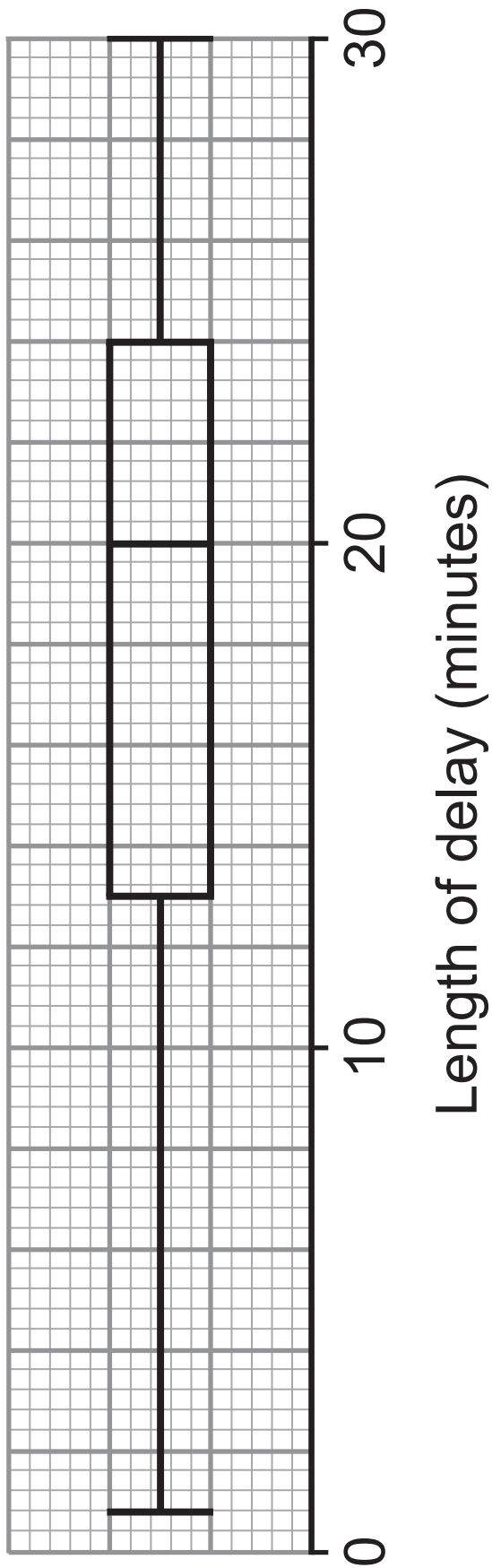
(i) Find the median. [1 mark]

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 _____

27 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)

28 (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 $x =$ _____

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

SOURCES

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Question Number	Marks
1	
2	
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Total Marks	

Examiner Number

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