Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2024

Mathematics

StemUp Model Solution

Unit M8 Paper 1
(Non-Calculator)
Higher Tier



[GMC81]

GMC81

MONDAY 3 JUNE, 9.15 am–10.30 am

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

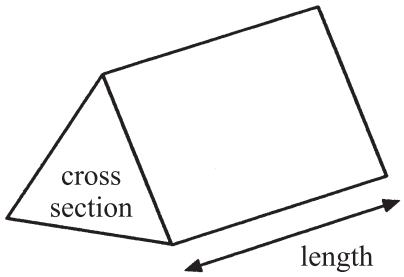
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all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

INFORMATION FOR CANDIDATES

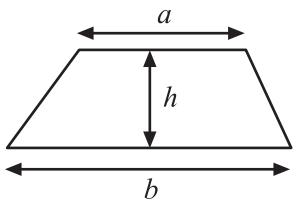
The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a ruler, compasses and a protractor.
The Formula Sheet is on page 2.

Formula Sheet

Volume of prism = area of cross section × length

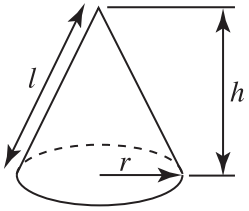


Area of trapezium = $\frac{1}{2}(a+b)h$



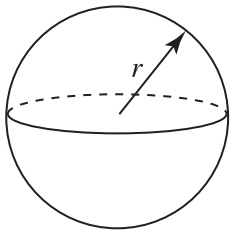
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

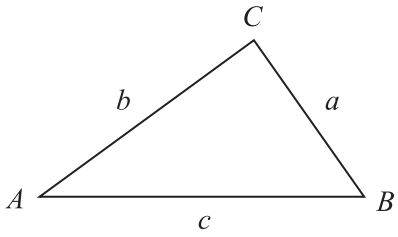


Volume of sphere = $\frac{4}{3}\pi r^3$

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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1 John spends x hours each week on homework.

Joanne spends 3 hours more than John each week on homework.

In total they spend more time on homework each week than Sam, who spends 14 hours per week on homework.

Write down an inequality and solve it for x.

John = x, Joanne = $x + 3$

$x + x + 3 > 14$

$2x + 3 > 14$

$2x > 11$

$x > \frac{11}{2}$

Answer $x > 5.5$ [3]

[Turn over



2 Each interior angle of a regular polygon is 140°

How many sides does it have?

Exterior angle = 180° − 140° = 40°

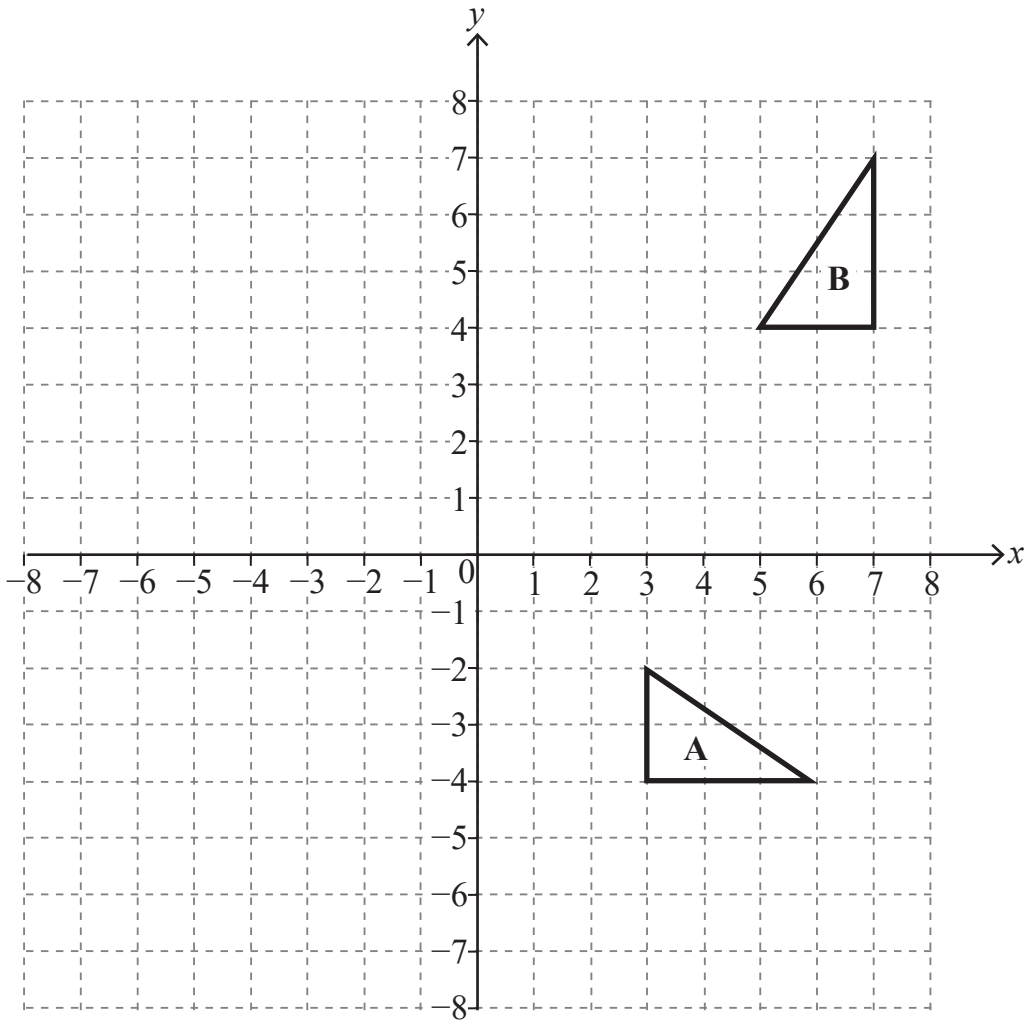
Number of sides = 360° ÷ 40° = 9

Answer *9* [2]



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3



Describe fully the **single** transformation which takes triangle **A** to triangle **B**.

Answer Rotation, 90° anticlockwise,

about centre (1, 2) [3]

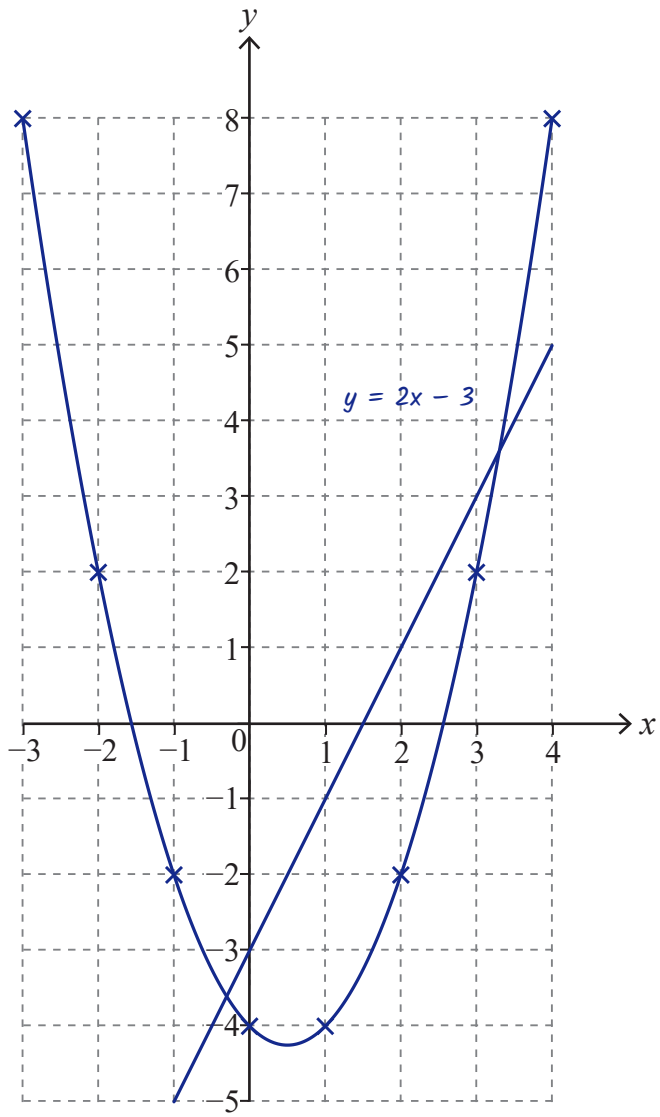
[Turn over

4 **(a)** **(i)** Complete the table for $y = x^2 - x - 4$

x	−3	−2	−1	0	1	2	3	4
y	8	2	−2	−4	−4	−2	2	8

[2]

(ii) Hence draw the graph of $y = x^2 - x - 4$ on the grid below.



[2]

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(b) Use the graph to solve the equation $x^2 - x - 4 = 0$

Read off where the curve crosses the x-axis (y = 0)

Answer *x = −1.6 or x = 2.6* [1]

(c) **(i)** Draw the line $y = 2x - 3$ on the grid.

[1]

(ii) Use your graph to find the points of intersection of $y = x^2 - x - 4$

and $y = 2x - 3$

Read off where the line crosses the curve

Answer (*−0.3* , *−3.6*) , (*3.3* , *3.6*) [2]

[Turn over

(d) What line would you draw on the graph to solve the equation $x^2 + x - 9 = 0$?

$x^2 + x - 9 = 0$

$x^2 - x - 4 + 2x - 5 = 0$

$x^2 - x - 4 = -2x + 5$

Answer $y = -2x + 5$ [2]

5 A jeweller sells watch batteries at a fixed price and watch straps at a different fixed price.

On Monday he sold 1 battery and 3 straps for £40

On Tuesday he sold 2 batteries and 1 strap for £25

Calculate the price of a battery and the price of a strap.

A solution by trial and error will not be accepted.

Let battery = £x, strap = £y

$x + 3y = 40$ (1)

$2x + y = 25$ (2)

(1) × 2: $2x + 6y = 80$

subtract (2): $5y = 55$

$y = 11$

$x + 33 = 40$, so $x = 7$

Answer Price of one battery £ 7

Price of one strap £ 11 [4]

[Turn over

6 A lunch deal consists of a sandwich, a drink and a piece of fruit.

On Friday there are 5 choices of sandwich, 6 choices of drink and 4 choices of fruit.

On Saturday there are 6 choices of sandwich, 8 choices of drink and 3 choices of fruit.

How many more combinations are available on Saturday than on Friday?

Friday = 5 × 6 × 4 = 120

Saturday = 6 × 8 × 3 = 144

144 − 120 = 24

Answer 24 [3]

7 Which is heavier, **A** or **B**?

Show your working.

A	**B**
1.05×10^7 g	1.5×10^4 kg

A: 1.05×10^7 g = 1.05×10^4 kg = 10 500 kg

B: 1.5×10^4 kg = 15 000 kg

15 000 kg > 10 500 kg, so B is heavier

Answer B [2]

8 A and B are similar shapes.

The area of A is 24 cm^2

The area of B is 96 cm^2

The height of B is 15 cm.

What is the height of A?

Ratio of areas A : B = 24 : 96 = 1 : 4

Ratio of heights = $\sqrt{1} : \sqrt{4} = 1 : 2$

$\frac{1}{2} = \frac{h}{15}$

$h = 15 \div 2 = 7.5$

Answer 7.5 cm [3]

[Turn over

9 A bag contains 2 yellow balls, 3 blue balls and 5 red balls.

Jill takes a ball at random out of the bag.

She **replaces** it.

She does this 3 times in total.

Work out the probability that the 3 balls are the same colour.

Same colour: YYY or BBB or RRR

$P(YYY) = \frac{2}{10} \times \frac{2}{10} \times \frac{2}{10} = \frac{8}{1000}$

$P(BBB) = \frac{3}{10} \times \frac{3}{10} \times \frac{3}{10} = \frac{27}{1000}$

$P(RRR) = \frac{5}{10} \times \frac{5}{10} \times \frac{5}{10} = \frac{125}{1000}$

$\frac{8}{1000} + \frac{27}{1000} + \frac{125}{1000} = \frac{160}{1000} = \frac{4}{25}$

Answer $\frac{4}{25}$ [4]

10 Simplify $(2x^2y^{-1})^4 \div 2y^3$

$(2x^2y^{-1})^4 = 16x^8y^{-4}$

$16x^8y^{-4} \div 2y^3 = 8x^8y^{-4-3}$

Answer $8x^8y^{-7}$ [3]

[Turn over

11 A box contains three green pens and five red pens.

Alfie takes two pens from the box without replacement.

What is the probability that the pens are not the same colour?

$P(GR) + P(RG)$

$= \frac{3}{8} \times \frac{5}{7} + \frac{5}{8} \times \frac{3}{7}$

$= \frac{15}{56} + \frac{15}{56} = \frac{30}{56} = \frac{15}{28}$

Answer $\frac{15}{28}$ [4]

12

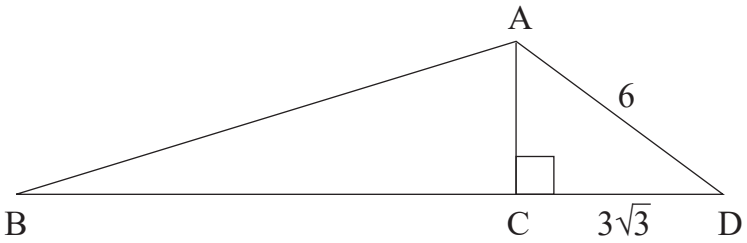


diagram not drawn accurately

The area of **ABC** is $8\sqrt{3}$

Show that the length of BD is $\frac{(25\sqrt{3})}{3}$

$AC^2 = 6^2 - (3\sqrt{3})^2$

$AC^2 = 36 - 27 = 9$, so $AC = 3$

Area $ABC = \frac{1}{2} \times 3 \times BC = 8\sqrt{3}$

$BC = \frac{16\sqrt{3}}{3}$

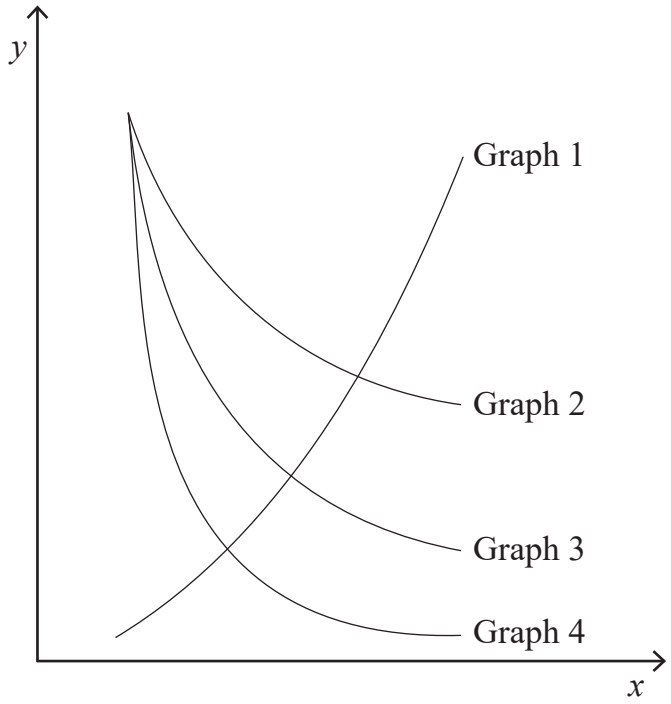
$BD = BC + CD = \frac{16\sqrt{3}}{3} + 3\sqrt{3}$

$BD = \frac{16\sqrt{3}}{3} + \frac{9\sqrt{3}}{3} = \frac{25\sqrt{3}}{3}$

[6]

[Turn over

13



Complete each sentence.

y is inversely proportional to x describes Graph 3

y is inversely proportional to the square of x describes Graph 4

y is inversely proportional to the square root of x describes Graph 2

y is directly proportional to the square of x describes Graph 1 [3]

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Question Number	**Marks**
1	
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Total Marks	

Examiner Number

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