Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2024

Mathematics

StemUp Model Solution

Unit M2
(With calculator)
Foundation Tier

[GMC21]



GMC21

THURSDAY 16 MAY, 9.15 am–11.00 am

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

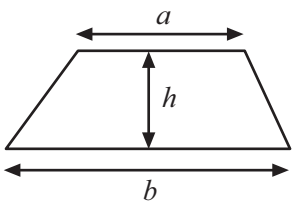
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all thirty** questions.
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

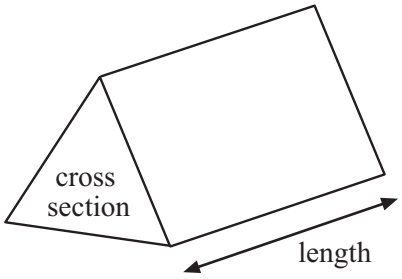
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

Formula Sheet

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



Volume of prism = area of cross section × length



14380

1 A company designs and prints badges.

To work out how much to charge customers, they use the rule

Total cost = £15 + (£2 × number of badges)

(a) A sports club ordered 40 badges.

How much was the total cost?

$15 + 2 \times 40$

$= 15 + 80 = 95$

Answer £ 95 [1]

(b) A different sports club paid a total cost of £245

How many badges did they order?

$245 - 15 = 230$

$230 \div 2 = 115$

Answer 115 [2]

[Turn over

2 In a game, players try to hit a target placed in the centre of a board.

The game is scored as follows.

20 points for hitting the target **(target)**

0 points for hitting the board but missing the target **(board)**

–5 points for missing the board **(miss)**

(a) Peter had 8 attempts.

His results were

miss target miss board target target board miss

What was his total score?

$-5 + 20 - 5 + 0 + 20 + 20 + 0 - 5$

$= 60 - 15 = 45$

Answer 45 [2]

(b) Jessica had 5 attempts.

She scored 80 points.

How many times did she hit the target?

$4 \times 20 = 80$ (and 1 board = 0)

Answer 4 [1]

3 **(a)** Yuri takes the overnight train from Moscow to St Petersburg.

The train departs Moscow at 21:55 and arrives in St Petersburg at 06:06 the next morning.

How long is the journey?

21:55 → 22:00 = 5 min

22:00 → 06:00 = 8 h

06:00 → 06:06 = 6 min

Total = 8 h 11 min

Answer 8 hours 11 minutes [1]

(b) A cargo container is 23 m long, 2.5 m wide and 3 m high.



What is the volume of the cargo container?

V = 23 × 2.5 × 3

= 172.5

Answer 172.5 m^3 [2]

[Turn over

4 **(a)** A meal in Jacob's school canteen costs £3.10

Jacob uses a pre-paid card to pay for his meals.

Jacob has £20 on his pre-paid card.

What is the maximum number of meals he will be able to pay for?

20 ÷ 3.10 = 6.4516...

so 6 meals

Answer 6 [1]

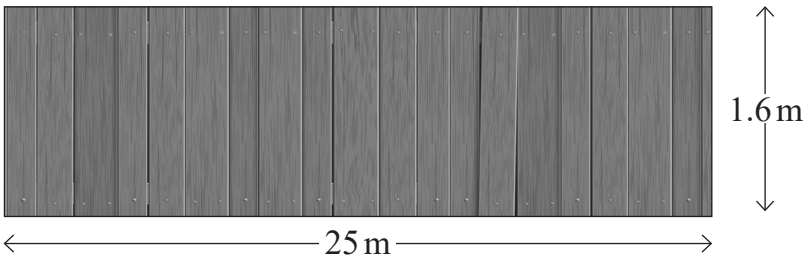
(b) How much will be left on the card after he has paid for the maximum number of meals?

6 × 3.10 = 18.60

20 − 18.60 = 1.40

Answer £ 1.40 [2]

5 Taylor is planning to paint one side of his rectangular garden fence.



Source: © Getty Images

The fence is 25 m long and 1.6 m high.

One tin of paint covers 7 m^2 and costs £9

How much will it cost Taylor for the paint?

Area = 25 × 1.6 = 40 m^2

40 ÷ 7 = 5.714... so 6 tins needed

Cost = 6 × 9 = £54

Answer £ 54 [3]

[Turn over

6 Anita is paid £1950 each month.

She saves 10% of her pay each month.

How much will she have saved after 1 **year**?

10% of 1950 = 1950 ÷ 100 × 10 = 195

195 × 12 = 2340

Answer £ 2340 [3]

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(Questions continue overleaf)

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7 **(a)** The minimum and maximum monthly temperatures, in degrees Fahrenheit, for Dublin last year are given in the table.

Month	Minimum (°F)	Maximum (°F)
January	36	47
February	36	47
March	37	50
April	39	54
May	44	59
June	48	64
July	52	67
August	52	66
September	48	63
October	44	57
November	40	51
December	37	47

What is the **range** of temperatures in June?

64 − 48 = 16

Answer 16 °F [1]

(b) The monthly rainfall, in millimetres, in Dublin last year is shown.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (millimetres)	65	50	55	55	60	65	55	75	60	80	75	75

(i) What is the median monthly rainfall?

50, 55, 55, 55, 60, 60, 65, 65, 75, 75, 75, 80

middle two: 60 and 65

(60 + 65) ÷ 2 = 62.5

Answer 62.5 mm [2]

(ii) The table shows that the wettest **month** last year was October.



Declan says:

The wettest **day** last year must have been in October.



Una says:

The wettest **day** last year may not have been in October.

Who is correct?

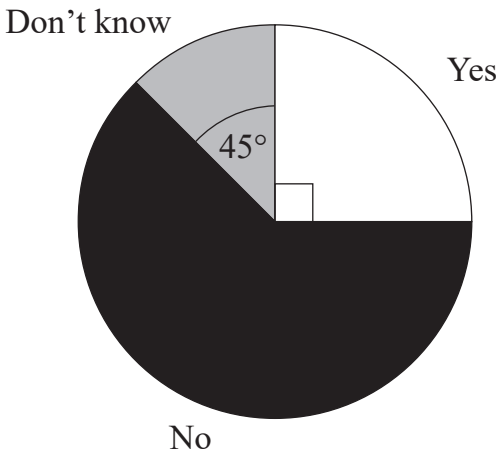
Circle your answer.

Declan **Una** **Declan and Una** **Neither** [1]

[Turn over

8 **(a)** The results of a survey are displayed.

Are there enough electric vehicle charging points in Belfast?



(i) 30 people surveyed said "Yes".

How many people in total were surveyed?

Yes = 90°

360 ÷ 90 = 4

30 × 4 = 120

Answer 120 people [1]

(ii) What fraction of those surveyed said "Don't know"?

Don't know = $\frac{45}{360} = \frac{1}{8}$

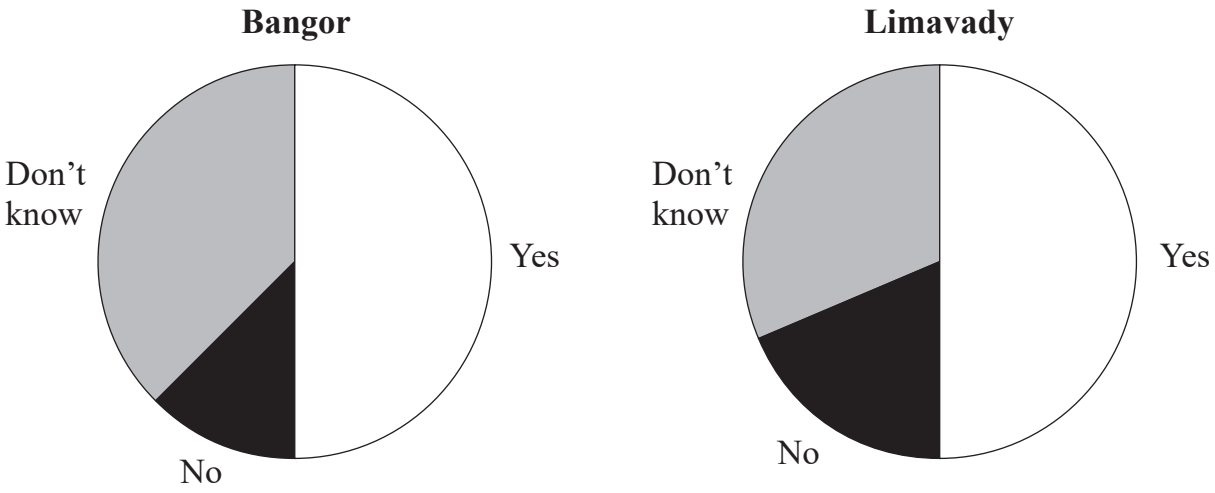
Answer $\frac{1}{8}$ [1]

(b) Other surveys were conducted in Bangor and Limavady.

One of the questions asked was:

Will your next vehicle be fully electric?

The results are shown in these pie charts.



Lewis thinks the same number of people in Bangor and Limavady answered "Yes" to this question.

Explain why Lewis may be wrong.

Answer *Different numbers of people may have been asked in each place, so equal angles need not mean equal numbers.* [1]

[Turn over

9 Calculate

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

8.84 + 24.6 = 33.44

9.2 − 4.8 = 4.4

33.44 ÷ 4.4 = 7.6

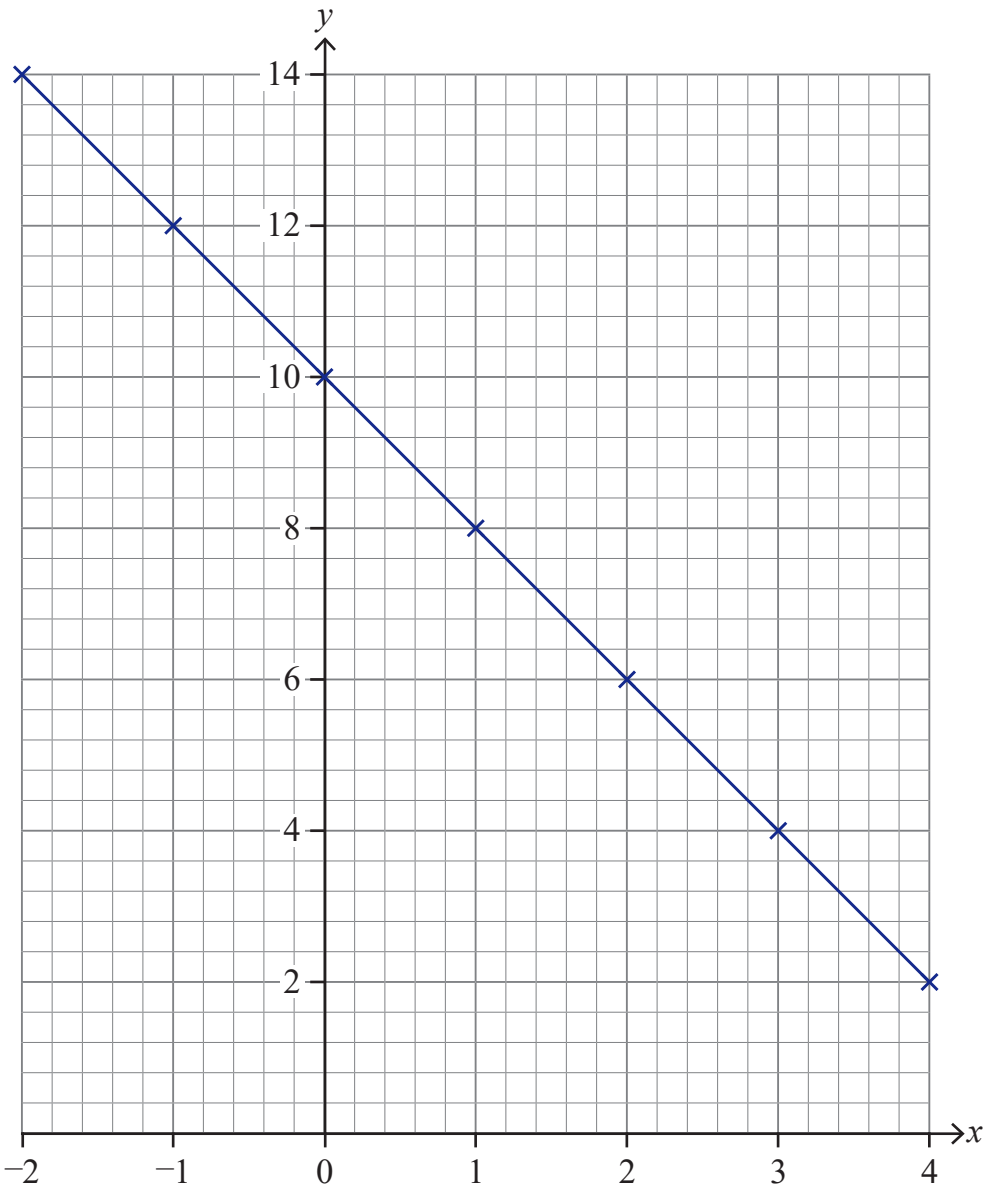
Answer 7.6 [2]

10 **(a)** Complete the table of values for the equation $y = 10 - 2x$

x	–2	–1	0	1	2	3	4
$y = 10 - 2x$	14	12	10	8	6	4	2

[1]

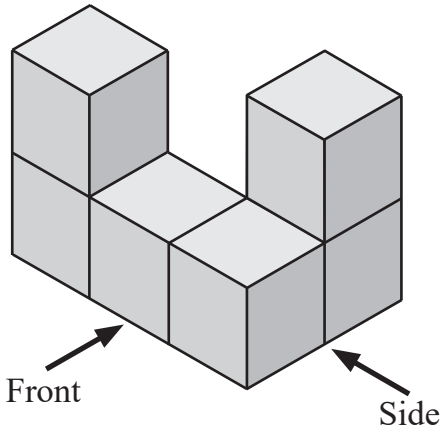
(b) Hence draw the graph of $y = 10 - 2x$ on the grid below.



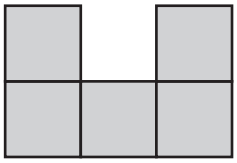
[2]

[Turn over

11 A 3D shape is shown.



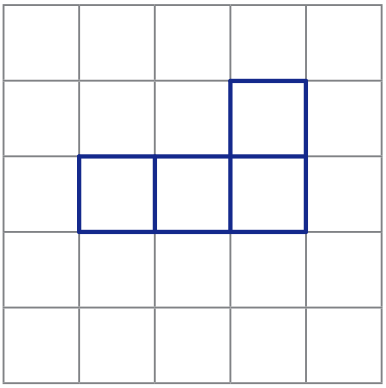
(a) Which elevation is drawn below?



Circle the correct response.

side **front** **neither** [1]

(b) Draw the **plan** of the 3D shape on the grid.



[1]

(c) Rosie is painting the outside of the 3D shape including the base.

How many squares will Rosie have to paint?

Circle the correct response.

13 **26** **30** **31** [1]

12 Calculate angle x.

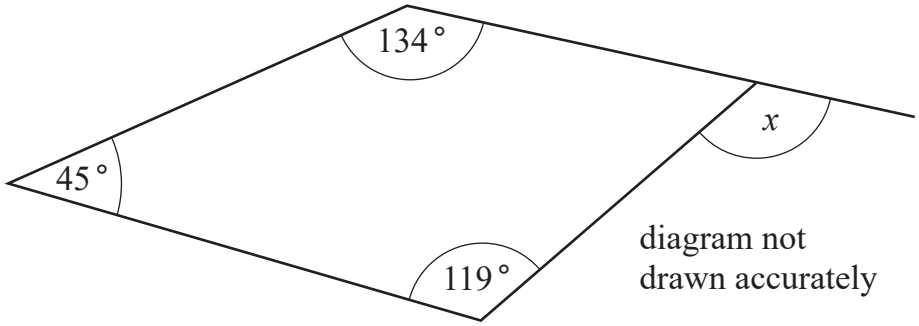


diagram not drawn accurately

Angles in a quadrilateral add up to 360°

134 + 45 + 119 = 298

360 − 298 = 62°

Angles on a straight line add up to 180°

x = 180 − 62 = 118°

Answer x = 118 ° [3]

[Turn over

13 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?

Living room: 24.5 × 37.20 = £911.40

Bedroom: 1068.70 − 911.40 = £157.30

157.30 ÷ 14.30 = 11

Answer 11 square metres [4]

14 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?

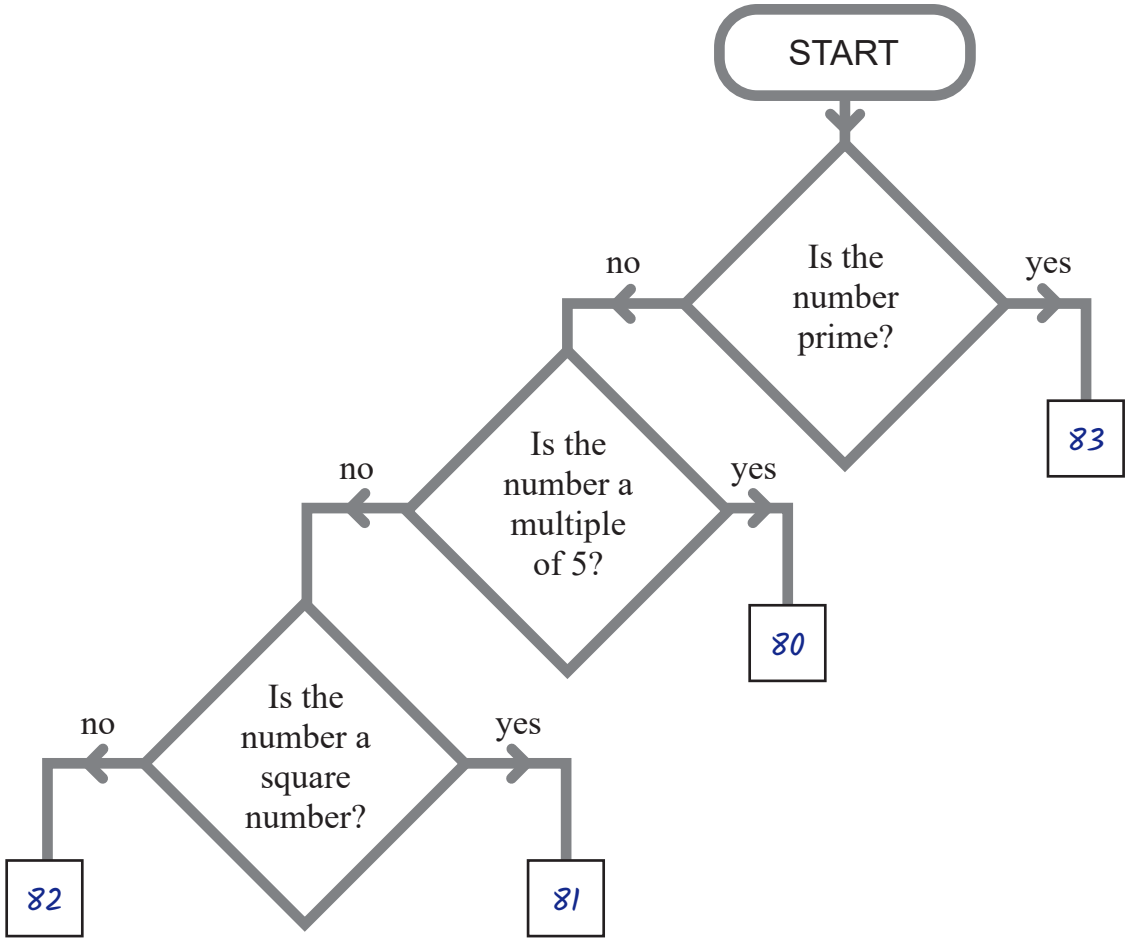
$p = \frac{16 \times 3}{8} = \frac{48}{8} = 6$

Answer 6 pizzas [3]

[Turn over

15 Look at the diagram below.

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



[2]

16 (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?

You must give a mathematical reason with your answer.

Brown: 113.2 + 114.5 + 116.7 + 118.1 + 114.0
+ 116.9 + 115.3 + 117.3 + 114.6 + 115.7 = 1156.3
mean = 1156.3 ÷ 10 = 115.63 g
Jack's mean 116.85 g > 115.63 g
Brown's range = 118.1 − 113.2 = 4.9 g

Answer Farmer Jack because his mean weight (116.85 g) is greater than Brown's mean (115.63 g). [3]

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

Why might this supermarket prefer to buy Farmer Brown's apples?

Answer Brown's apples have a smaller range (4.9 g < 19.1 g), so his apples are more consistent in size. [1]

[Turn over

17 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?

You must show working to explain your answer.

Every Second: 15% of 135 = 135 ÷ 100 × 15 = 20.25

135 − 20.25 = £114.75

Minutes Matter: 174 ÷ 3 = 58

174 − 58 = £116

£114.75 < £116

Answer *Every Second* [4]

18 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.

Distance 1 = 30 × 1 = 30 miles

Distance 2 = 54 × ½ = 27 miles

Total distance = 57 miles, total time = 1.5 h

Average speed = 57 ÷ 1.5 = 38

Answer 38 miles per hour [3]

[Turn over



19 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?

Circumference = π × 2 = 6.283185307...

15 tables: 6.283185307... × 15 = 94.24777961...

so 95 m of ribbon needed

95 × £1.25 = £118.75

Answer £ 118.75 [4]

20 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?

70% of 200 = 140 hats: 140 × 3 = £420

¼ of 200 = 50 hats: 50 × 2.50 = £125

Remaining 200 − 140 − 50 = 10 hats: 10 × 1 = £10

Income = 420 + 125 + 10 = £555

Costs = 120 + 20 = £140

Profit = 555 − 140 = £415

Answer £ 415 [5]

[Turn over

21 Solve the equation $5(2y + 3) = 79$

$5(2y + 3) = 79$

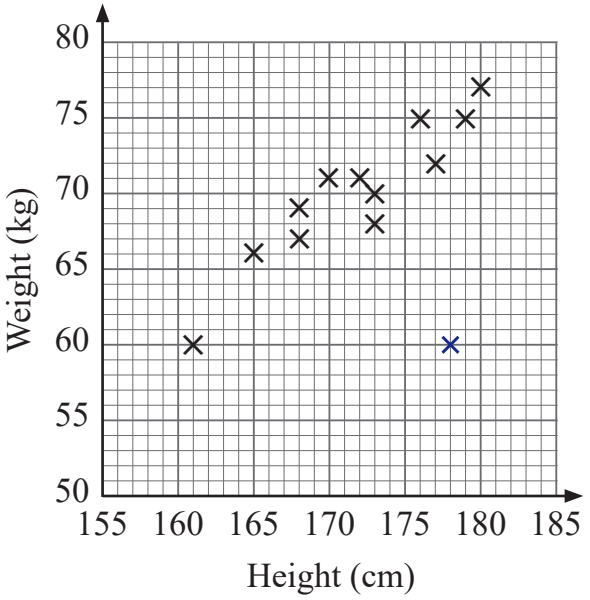
$10y + 15 = 79$

$10y = 64$

$y = 64 \div 10 = 6.4$

Answer $y =$ 6.4 [3]

22 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.

Answer *Positive correlation: taller players weigh more* [1]

(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 above. [1]

(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.

Answer *higher* [1]

[Turn over

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

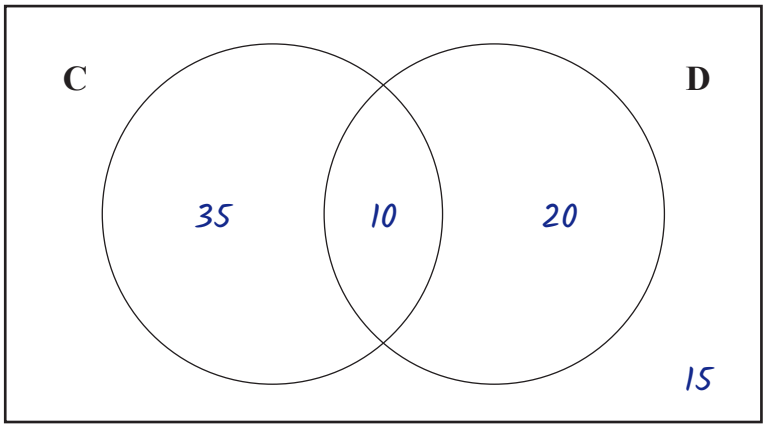
The school has 80 pupils.

45 pupils attend Choir.

30 pupils attend Drama.

15 pupils attend neither.

(a) Complete the Venn diagram using this information.



[3]

45 + 30 + 15 = 90, 90 − 80 = 10 in both

(b) What fraction of the pupils attend **only** the Drama Club?

Drama only = 30 − 10 = 20

$\frac{20}{80} = \frac{1}{4}$

Answer $\frac{1}{4}$ [1]

24 ABC is a right-angled triangle.

AC = 15 cm.

BC = 7.5 cm.

Work out the length of AB.

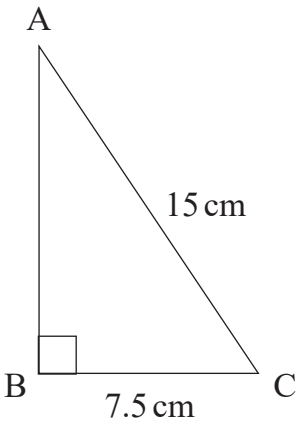


diagram not drawn accurately

$AC^2 = AB^2 + BC^2$

$15^2 = AB^2 + 7.5^2$

$225 = AB^2 + 56.25$

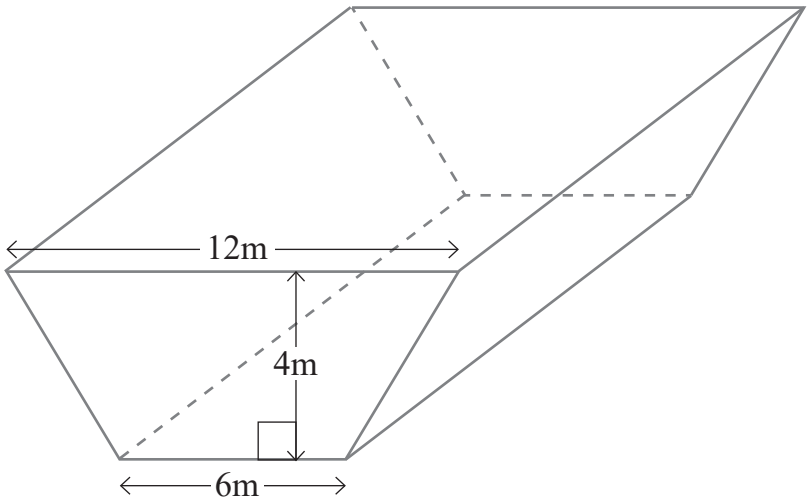
$AB^2 = 225 - 56.25 = 168.75$

$AB = \sqrt{168.75} = 12.99038...$

Answer 12.99 cm [3]

[Turn over

25 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.

Area of trapezium = $\frac{1}{2}(12 + 6) \times 4 = 36\ m^2$

$36 \times \text{length} = 522$

$\text{length} = 522 \div 36 = 14.5$

Answer 14.5 m [3]

26 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
$100 \leqslant h < 110$	6
$110 \leqslant h < 120$	13
$120 \leqslant h < 130$	12
$130 \leqslant h < 140$	15
$140 \leqslant h < 150$	3
$150 \leqslant h < 160$	1

(a) Calculate an estimate for the mean height.

Midpoints: 105, 115, 125, 135, 145, 155

$\Sigma fx = 6\times105 + 13\times115 + 12\times125 + 15\times135 + 3\times145 + 1\times155$

$= 630 + 1495 + 1500 + 2025 + 435 + 155$

$= 6240$

$\Sigma f = 6 + 13 + 12 + 15 + 3 + 1 = 50$

Mean $= 6240 \div 50 = 124.8$

Answer 124.8 m [4]

(b) In which class interval does the median lie?

50 trees: 25th/26th, cum. freq. 6, 19, 31

Answer $120 \leqslant h < 130$ [1]

[Turn over

27 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.

Bank A

Year 1: 3% of 2400 = 72, 2400 + 72 = 2472

Year 2: 1% of 2472 = 24.72, 2472 + 24.72 = 2496.72

Bank B

Year 1: 4% of 2400 = 96, 2400 + 96 = 2496

Year 2: 0.5% of 2496 = 12.48, 2496 + 12.48 = 2508.48

Answer **Bank A**: £ 2496.72

Bank B: £ 2508.48 [4]

28 **(a)** Find the HCF of 30 and 45

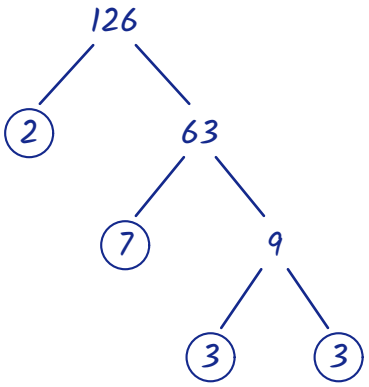
30: 1, 2, 3, 5, 6, 10, 15, 30

45: 1, 3, 5, 9, 15, 45

Highest common factor = 15

Answer 15 [2]

(b) Write 126 as a product of its prime factors.



126 = 2 × 3 × 3 × 7

Answer $2 \times 3^2 \times 7$ [2]

[Turn over

29 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.

Length = $x + 13$

Perimeter: $2x + 2(x + 13) = 86$

$2x + 2x + 26 = 86$

$4x + 26 = 86$

$4x = 60$

$x = 15$

Answer $x =$ 15 m [3]

30 (2, 5) is the midpoint of the line joining (a, b) and $(3a, 3)$.

Find the values of a and b.

$\frac{a + 3a}{2} = 2$

$4a = 4, \quad a = 1$

$\frac{b + 3}{2} = 5$

$b + 3 = 10, \quad b = 7$

Answer $a =$ 1 , $b =$ 7 [3]

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Q3b, Q5, Q7b(ii).....© Getty Images

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