Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2025

# Mathematics

StemUp Model Solution

Unit M8 Paper 2
**(With calculator)**
Higher Tier



**[GMC82]**

*GMC82*

## THURSDAY 20 NOVEMBER, 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 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 **may** use a calculator for this paper.
Answer **all twelve** questions.

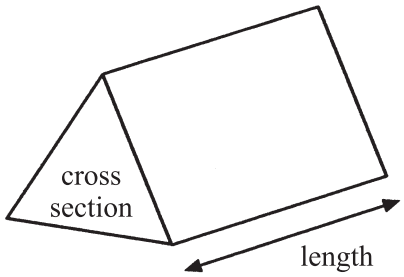
**INFORMATION FOR CANDIDATES**

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 calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

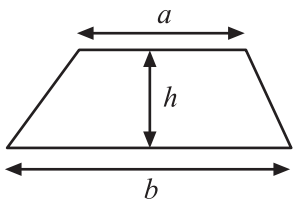
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# Formula Sheet

**Volume of prism** = area of cross section × length

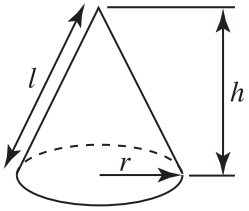



**Area of trapezium** = $\frac{1}{2}(a+b)h$



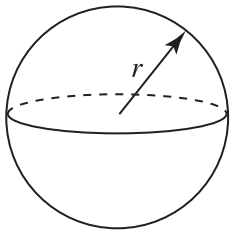

**Volume of cone** = $\frac{1}{3}\pi r^2 h$

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

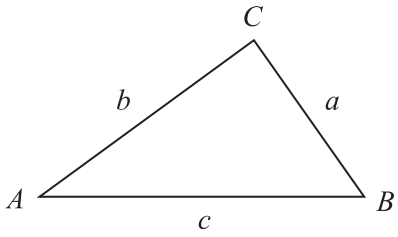



**Volume of sphere** = $\frac{4}{3}\pi r^3$

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

15163

**1** Two regular pentagons are placed together.

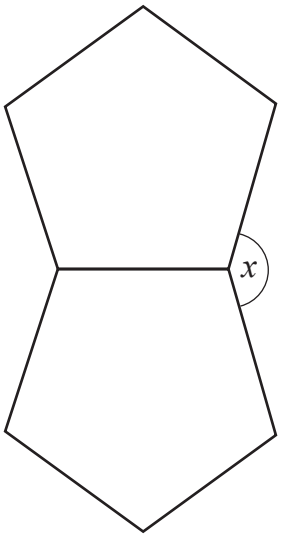



diagram not drawn accurately

Work out the size of angle $x$.

Sum of interior angles of a pentagon = 3 × 180 = 540°

Interior angle = 540 ÷ 5 = 108°

Angles at a point add up to 360°:

x = 360 − (108 + 108)

x = 360 − 216 = 144

Answer 144 ° [4]

**[Turn over**

**2** Simplify

**(a)** $(m^3)^4$

$(m^3)^4 = m^{3 \times 4}$

Answer $m^{12}$ [1]

**(b)** $\frac{e^{15}}{e^3}$

$e^{15-3}$

Answer $e^{12}$ [1]

**3** Solve $4x - 1 < 2$

$4x - 1 < 2$

$4x < 2 + 1$

$4x < 3$

$x < \frac{3}{4}$

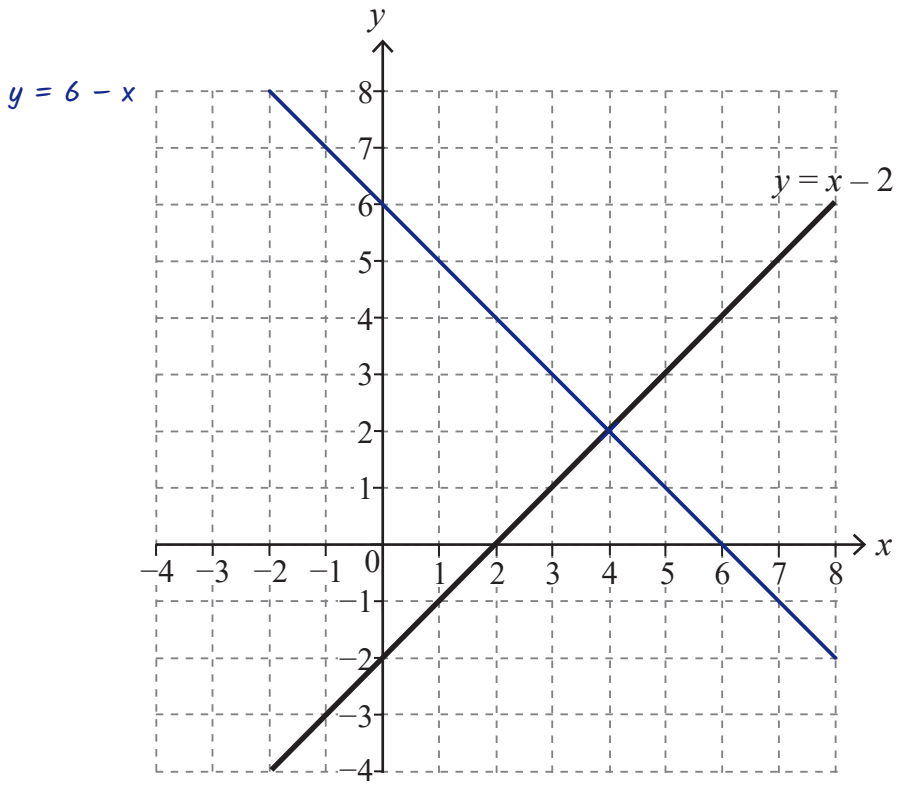
Answer $x < \frac{3}{4}$ [2]

**4** Grace is trying to solve the simultaneous equations

$y = x - 2$

$y = 6 - x$

Grace begins by drawing the line $y = x - 2$ as shown.




**(a)** Draw the other line needed to solve the simultaneous equations. [2]

**(b)** Write down the solution to these simultaneous equations.

lines cross at (4, 2)

Answer $x =$ 4 $y =$ 2 [1]

**[Turn over**

**5** Jack owns a shop.

He offers a special deal when a customer buys a drink, a sandwich and a cookie.

There are 9 different drinks and 6 different sandwiches to choose from.

There are 270 different combinations in this special deal.

How many different cookies are there to choose from?

*drinks × sandwiches × cookies = combinations*

*9 × 6 × c = 270*

*54c = 270*

*c = 270 ÷ 54 = 5*

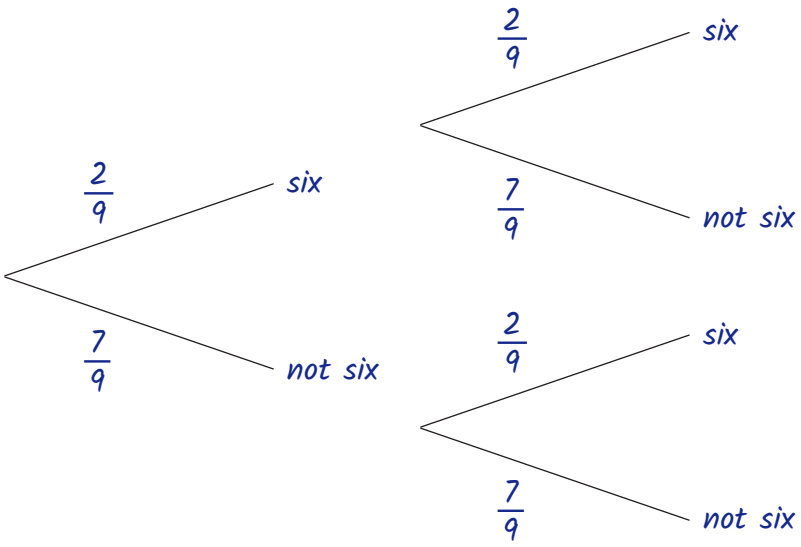
Answer *5* [2]

**6** A dice is biased.

The probability of getting a six is $\frac{2}{9}$

The dice is rolled twice.

**(a)** Complete the tree diagram to show this information.




[2]

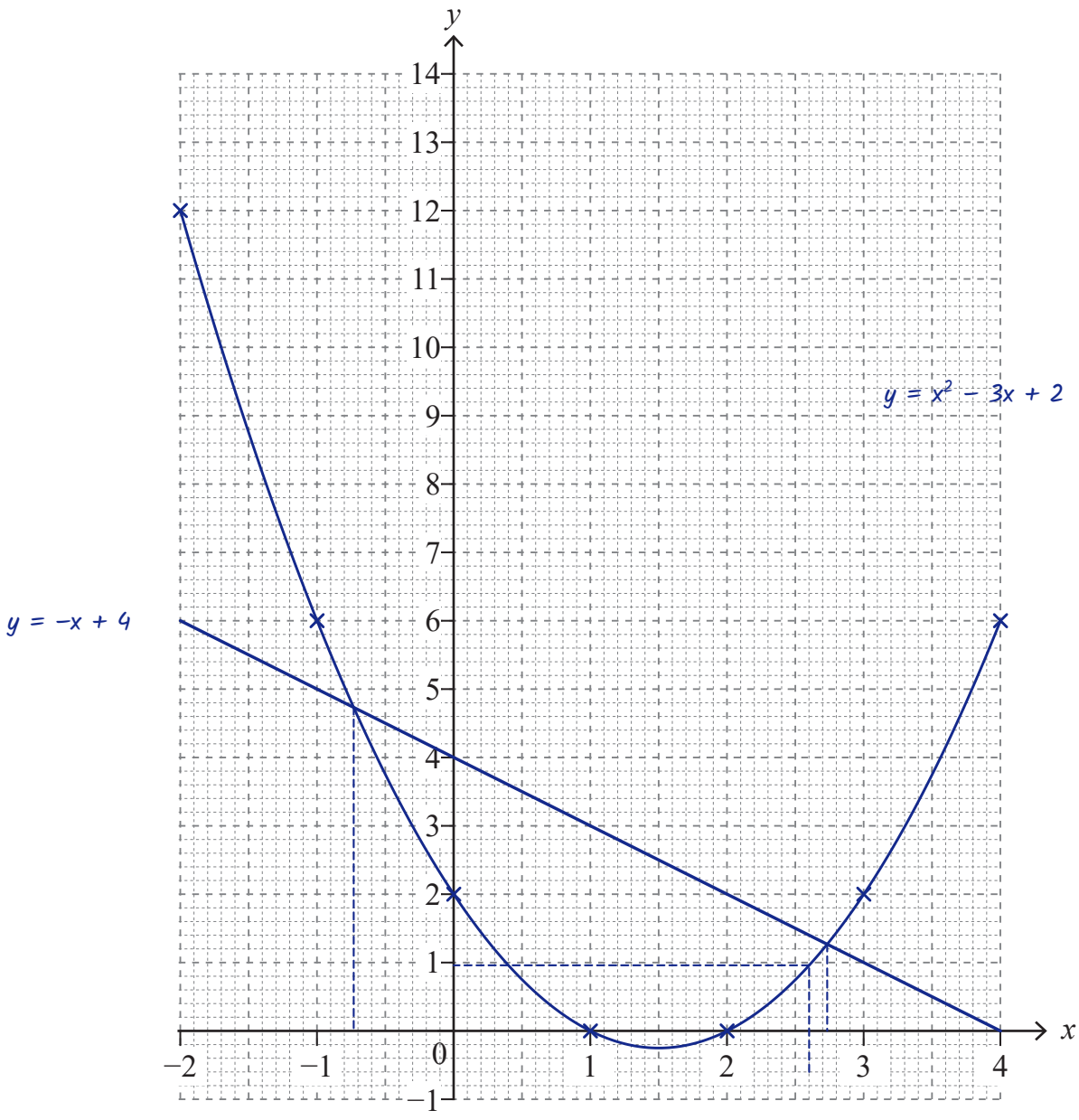
**(b)** What is the probability of getting no sixes?

$P(\text{no sixes}) = \frac{7}{9} \times \frac{7}{9} = \frac{49}{81}$

Answer $\frac{49}{81}$ [2]

**[Turn over**

**7** **(a)** Draw the graph of $y = x^2 - 3x + 2$ from $x = -2$ to $x = 4$ [3]



**(b)** Use your graph to estimate the value of $y$ for $x = 2.6$

Answer 1 [1]

**(c)** Use your graph to estimate the minimum value of $y$.

Answer −0.25 [1]

**(d)** By drawing a suitable line on your graph, solve the equation $x^2 - 2x - 2 = 0$

$x^2 - 3x + 2 = -x + 4$ gives $x^2 - 2x - 2 = 0$,
so draw $y = -x + 4$; it meets the curve at $x \approx -0.7$ and 2.7

Answer $x = -0.7$ or $x = 2.7$ [3]

**[Turn over**

**8** A and B are similar shapes.

The area of A is $10\,cm^2$ and the area of B is $160\,cm^2$

The height of A is $x$ cm and the height of B is $(x + 9)$ cm.

Work out the value of $x$.

**Show your working out clearly.**

Ratio of areas = 10 : 160 = 1 : 16

Ratio of heights = $\sqrt{1}$ : $\sqrt{16}$ = 1 : 4

$$\frac{x}{x+9} = \frac{1}{4}$$

$4x = x + 9$

$3x = 9$

$x = 3$

Answer $x =$ 3 [4]

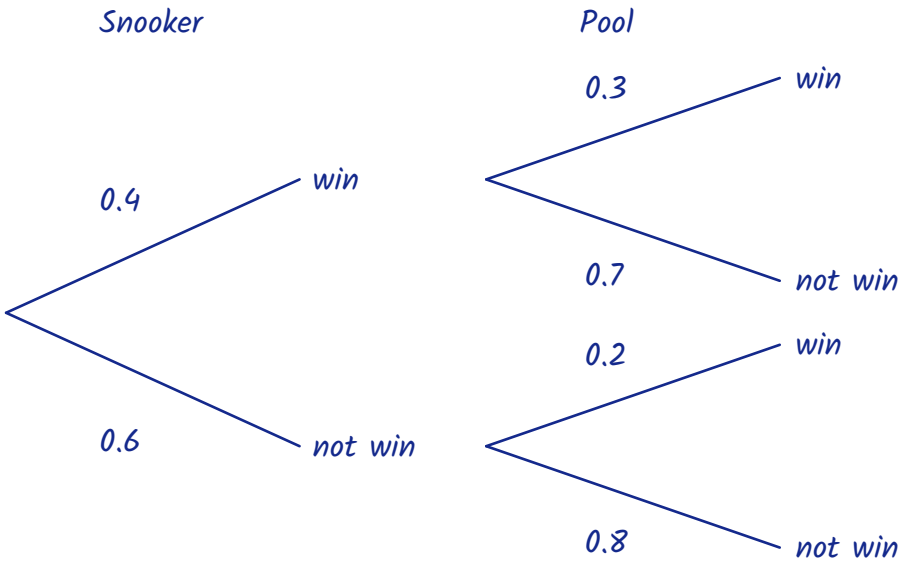
**9** Tom plays a game of snooker and a game of pool.

The probability that Tom will win his game of snooker is 0.4

If Tom wins his game of snooker, the probability that he will win his game of pool is 0.3

If Tom does not win his game of snooker, the probability that he will win his game of pool is 0.2

**(a)** Draw a tree diagram for this information.




[2]

**(b)** Hence find the probability that Tom will win at least one of his two games.

P(loses both) = 0.6 × 0.8 = 0.48

P(wins at least one) = 1 − 0.48 = 0.52

Answer 0.52 [2]

**[Turn over**

**10** The point (6, 1) lies on the circumference of a circle, centre the origin.

**(a)** Find the equation of the circle.

$x^2 + y^2 = r^2$

$r^2 = 6^2 + 1^2 = 36 + 1 = 37$

Answer $x^2 + y^2 = 37$ [2]

**(b)** Find the equation of the tangent to the circle at (6, 1).

gradient of radius $= \frac{1 - 0}{6 - 0} = \frac{1}{6}$

tangent is perpendicular to radius, so

gradient of tangent $= -6$

$y = -6x + c$, at (6, 1): $1 = -6 \times 6 + c$

$1 = -36 + c$, $c = 37$

Answer $y = -6x + 37$ [3]

**11**

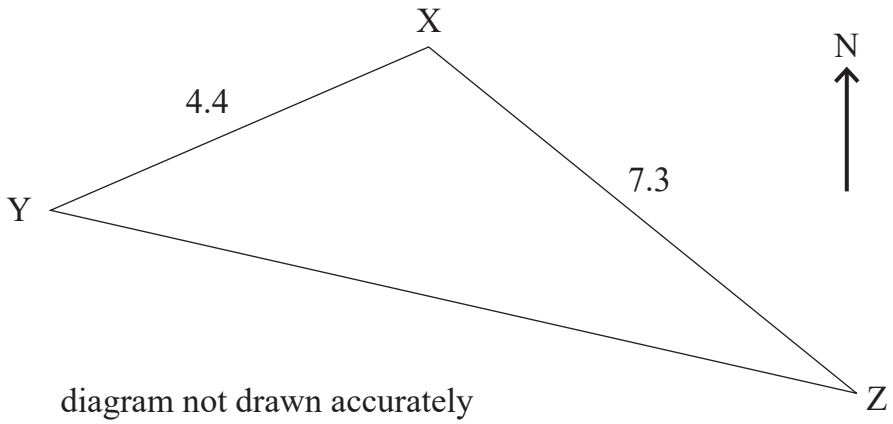



diagram not drawn accurately

X is 4.4 km from Y and 7.3 km from Z.

The bearing of X from Y is 053°

Angle XZY is 27°

Find the bearing of Z from Y.

$\frac{\sin XYZ}{7.3} = \frac{\sin 27°}{4.4}$

$\sin XYZ = 7.3 \times \sin 27° \div 4.4 = 0.7532115109...$

$\text{angle } XYZ = \sin^{-1}(0.7532115...) = 48.86933998...°$

$\text{bearing of Z from Y} = 53° + 48.869...°$

$= 101.869...° = 101.87°$

Answer 101.87 ° [4]

**[Turn over**

**12**

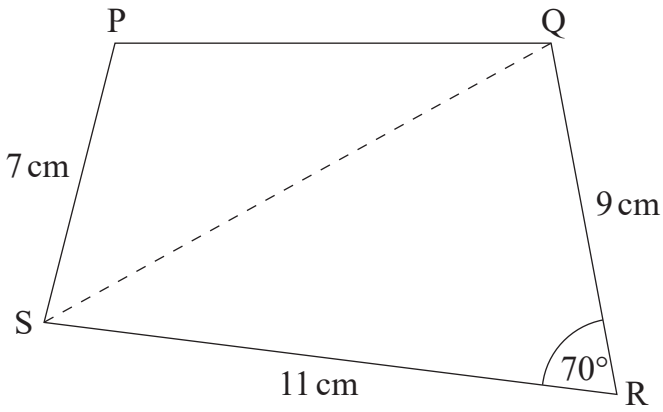



diagram not drawn accurately

PQRS has an area of 80 $cm^2$

Calculate the size of the angle PSQ.

Area SQR = $\frac{1}{2}$ × 11 × 9 × sin 70° = 46.51478473

Area PSQ = 80 − 46.51478473 = 33.48521527

$SQ^2 = 11^2 + 9^2 - 2 \times 11 \times 9 \times \cos 70°$

$SQ^2 = 134.2800116$

$SQ = \sqrt{134.2800116} = 11.58792525$

$\frac{1}{2} \times 7 \times 11.58792525 \times \sin PSQ = 33.48521527$

$40.55773838 \times \sin PSQ = 33.48521527$

$\sin PSQ = 33.48521527 \div 40.55773838 = 0.8256184...$

$PSQ = \sin^{-1}(0.8256184...) = 55.65123...°$

Answer 55.65 ° [8]

**THIS IS THE END OF THE QUESTION PAPER**

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|---|---|
| **Question Number** | **Marks** |
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| 2 | |
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| **Total Marks** | |

**Examiner Number**

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