Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2022

Mathematics

StemUp Model Solution

Unit M2
(With calculator)
Foundation Tier



[GMC21]

GMC21

TUESDAY 29 NOVEMBER, 9.15am–11.00am

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 are provided with Foundation Tier Additional Support Materials for use with this paper.**
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 twenty-six** 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.

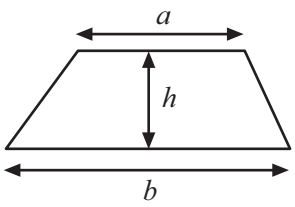
INFORMATION FOR CANDIDATES

Functional Mathematics is assessed in this unit.
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.

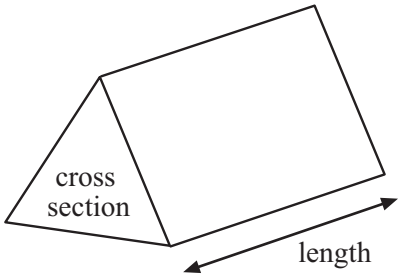
13326

Formula Sheet

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



Volume of prism = area of cross section × length



13326

1 Insert a unit from the list to make each statement correct.

km	g	m	kg	mg	cm

(a) 1500 cm = 15 *m*

(b) 3.5 kg = 3500 *g*

(c) 67 mm > 6 *cm*

(d) 1200 g < 2 *kg*

[4]

2

Ulster Folk & Transport Museum

Entrance Prices

Adult £11

Child £6

Senior Citizen £8.50

10% discount for groups of 15 or more adults

(a) Two adults, two children and a senior citizen visit the museum.

How much change will there be from £50?

$2 \times 11 + 2 \times 6 + 8.50$

$= 22 + 12 + 8.50 = £42.50$

$Change = 50 - 42.50 = £7.50$

Answer £ 7.50 [2]

(b) A group of 46 adults visits the museum.

Riley thinks they are entitled to a total discount of at least £50

Is Riley correct?

Show all your working.

46 × 11 = £506
10% of 506 = 506 ÷ 10 = £50.60
£50.60 > £50
Yes, Riley is correct: the discount is £50.60

[2]

(c) Sian works in the museum café 32 hours each week.

She earns £272 each week.

What is her hourly rate of pay?

272 ÷ 32 = 8.5

Answer £ 8.50 [2]

[Turn over

3 **(a)** The temperature in Siberia rose from –15°C to –7°C.

By how many degrees did it rise?

$-7 - (-15) = -7 + 15 = 8$

Answer 8 °C [1]

(b) The temperature in Dublin was 4°C in the morning.

In the afternoon it fell by 7°C.

It then rose by 2°C in the evening.

What was the temperature in the evening?

$4 - 7 + 2 = -1$

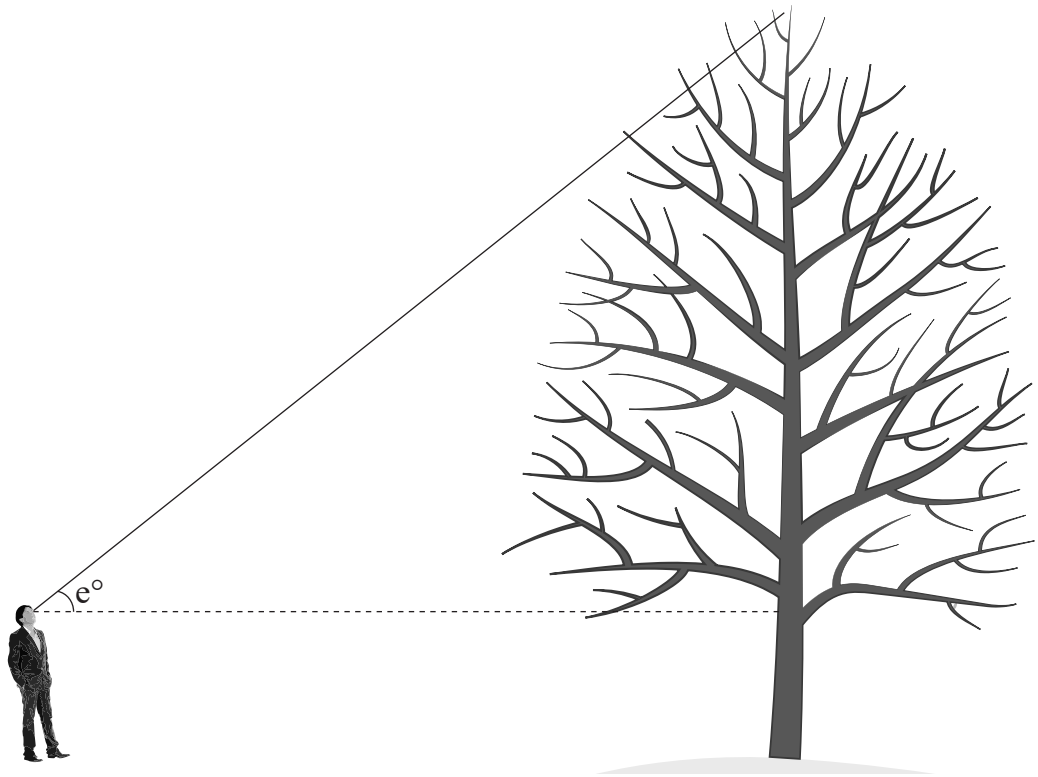
Answer −1 °C [1]

(c) Insert brackets to make the calculations correct.

(i) $8 \times (3 + 5) = 64$ $8 \times 8 = 64$ [1]

(ii) $(7 - 5 + 8) \div 2 = 5$ $10 \div 2 = 5$ [1]

4 A man stood and looked up to the top of a tree, as shown in the diagram.



(a) Measure the angle, e°, marked on the diagram.

Answer 39 ° [1]

(b) The man is approximately 2 m tall.

Use this fact to estimate the height of the tree.

Tree is about 5 times the man's height
5 × 2 = 10 m

Answer 10 m [1]

[Turn over

5 The owner of Rick's Restaurant recorded the total number of meals served each day for 6 days.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Number of meals	108	122	117	123	110	119

(a) Calculate the mean number of meals served per day.

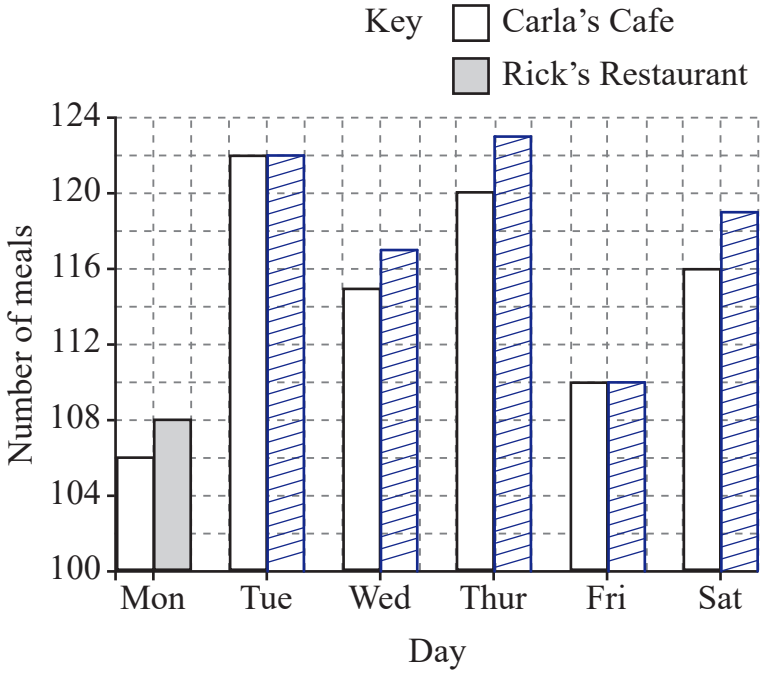
108 + 122 + 117 + 123 + 110 + 119 = 699

Mean = 699 ÷ 6 = 116.5

Answer 116.5 [3]

(b) The owner of Carla's Cafe recorded the total number of meals served each day for the same 6-day period.

The results are shown in the diagram below.



(i) Complete the dual bar chart by drawing the bars for Rick's Restaurant.

The first one has been done for you. [2]

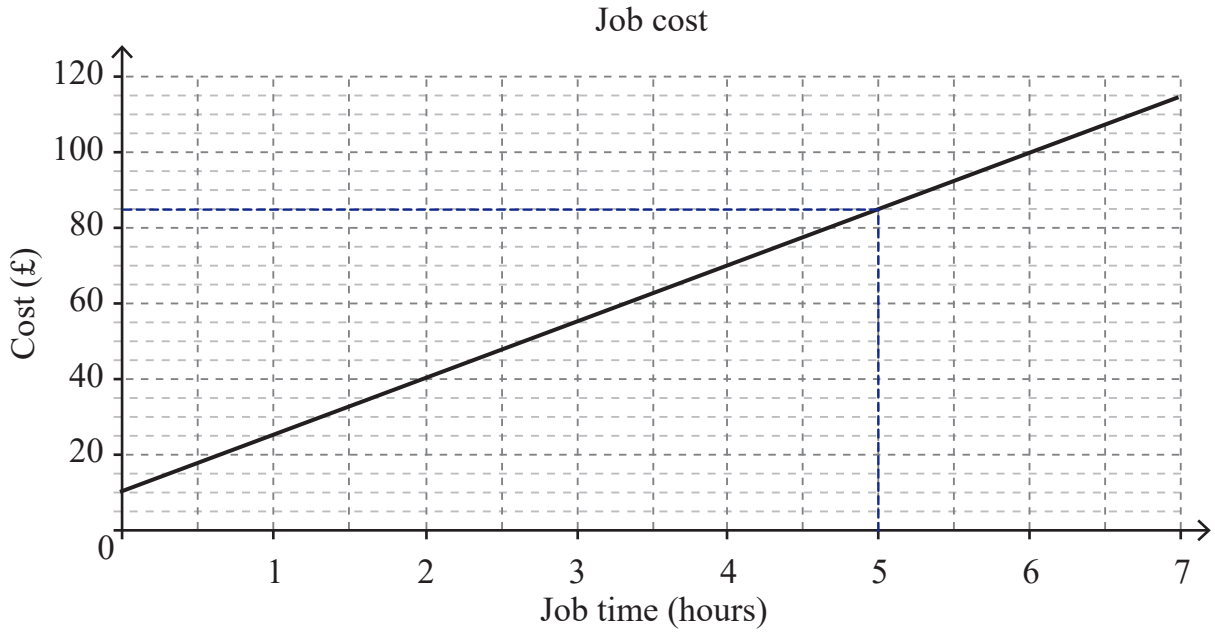
(ii) Without doing any calculations, state whether the mean number of meals served per day in Carla's Cafe is higher or lower than in Rick's Restaurant.

Give a reason for your answer.

Answer lower because all of Carla's bars are the same height or lower than Rick's; none of her bars are higher [1]

[Turn over

6 Harry uses the graph below to price jobs.



(a) How much does a 5-hour job cost?

Answer £ 85 [1]

(b) Harry completes two jobs on Friday.

One job lasts an hour longer than the other.

What is the difference in cost?

From the graph: 2 hours = £40, 3 hours = £55

Difference = 55 − 40 = £15

Answer £ 15 [2]

7 Fill in the missing values in each of the following boxes.

(a) 2.5% $= \frac{\boxed{2.5}}{100} = \frac{\boxed{5}}{200}$ [2]

(b) $\frac{9}{27} = \frac{2}{\boxed{6}}$ [1]

2.5% = 2.5 ÷ 100, × 2 gives 5 ÷ 200

$\frac{9}{27} = \frac{1}{3} = \frac{2}{6}$

[Turn over

8

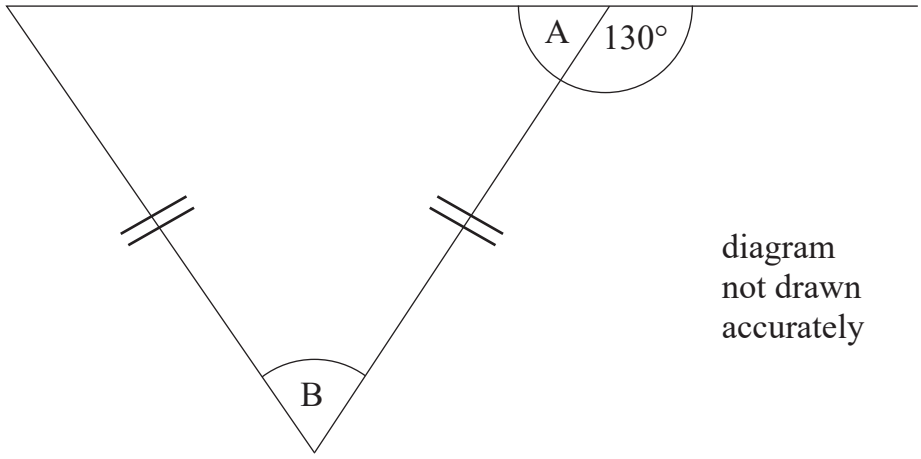


diagram
not drawn
accurately

Work out the sizes of the angles marked A and B in the diagram.

A = 180 − 130 = 50° (angles on a straight line add to 180°)

Isosceles triangle so the base angles are equal: 50° and 50°

B = 180 − (2 × 50) = 180 − 100 = 80° (angles in a triangle)

Answers A = 50 °

B = 80 °

[3]

9 A local drama group sold the following tickets.

Type of ticket	Number of tickets sold
Senior citizen	15
Adult	48
Youth	6
Child	18
Infant	3

Total = 15 + 48 + 6 + 18 + 3 = 90

360 ÷ 90 = 4° per ticket

Youth: 6 × 4 = 24°

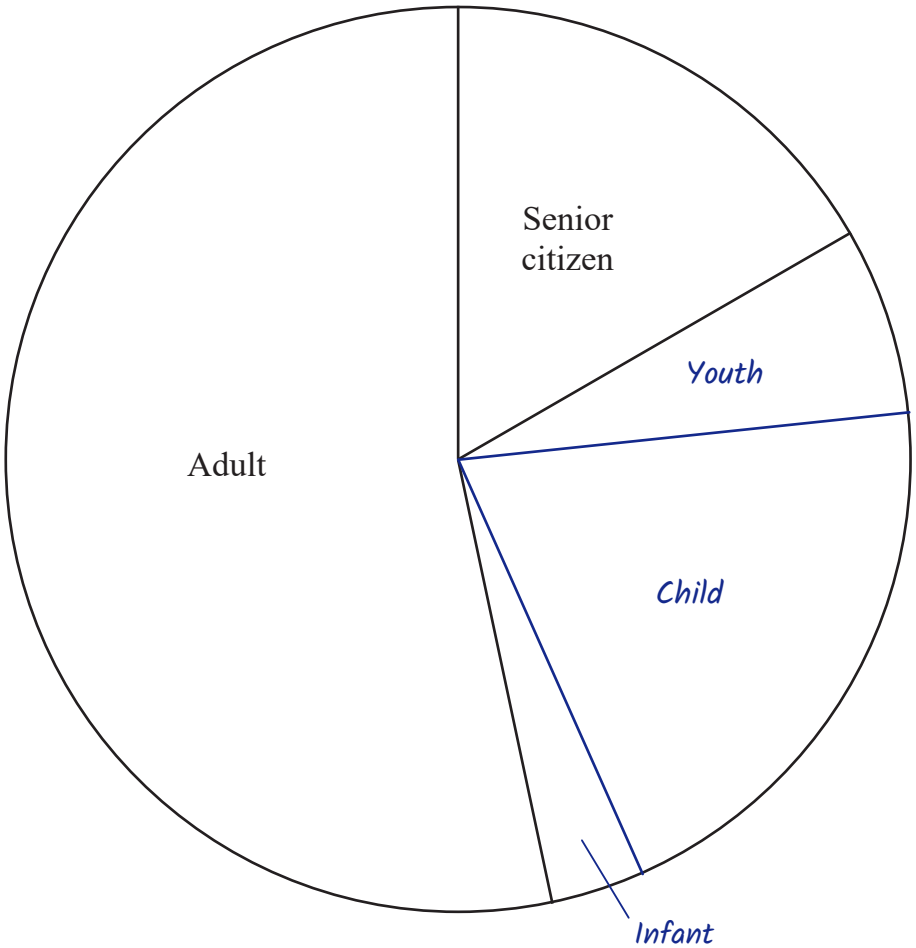
Child: 18 × 4 = 72°

Infant: 3 × 4 = 12°

(a) The drama group leader started to draw a pie chart representing the number of tickets sold in each age category.

The first two sectors have been drawn.

Complete the pie chart.



[3]

[Turn over

(b) The table below includes the cost of the tickets.

Calculate the total income from ticket sales.

Type of ticket	Cost of ticket	No. of tickets sold
Senior citizen	£6	15
Adult	£10	48
Youth	£5	6
Child	£3	18
Infant	Free	3

$(6 \times 15) + (10 \times 48) + (5 \times 6) + (3 \times 18) + (0 \times 3)$

$= 90 + 480 + 30 + 54 + 0 = 654$

Answer £ 654 [2]

(c) At the interval, hot and cold drinks were sold as shown in the table below.

	Small	Medium	Large
Hot	4	24	7
Cold	3	12	15

The drama group leader said:

"Half of the medium drinks sold were cold."

Is this statement correct? Explain your answer.

Answer No because only 12 of the 36 medium drinks were cold, which is one third. Half of 36 would be 18. [2]

10 Mr Jenkins is a bus driver.

His standard rate of pay is £12 per hour.

At weekends he gets "time and a half".

If he works a split shift (two separate blocks of time) on any day he gets an additional £18 for that day.

Mr Jenkins' timesheet for the first week in January is shown below.

Monday	0800–1400
Tuesday	0730–0930 and 1500–2200
Wednesday	Off
Thursday	1500–2230
Friday	Off
Saturday	0800–1500
Sunday	1230–1830

Calculate Mr Jenkins' total pay for this week.

Weekdays (£12 per hour):

Mon 0800 to 1400 = 6 h; Tue 2 h + 7 h = 9 h; Thu 7.5 h

6 + 9 + 7.5 = 22.5 h, 22.5 × 12 = £270

Weekend (time and a half = £18 per hour):

Sat 7 h + Sun 6 h = 13 h, 13 × 12 × 1.5 = £234

Split shift on Tuesday = £18

Total = 270 + 234 + 18 = £522

Answer £ 522 [4]

[Turn over

11 **(a)** A farm worker can pick 90 strawberries every 5 minutes.

How many strawberries can the farm worker pick in an hour?

60 ÷ 5 = 12, 12 × 90 = 1080

Answer 1080 [1]

(b) The average picking rate for each worker is 1000 strawberries per hour.

There are 8 workers on the farm.

They need to pick 58 000 strawberries for a special order.

If they pick at the average rate, how long should it take them?

Give your answer in hours and minutes.

8 workers × 1000 = 8000 strawberries per hour

58 000 ÷ 8000 = 7.25 hours

0.25 × 60 = 15 minutes

Answer 7 hours and 15 minutes [2]

12 **(a)** Simplify $5a + 2b - 3a - 8b$

$5a - 3a = 2a, \quad 2b - 8b = -6b$

Answer $2a - 6b$ [2]

(b) Multiply out $4(3x - 5)$

$4 \times 3x - 4 \times 5$

Answer $12x - 20$ [2]

(c) Solve $8x - 10 = 6x + 2$

$8x - 6x = 2 + 10$

$2x = 12$

$x = 12 \div 2 = 6$

Answer $x =$ 6 [3]

13 Calculate $5.9^2 + \sqrt{80}$

Give your answer correct to 1 decimal place.

$5.9^2 = 34.81, \quad \sqrt{80} = 8.94427191...$

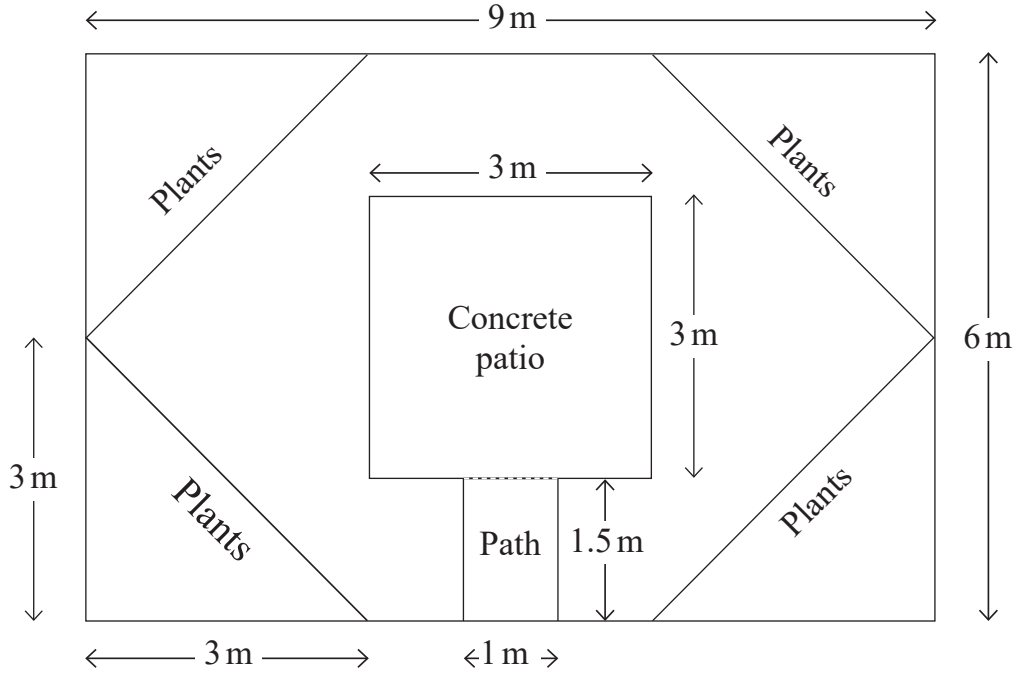
$34.81 + 8.94427191 = 43.75427191$

Answer 43.8 [2]

[Turn over



14 The diagram shows the layout of a rectangular garden.



(a) There are four identical triangular sections of the garden covered with plants.

Calculate the area of one of these triangular sections.

You must include units with your answer.

Each triangle has base 3 m and height 3 m

Area = (3 × 3) ÷ 2 = 4.5

Answer *4.5 m²* [3]

(b) The garden also has a rectangular path leading to a square concrete patio.

The remainder of the garden is covered by grass.

Calculate the total area of grass in the garden.

Garden = $9 \times 6 = 54\ m^2$

Plants = $4 \times 4.5 = 18\ m^2$

Patio = $3 \times 3 = 9\ m^2$, Path = $1.5 \times 1 = 1.5\ m^2$

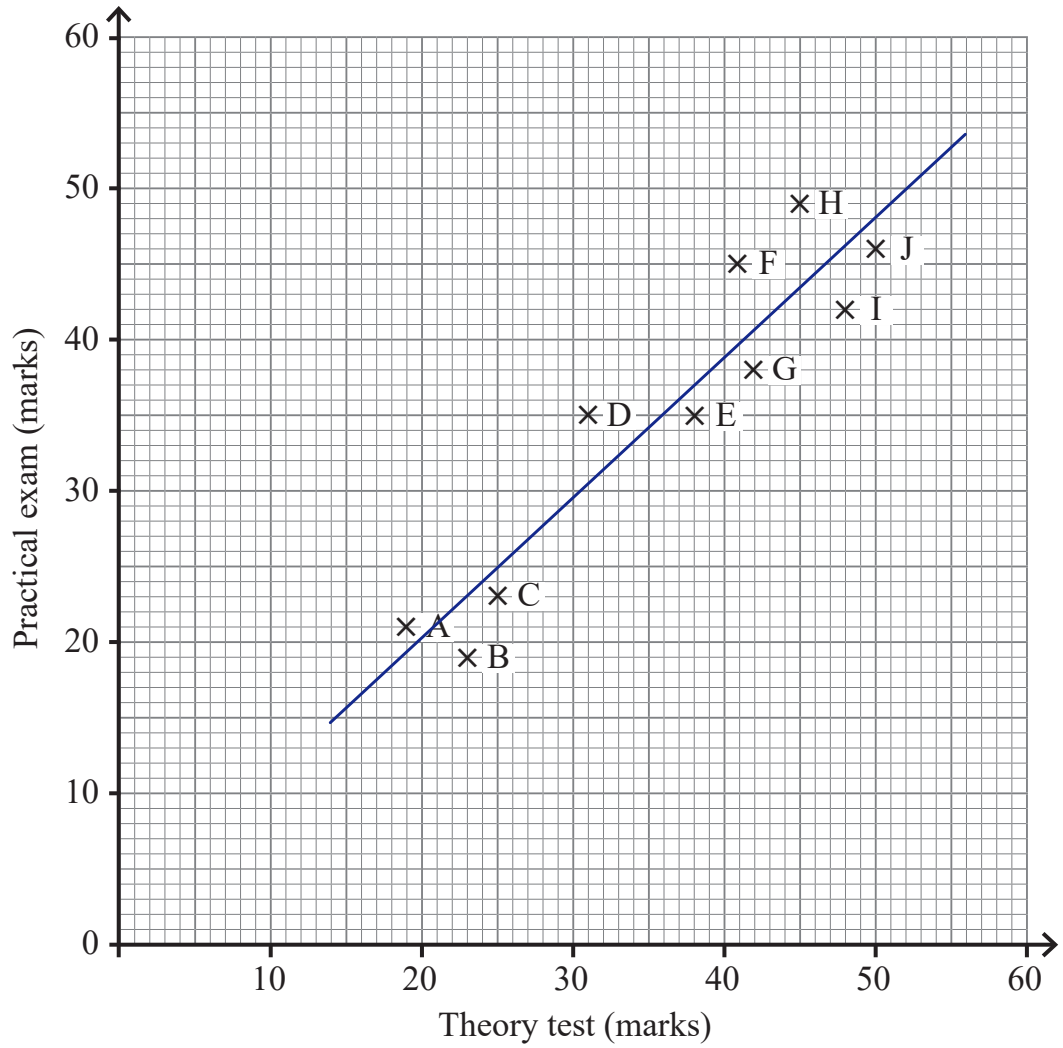
Grass = $54 - 18 - 9 - 1.5 = 25.5\ m^2$

Answer 25.5 m^2 [3]

[Turn over

15 Ten job applicants completed a theory test and a practical exam.

The marks are shown in the scatter graph below.



(a) What was the highest mark obtained in the practical exam?

Answer 49 [1]

(b) One applicant scored a total of 80 marks.

Which applicant was this?

G: 42 + 38 = 80

Answer G [1]

(c) Draw a line of best fit on the graph. [1]

[Turn over

16 The stem and leaf diagram shows the heights of 19 members of a sports team.

16	3	4	9						
17	1	2	4	5	6	7	8	9	9
18	0	2	3	5	5	8			
19	0								

Key 17 | 5 = 175 cm

Four new players attend trials to become the 20th member of the team.

Their heights are

Player A	185 cm
Player B	179 cm
Player C	177 cm
Player D	191 cm

If added to the team, which player would make

(a) the modal height greater than 180 cm?

Mode would be 185 (three times)

Answer A [1]

(b) the range of the heights 28 cm?

191 − 163 = 28

Answer D [1]

(c) the median height 177.5 cm?

10th = 177, 11th = 178: (177 + 178) ÷ 2 = 177.5

Answer C [1]

17 A coat has an original price of £87

Online Shop A offers a 33% discount.

Online Shop B offers a third off.

Which shop offers the greatest saving and how much greater is the saving in pence?

You must show all your working.

Shop A: 33% of £87 = 0.33 × 87 = £28.71

Shop B: one third of £87 = 87 ÷ 3 = £29

£29 > £28.71 so Shop B saves more

29 − 28.71 = £0.29 = 29p

Answer Shop B offers greater saving by 29 p [4]

[Turn over

18 Philip says $2\frac{1}{3} + 4\frac{1}{2} = 6\frac{2}{5}$

because 2 + 4 = 6 for the whole numbers,

1 + 1 = 2 on the numerator and

3 + 2 = 5 on the denominator.

Prove that he is incorrect by showing a step-by-step solution to the correct answer, without using a calculator.

2 + 4 = 6 (whole numbers)

$\frac{1}{3} + \frac{1}{2} = \frac{2}{6} + \frac{3}{6} = \frac{5}{6}$

So $2\frac{1}{3} + 4\frac{1}{2} = 6\frac{5}{6}$ not $6\frac{2}{5}$

Philip is incorrect.

[3]

19 Factorise

(a) $8p + 12t$

Answer 4(2p + 3t) [1]

(b) $r - r^2$

Answer r(1 − r) [1]

20 Two points P(4, 8) and Q(x, y) are joined to form a straight line.

The midpoint of the line PQ has coordinates (1, 7)

Find the coordinates of Q.

x: $\frac{4 + x}{2} = 1 \rightarrow 4 + x = 2 \rightarrow x = -2$

y: $\frac{8 + y}{2} = 7 \rightarrow 8 + y = 14 \rightarrow y = 6$

Answer Q (−2 , 6) [3]

21 Solve $\frac{3x - 1}{4} = 5$

$3x - 1 = 5 \times 4$

$3x - 1 = 20$

$3x = 21$

$x = 21 \div 3 = 7$

Answer x = 7 [3]

[Turn over

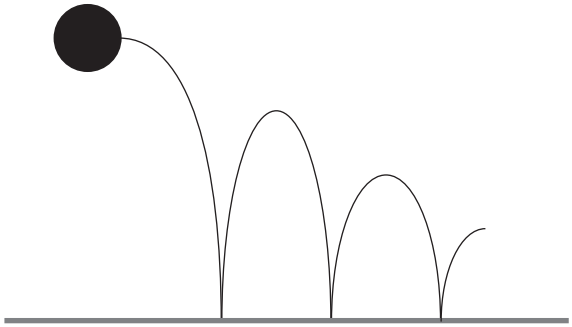
22 A ball is dropped from a height of 2.5 m above the ground.

Each time it hits the ground it bounces to $\frac{3}{5}$ of its previous height.

Kevin says that after it hits the ground for the third time it will not bounce above half a metre.

Is Kevin correct?

You must show all your working.



1st bounce: $\frac{3}{5} \times 2.5 = 1.5$ m

2nd bounce: $\frac{3}{5} \times 1.5 = 0.9$ m

3rd bounce: $\frac{3}{5} \times 0.9 = 0.54$ m

0.54 m > 0.5 m, so it bounces above half a metre.

Kevin is not correct.

Answer No [3]

23 **(a)** Write down any two numbers whose highest common factor (HCF) is 8

HCF(8, 16) = 8

Answer 8 and 16 [2]

(b) Given that $600 = 2^a \times 3 \times 5^b$ find the values of a and b

2	600
2	300
2	150
3	75
5	25
5	5
	1

$600 = 2 \times 2 \times 2 \times 3 \times 5 \times 5$

$= 2^3 \times 3 \times 5^2$

Answer $a =$ 3 $b =$ 2 [2]

[Turn over

24 A cuboid has length 90 cm, width 45 cm and height 30 cm.

It has a mass of 24 300 g.

Calculate the density of the cuboid.

Include units in your answer.

Volume = 90 × 45 × 30 = 121 500 cm^3

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{24\ 300}{121\ 500} = 0.2$$

Answer 0.2 g/cm^3 [4]

25 Leah walks 4.7 m in a straight line.

She then turns 90° clockwise and walks 2.5 m in another straight line.

How far is Leah from where she started?

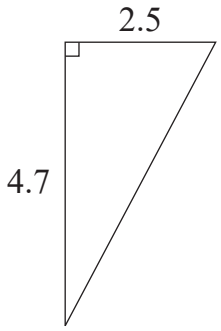


diagram not drawn accurately

$x^2 = 4.7^2 + 2.5^2$

$x^2 = 22.09 + 6.25 = 28.34$

$x = \sqrt{28.34} = 5.323532662...$

Answer 5.32 m [3]

[Turn over

26 The front door of Martin's house is wooden.

The top of the door is a semicircle.

It has a window in the shape of a rhombus as shown in the diagram.

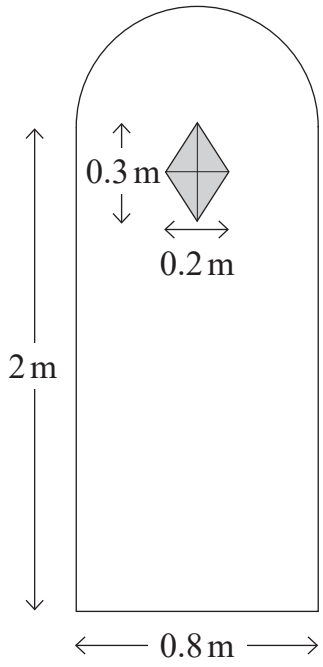


diagram not drawn accurately

What is the area of the wooden part of the door?

Rectangle = $2 \times 0.8 = 1.6$

Semicircle = $\frac{1}{2} \times \pi \times 0.4^2 = 0.2513274...$

Rhombus = $\frac{1}{2} \times 0.2 \times 0.3 = 0.03$

Wood = $1.6 + 0.2513274 - 0.03$

$= 1.8213274 12...$

Answer 1.82 m^2 [5]

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Question Number	**Marks**
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November 2022

GCSE Mathematics

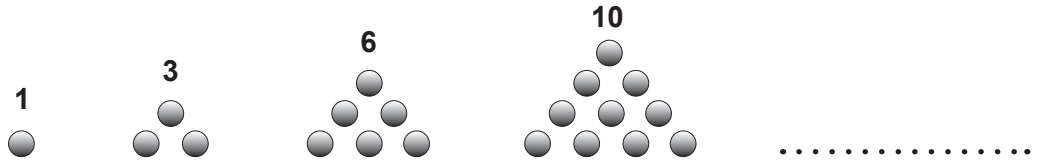
FOUNDATION TIER
ADDITIONAL SUPPORT MATERIALS
(For use in November 2022)

stemup.co.uk

Numbers

Highest Common Factor (HCF): The highest common factor is the largest number that divides evenly into two or more numbers, e.g. 4 is the HCF of 8 and 20

Triangular numbers – are a pattern of numbers which form triangles. Each number in the sequence adds a new row of dots to the triangle.



Trial and Improvement

This is a method of trying different values in an equation until you get a suitable solution (e.g. to 1 decimal place).

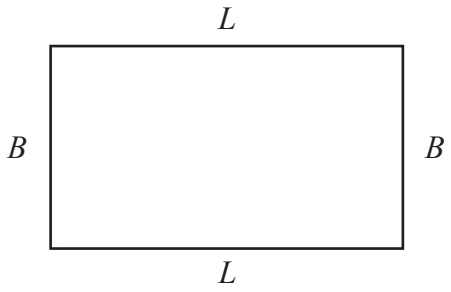
Range

The range of a set of data is the difference between the largest value and the smallest value in the data set.

Mean

The mean of a set of data is the sum of all the data values divided by the number of data values.

Area and Volume



The area of a rectangle is found by multiplying the length of the rectangle by the breadth.

$A = L \times B$ where A is area, L is length and B is breadth.

The area of a triangle is found by multiplying half the length of the base by the perpendicular height of the triangle.

$A = \frac{1}{2}bh$ where b is the base and h is the perpendicular height of the triangle.

The area of a circle is $A = \pi r^2$ where r is the radius of the circle.

The volume of a cuboid is found by multiplying the length by the breadth by the height of the cuboid.

$V = L \times B \times H$ where V is volume, L is length, B is breadth and H is height.

Angles

There are 180° on a straight line.
There are 180° inside a triangle.
An isosceles triangle is a triangle with 2 equal sides and 2 equal angles.
The sum of all the angles inside a polygon is given by $180(n - 2)$ where n is the number of sides in the polygon.

Pie Chart

In a pie chart, the total angle that corresponds to the entire data set is 360°

Probability

The sum of the probabilities of all outcomes equals 1

Compound Measures

$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

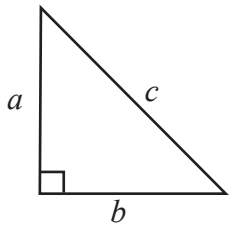
$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

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Pythagoras' Theorem

If a, b and c are the sides of a right angled triangle shown below, then

$$a^2 + b^2 = c^2$$



Midpoint of a line

If (x_1, y_1) and (x_2, y_2) are the end points of a line, then the coordinates of the midpoint M of the line are

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$