Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2022

Mathematics

StemUp Model Solution

Unit M7 Paper 2
(With calculator)
Higher Tier



[GMC72]

GMC72

THURSDAY 1 DECEMBER, 10.45am–12 NOON

TIME

1 hour 15 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 Higher 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, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all sixteen** 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.

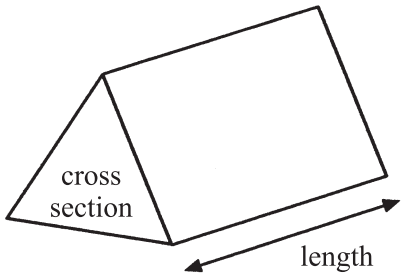
INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
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.

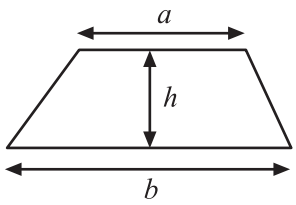
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Formula Sheet

Volume of prism = area of cross section × length

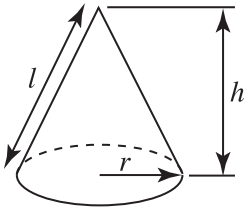


Area of trapezium = $\frac{1}{2}(a+b)h$



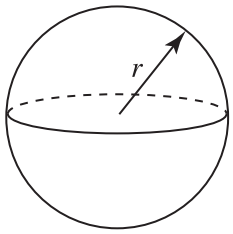
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

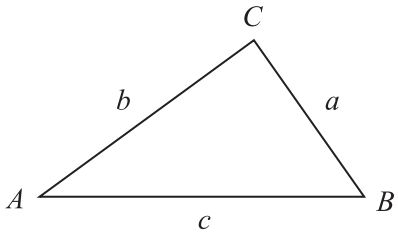


Volume of sphere = $\frac{4}{3}\pi r^3$

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



In any triangle *ABC*



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

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 = $\frac{1}{2}ab\sin C$

13334

1 In a group, the number of boys and girls with a certain eye colour is recorded as shown below.

	Boys	Girls
Brown eyes	10	8
Blue eyes	4	7
Green eyes	6	5

A child is chosen at random from this group of boys and girls.

What is the probability that the child is a girl with blue eyes?

Total = 10 + 8 + 4 + 7 + 6 + 5 = 40

Girls with blue eyes = 7

$P(\text{girl, blue}) = \frac{7}{40}$

Answer $\frac{7}{40}$ [2]

[Turn over

2 Ticket prices for adults and children are shown for two rugby clubs.

Ulster	Clermont
Adults: £29 each	Adults: €32.50 each
Children: £14.95 each	Children: €17 each

The exchange rate is €1 = £0.83

At which rugby club is it more expensive to buy tickets for 2 adults and 1 child and how much more expensive is it?

State units with your answer.

Ulster: 2 × 29 + 14.95 = £72.95

Clermont: 2 × 32.50 + 17 = €82

€82 in pounds: 82 × 0.83 = £68.06

Difference: 72.95 − 68.06 = £4.89

Ulster is more expensive by £4.89

Answer _____*Ulster*_____ is more expensive by _____*£4.89*_____ [4]

3 **(a)** The school is West of the church.

Complete the sentence by filling in the correct direction.

The church is _____East_____ of the school. [1]

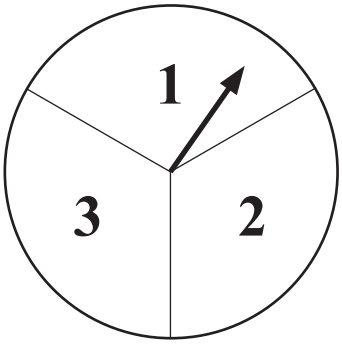
(b) The shop is North East of the station.

Complete the sentence by filling in the correct direction.

The station is _____South West_____ of the shop. [1]

[Turn over

4





The fair spinner shown is spun and a fair dice is thrown.

The number the spinner lands on is added to the number on the dice to give a total score.

(a) Complete the table of total scores.

		Dice					
		1	2	3	4	5	6
Spinner	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9

[2]

(b) What is the probability of a total score of 4?

18 outcomes; total of 4 occurs 3 times

Answer $\frac{3}{18}$ [1]

(c) What is the probability of a total score **greater than or equal to** 5?

totals ≥ 5: 3 + 4 + 5 = 12 out of 18

Answer $\frac{12}{18}$ [1]

5



© Getty Images

When Susan goes to the cinema, she always buys only one item.

She buys a drink or popcorn or crisps or ice cream.

Some of the probabilities are shown.

Item	Probability
A drink	0.4
Popcorn	0.15
Crisps	0.25
Ice cream	0.2

(a) Work out the probability that Susan buys crisps.

$1 - (0.4 + 0.15 + 0.2) = 1 - 0.75 = 0.25$

Answer 0.25 [2]

(b) Susan goes to the cinema 20 times.

Calculate how many times you would expect her to buy a drink.

$20 \times 0.4 = 8$

Answer 8 [2]

[Turn over

6 Adam, Bob and Carol play a coin game.



© Getty Images

Two fair coins are tossed.

Adam wins if there are no heads shown.

Bob wins if there is one head shown.

Carol wins if there are two heads shown.

Is the game fair to all players? Calculate who is most likely to win.

Outcomes: HH HT TH TT (4 equally likely)

Adam (no heads): TT, P = 1/4

Bob (one head): HT, TH, P = 2/4 = 1/2

Carol (two heads): HH, P = 1/4

The game is not fair.

Bob is the most likely to win.

[2]

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(Questions continue overleaf)

[Turn over

7 Avril's recipe makes 16 tray bakes with the following ingredients.

Chocolate tray bakes	(to make 16 tray bakes)
crushed biscuits	240 g
butter	200 g
brown sugar	150 g
chocolate	240 g
condensed milk	400 g

Avril has 250 g of butter to make chocolate tray bakes.

She has enough of the other ingredients.

(a) How many tray bakes can she make?

250 ÷ 200 = 1.25

16 × 1.25 = 20

Answer 20 [1]

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(b) Complete the amounts needed for the other ingredients.

Multiply each amount by 1.25:

biscuits 240 × 1.25 = 300 g

sugar 150 × 1.25 = 187.5 g

chocolate 240 × 1.25 = 300 g

condensed milk 400 × 1.25 = 500 g

crushed biscuits	300	g
butter	250	g
brown sugar	187.5	g
chocolate	300	g
condensed milk	500	g

[3]

[Turn over

8 Orange juice is mixed with water in the ratio 1:11 (orange juice:water).

How much orange juice and how much water make up 3 litres in total?

Give your answers in ml.

1 + 11 = 12 parts
3 litres = 3000 ml
1 part = 3000 ÷ 12 = 250 ml
Water = 11 × 250 = 2750 ml

Answer Orange juice 250 ml

Water 2750 ml

[3]

9 Simplify

(a) $t^3 \times t^8$

Answer t^{11} [1]

(b) $(t^2)^3$

Answer t^6 [1]

(c) $\frac{t^{-3}}{t^2}$

Answer t^{-5} [1]

10 **(a)** Show that $20x - x^3 = 1$ has a solution between 4 and 5

$x = 4$: $20 \times 4 - 4^3 = 80 - 64 = 16$ (> 1)

$x = 5$: $20 \times 5 - 5^3 = 100 - 125 = -25$ (< 1)

1 lies between 16 and −25, so a solution is between 4 and 5

[1]

(b) Use Trial and Improvement to find this solution correct to 1 decimal place.

Show all your working.

x	$20x - x^3$	
4.5	−1.125	too small
4.4	2.816	too big
4.45	0.878875	too small

Solution is between 4.4 and 4.45

so $x = 4.4$ (to 1 d.p.)

Answer 4.4 [3]

[Turn over



11 Rearrange $v = u + at$ to make a the subject.

$v = u + at$

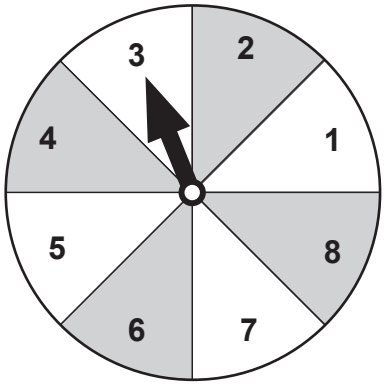
$v - u = at$

$a = \frac{v - u}{t}$

Answer $a =$ $\frac{v - u}{t}$ [2]

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12



The spinner is spun 1000 times.

The table shows some of the number of times it landed on the number 3 and some of the calculated relative frequency values.

Number of spins	Number of threes	Relative frequency
20	2	0.1
200	26	0.13
500	64	0.128
1000	122	0.122

(a) Calculate the missing relative frequency value.

64 ÷ 500 = 0.128

Answer 0.128 [1]

(b) Calculate the number of times it landed on a 3 for the 1000 spins.

1000 × 0.122 = 122

Answer 122 [1]

(c) Use the best relative frequency value from the table to calculate the number of threes you would expect to get in 2500 spins.

best value 0.122: 2500 × 0.122 = 305

Answer 305 [2]

[Turn over

13 $(2.5 \times 10^6) \times (4.8 \times 10^x) = A \times 10^4$

Find the values of A and x

$2.5 \times 4.8 = 12$, so $A = 1.2$

$12 \times 10^{6+x} = 1.2 \times 10^{7+x}$

$7 + x = 4$

$x = -3$

Answer A = 1.2 , x = −3 [3]

14 For his morning run, Tony goes to the park by one of three different routes.

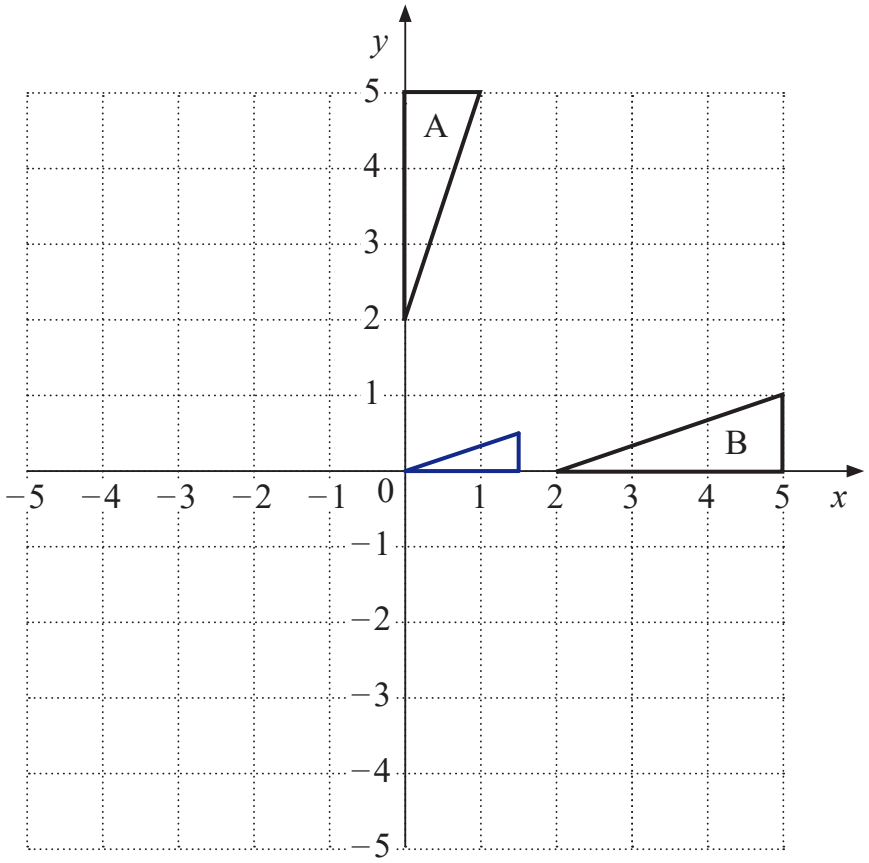
In the park he chooses one of eight different circuits to run.

In how many ways can he go to the park and complete a circuit?

$3 \times 8 = 24$

Answer 24 [2]

15



(a) Describe fully the single transformation which maps triangle A to triangle B.

Answer Reflection in the line y = x [2]

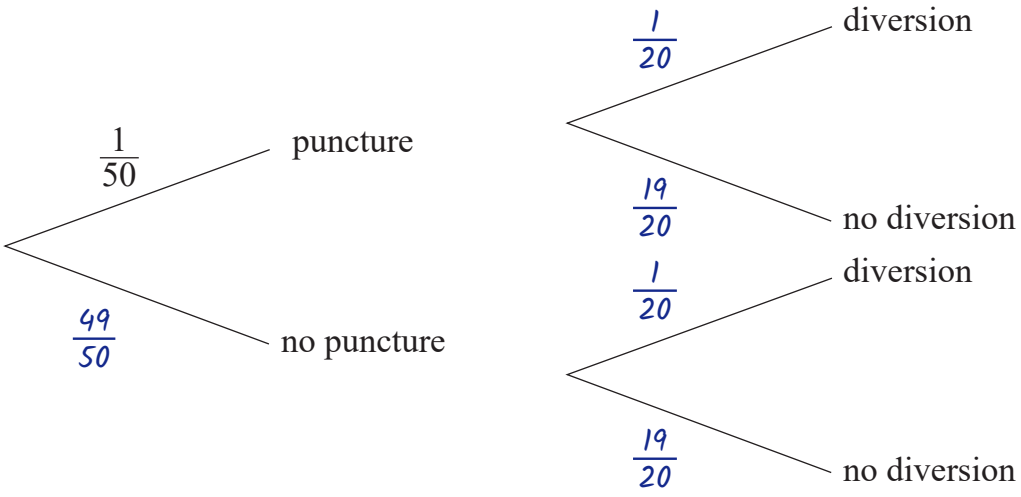
(b) Draw the enlargement of triangle B using scale factor $\frac{1}{2}$ and centre (–2, 0) [2]

[Turn over

16 The probability that Orla has a puncture on her cycle ride to school is $\frac{1}{50}$

The probability that there is a traffic diversion is $\frac{1}{20}$

(a) Complete the tree diagram to show this information. [2]



(b) What is the probability there will be no puncture and no diversion for Orla?

$\frac{49}{50} \times \frac{19}{20} = \frac{931}{1000}$

Answer $\frac{931}{1000}$ [1]

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Question Number	**Marks**
1	
2	
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Total Marks	

Examiner Number

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General Certificate of Secondary Education
November 2022

GCSE Mathematics

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

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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

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).

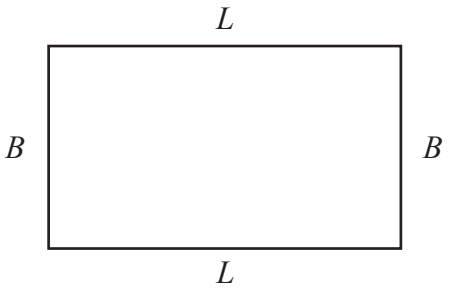
Range

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

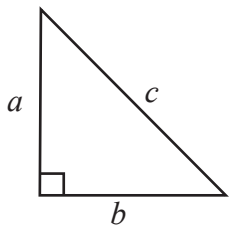
$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

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

Pythagoras' Theorem

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

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



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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

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

Gradient of a line

If (x_1, y_1) and (x_2, y_2) are two points on a line, then the gradient m of the line is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Lines

Parallel lines have the same gradient.

If a straight line has gradient m, then a line which is perpendicular to this line has a gradient $-\frac{1}{m}$

Equation of a circle

The equation of a circle of radius r and centre, the origin (0, 0), is given by $x^2 + y^2 = r^2$ where (x, y) are the coordinates of any point on the circumference of the circle.

Tangent/Radius property

The tangent to a circle is perpendicular to the radius at the point of contact with the circle.

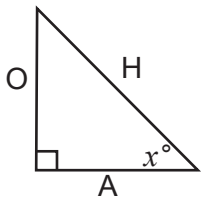
Cyclic Quadrilateral property

The opposite angles of a cyclic quadrilateral add up to 180°

Alternate Segment Theorem

In a circle, the angle between a chord and a tangent through one of the end points of the chord is equal to the angle in the alternate segment.

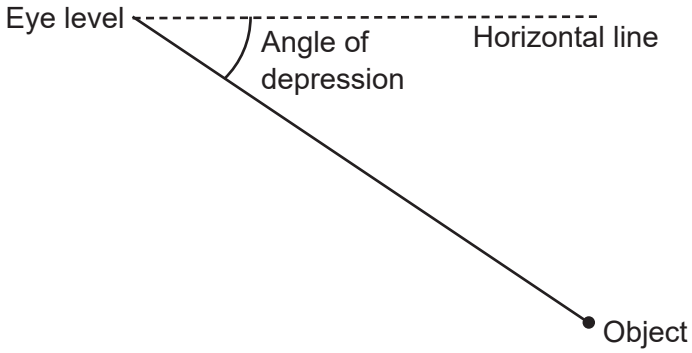
Trigonometric ratios in right angled triangles



$\sin x° = \frac{O}{H}$ $\cos x° = \frac{A}{H}$ $\tan x° = \frac{O}{A}$

Angle of depression

If a person stands and looks down at an object, the **angle of depression** is the angle between the horizontal line of sight and the object.



Frequency density in histograms

$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$