Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2024

Mathematics

StemUp Model Solution

Unit M8 Paper 1
(Non-Calculator)
Higher Tier

[GMC81]



GMC81

THURSDAY 21 NOVEMBER, 9.15am–10.30am

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

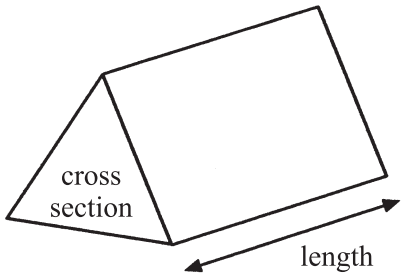
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Questions which require drawing or sketching should be completed using an HB pencil.
All working **must** be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **must not** use a calculator for this paper.
Answer **all fourteen** questions.

INFORMATION FOR CANDIDATES

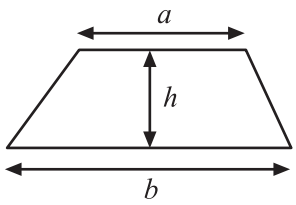
The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a ruler, compasses and a protractor.
The Formula Sheet is on page 2.

Formula Sheet

Volume of prism = area of cross section × length

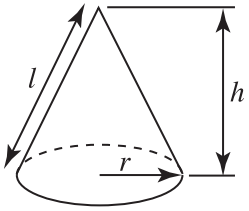


Area of trapezium = $\frac{1}{2}(a+b)h$



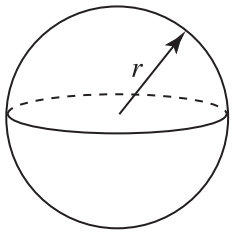
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

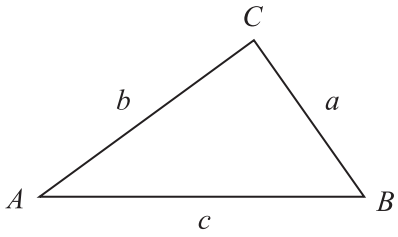


Volume of sphere = $\frac{4}{3}\pi r^3$

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

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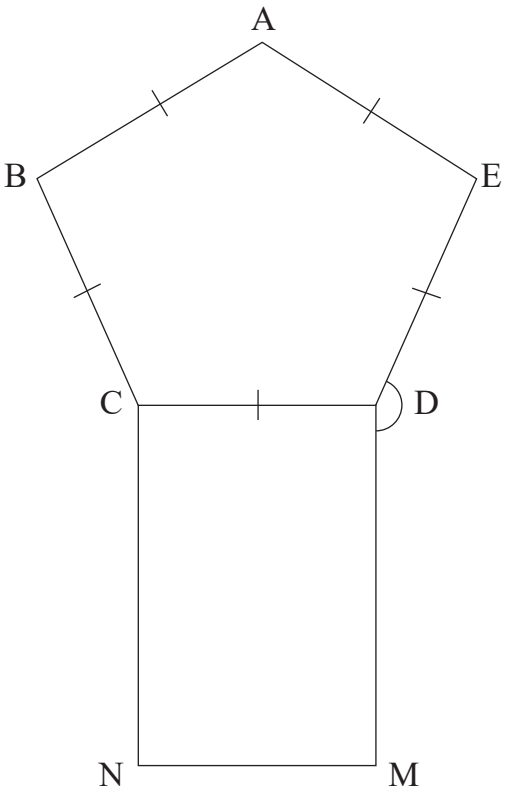


diagram not
drawn accurately

ABCDE is a regular pentagon.

CDMN is a rectangle.

Work out the size of the obtuse angle EDM.

Sum of interior angles = (5 − 2) × 180° = 540°

Each interior angle = 540° ÷ 5 = 108°

Angle CDM = 90° (angle in a rectangle)

Angle EDM = 360° − (108° + 90°)

= 162°

Answer 162 ° [4]

[Turn over

2 Kevin tosses a coin.

He knows it is biased.

It lands 60 times on Heads.

Kevin uses his experiment to work out that the relative frequency of his coin landing on Heads is $\frac{2}{3}$

How many times did Kevin toss the coin?

Relative frequency $= \frac{60}{n} = \frac{2}{3}$

$2n = 180$

$n = 90$

Answer 90 [2]

3 Katie used flour to make muffins.

She used an equal amount of flour for each muffin.

To begin, she made three muffins and had $\frac{3}{4}$ of her flour left.

(a) What fraction of her flour did Katie **use** for **each** muffin?

Flour used for 3 muffins = $1 - \frac{3}{4} = \frac{1}{4}$

Each muffin = $\frac{1}{4} \div 3 = \frac{1}{12}$

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

Katie then made **another** seven muffins, giving a total of 10 muffins, and had 50 g of flour left.

(b) How many grams of flour did Katie use for **each** muffin?

10 muffins use $\frac{10}{12}$ of the flour, so $\frac{2}{12} = \frac{1}{6}$ is left

$\frac{1}{6}$ of the flour = 50 g

All the flour = $6 \times 50 = 300$ g

1 muffin = $\frac{1}{12} \times 300 = 25$ g

Answer 25 g [2]

[Turn over

4 A rectangle is divided into four triangles.

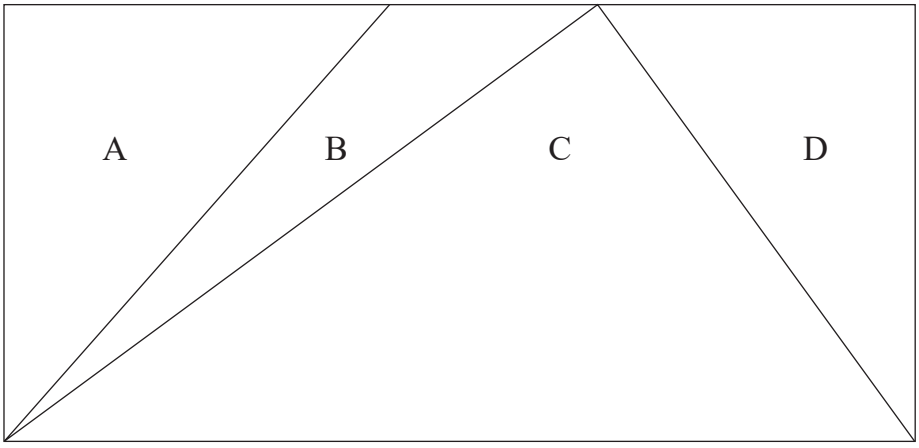


diagram not drawn accurately

The area of triangle C is 120 cm^2 and is **half** of the area of the rectangle.

The ratio of the area of triangle A to the area of the rectangle is 1 : 4

The ratio of the area of triangle D to the area of the rectangle is 1 : 6

What is the area of triangle B?

Area of rectangle = 120 × 2 = 240 cm^2

Area of A = 240 ÷ 4 = 60 cm^2

Area of D = 240 ÷ 6 = 40 cm^2

Area of B = 240 − (120 + 60 + 40)

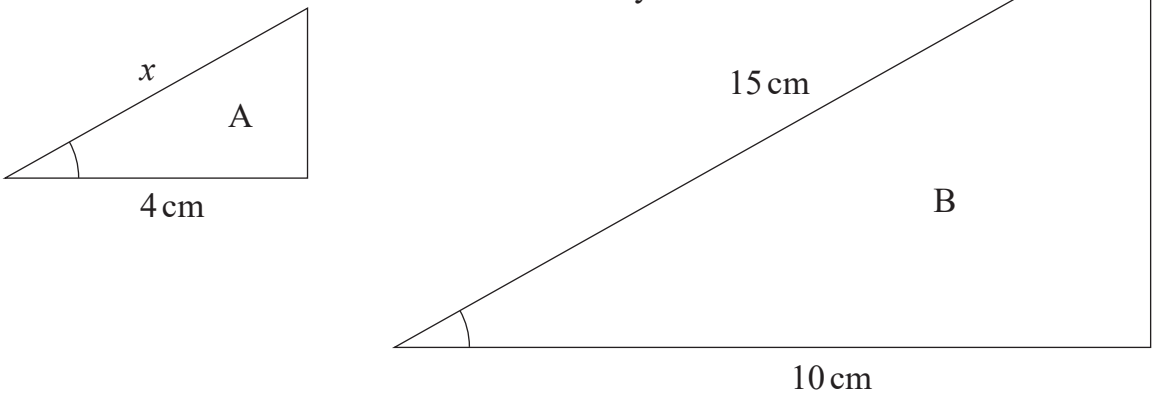
= 240 − 220

= 20 cm^2

Answer 20 cm^2 [4]

5

diagrams not
drawn accurately



A and B are similar triangles.

Work out the length of x.

$\frac{x}{15} = \frac{4}{10}$

$10x = 60$

$x = 6$

Answer 6 cm [2]

[Turn over

6 **(a)** Write 463 in standard form.

Answer 4.63×10^2 [1]

(b) Calculate $(4 \times 10^3) \times (5 \times 10^{-4})$

$(4 \times 10^3) \times (5 \times 10^{-4}) = (4 \times 5) \times 10^{3 + (-4)}$

$= 20 \times 10^{-1}$

$= 2$

Answer 2 [1]

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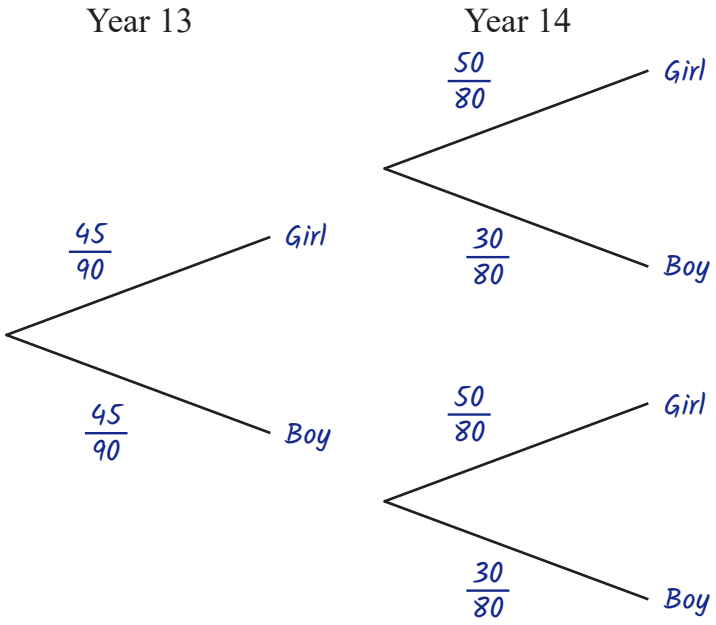
7 Two students from Sixth Form are given the opportunity to go on a trip to London to represent their school.

A student is taken at random from Year 13 and a student is taken at random from Year 14

The numbers of girls and boys in each year are given in the table.

	Year 13	**Year 14**
Girls	45	50
Boys	45	30

(a) Complete the probability tree diagram.



[2]

(b) What is the probability that two boys go on the trip?

$P(\text{boy, boy}) = \frac{45}{90} \times \frac{30}{80} = \frac{1}{2} \times \frac{3}{8} = \frac{3}{16}$

Answer $\frac{3}{16}$ [2]

[Turn over

8 Simplify $(4x^2y^3) \times (x^3y^4)$

$4 \times 1 = 4, \quad x^2 \times x^3 = x^5, \quad y^3 \times y^4 = y^7$

Answer $4x^5y^7$ [2]

9 Rearrange to make x the subject of

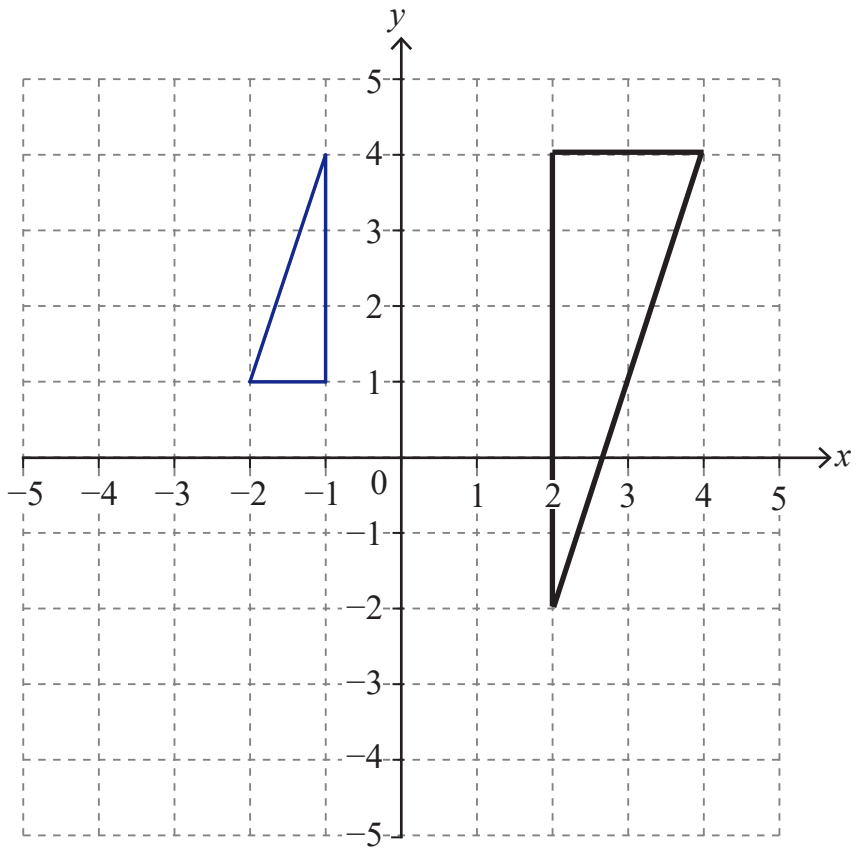
$$Ax^2 = B$$

$x^2 = \frac{B}{A}$

$x = \pm\sqrt{\frac{B}{A}}$

Answer $x =$ $\pm\sqrt{\frac{B}{A}}$ [2]

10

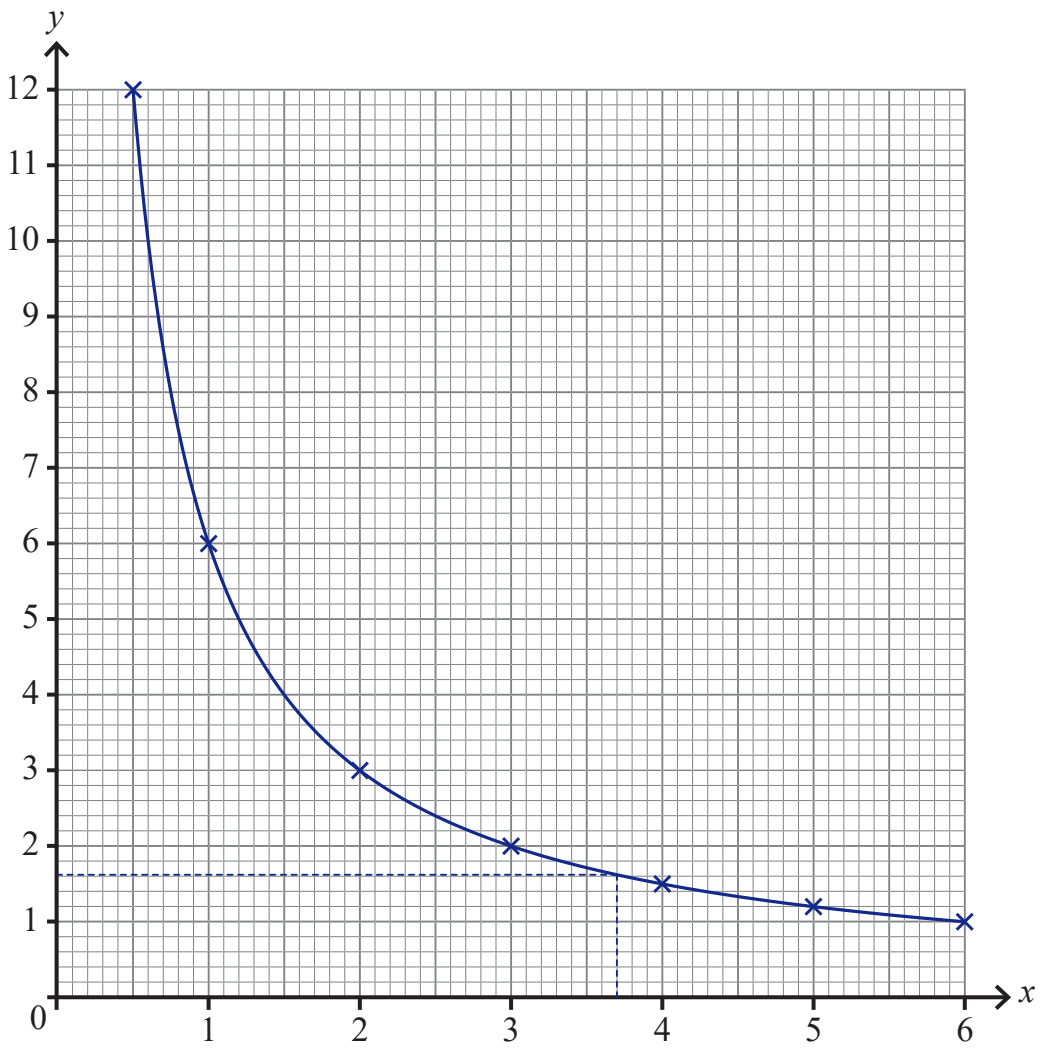


Draw the image of the triangle after an enlargement of scale factor $-\frac{1}{2}$ with centre (0, 2).

[2]

[Turn over

11 (a) Sketch the graph of $y = \frac{6}{x}$ on the grid below.



[3]

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(b) Use your graph to estimate the value of $\frac{6}{3.7}$

At $x = 3.7$ on the graph, $y = \frac{6}{3.7} \approx 1.6$

Answer 1.6 [1]

(c) The curved surface area of a cone is 6π.

If x is the radius of the base of the cone, what does y represent?

Curved surface area $= \pi rl$

$6\pi = \pi x l$

$l = \frac{6}{x} = y$

Answer y is the slant height of the cone [2]

[Turn over



12 PQ is a diameter of the circle whose equation is $x^2 + y^2 = 90$

(2, 6) is a point on the diameter PQ.

(a) Write down the equation of the diameter PQ.

PQ passes through the centre (0, 0) and (2, 6)

gradient = 6 ÷ 2 = 3

equation: $y = 3x$

Answer $y = 3x$ [2]

(b) Find the coordinates of P and Q.

$x^2 + (3x)^2 = 90$

$x^2 + 9x^2 = 90$

$10x^2 = 90$

$x^2 = 9$, $x = 3$ or $x = -3$

$x = 3$: $y = 3 \times 3 = 9$

$x = -3$: $y = 3 \times (-3) = -9$

Answer (3 , 9) and (−3 , −9) [3]

(c) Find the equations of the tangents at P and Q.

Gradient of PQ = 3, so gradient of tangents = $-\frac{1}{3}$

At P(3, 9): $y = -\frac{1}{3}x + c$

$9 = -1 + c, \quad c = 10$

$y = -\frac{1}{3}x + 10$

At Q(−3, −9): $y = -\frac{1}{3}x + c$

$-9 = 1 + c, \quad c = -10$

$y = -\frac{1}{3}x - 10$

Answer $y = -\frac{1}{3}x + 10$ and $y = -\frac{1}{3}x - 10$ [4]

[Turn over

13

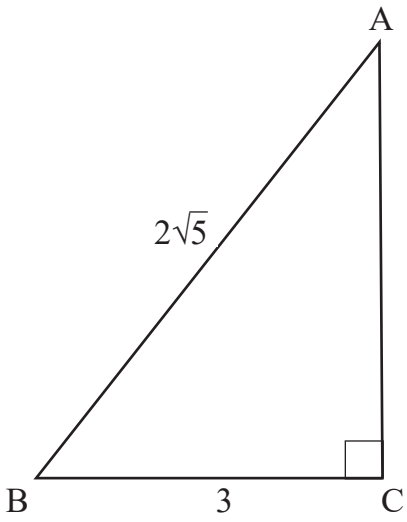


diagram not drawn accurately

In triangle ABC, angle C is a right angle, AB = $2\sqrt{5}$ cm and BC = 3 cm.

Find tan B, giving your answer in surd form.

$AC^2 = AB^2 - BC^2$

$AC^2 = (2\sqrt{5})^2 - 3^2 = 20 - 9 = 11$

$AC = \sqrt{11}$

$\tan B = \frac{\text{opposite}}{\text{adjacent}} = \frac{AC}{BC} = \frac{\sqrt{11}}{3}$

Answer $\frac{\sqrt{11}}{3}$ [3]

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14 $2^x \times 2^{2y} = 2^3$

$2^{2x} \times (2^y)^{12} = 2^2$

Find the values of x and y.

Show your working.

A solution by trial and improvement will not be accepted.

$2^x \times 2^{2y} = 2^3 \Rightarrow x + 2y = 3 \quad (1)$

$2^{2x} \times (2^y)^{12} = 2^{2x} \times 2^{12y} = 2^2$

$\Rightarrow 2x + 12y = 2 \quad (2)$

$(1) \times 2: \quad 2x + 4y = 6 \quad (3)$

$(2) - (3): \quad 8y = -4$

$y = -\frac{4}{8} = -\frac{1}{2}$

Sub into (1): $x + 2(-\frac{1}{2}) = 3$

$x - 1 = 3, \quad x = 4$

Answer $x =$ 4 , $y =$ $-\frac{1}{2}$ [5]



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