Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2021

Mathematics

StemUp Model Solution

Unit M8 Paper 2
(With calculator)
Higher Tier



[GMC82]

GMC82

THURSDAY 2 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 twelve** 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.

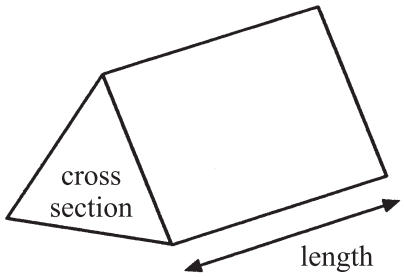
INFORMATION FOR CANDIDATES

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.

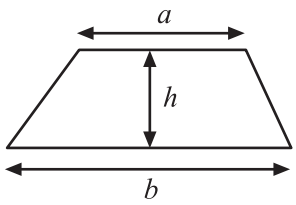
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Formula Sheet

Volume of prism = area of cross section × length

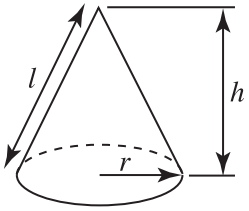


Area of trapezium = $\frac{1}{2}(a+b)h$



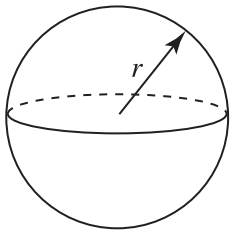
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

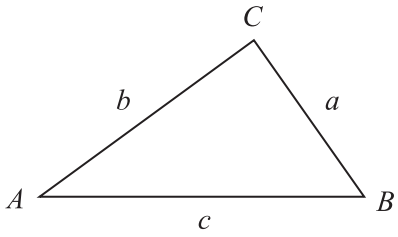


Volume of sphere = $\frac{4}{3}\pi r^3$

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

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1 **(a)** Simplify

(i) $12x^5 \div 3x^3$

12 ÷ 3 = 4, $x^5 \div x^3 = x^2$

Answer $4x^2$ [2]

(ii) $(2x^3y)^4$

$2^4 \times x^{12} \times y^4$

Answer $16x^{12}y^4$ [2]

(b) Eva wants to find the nth term of this sequence.

1, 5 , 9, 13, 17 …

She knows that it starts with $4n$

Complete the nth term for this sequence.

differences +4, so 4n: 4, 8, 12, 16, 20
sequence is 3 less each time

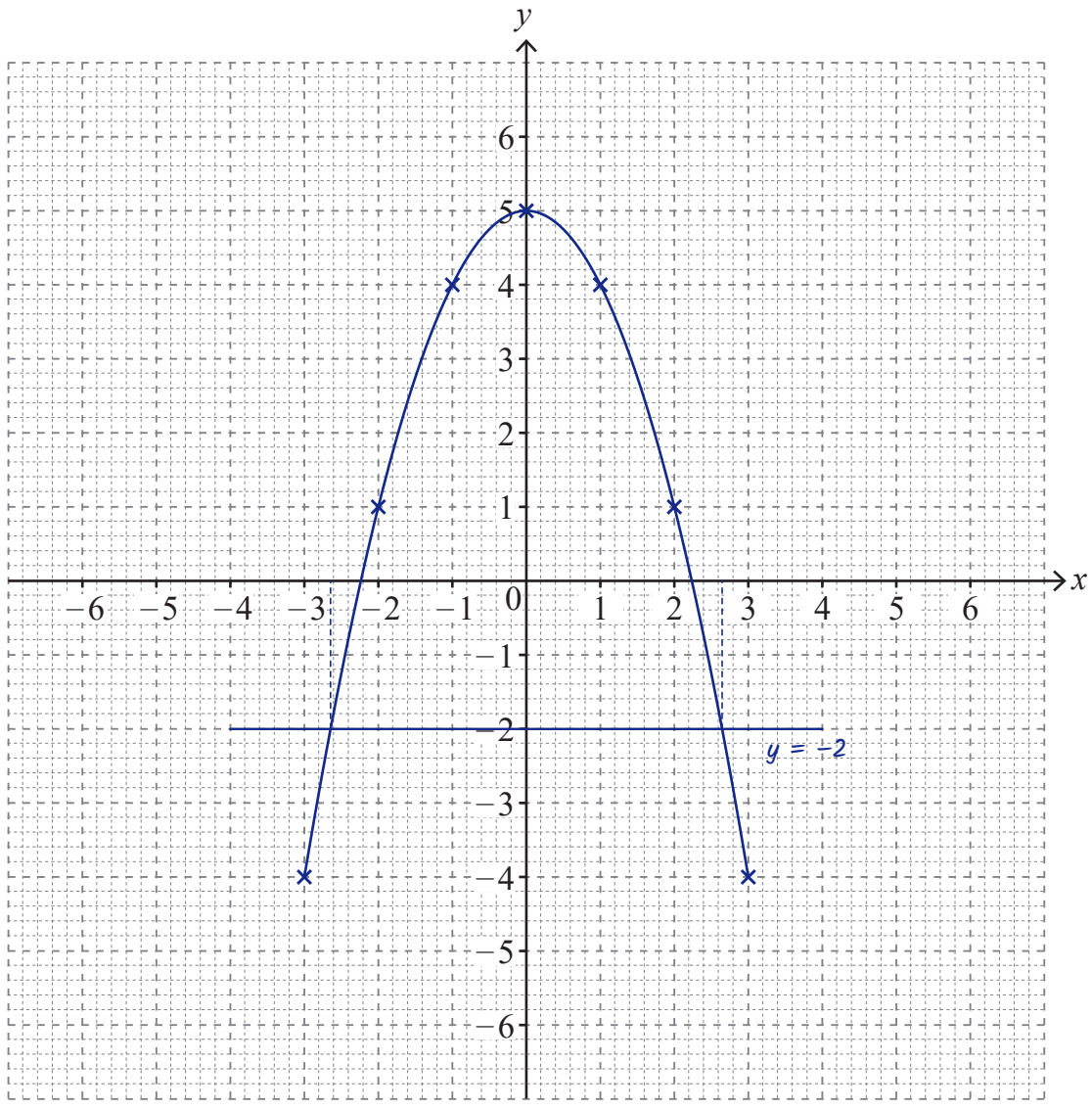
Answer $4n - 3$ [1]

[Turn over

2 **(a)** Draw the graph of $y = 5 - x^2$

Use the table below to help you.

x	–3	–2	–1	0	1	2	3
y	–4	1	4	5	4	1	–4



[3]

(b) Use the graph of $y = 5 - x^2$ to solve the equation $5 - x^2 = -2$

Answer $x =$ ___−2.6___ or $x =$ ___2.6___ [1]

3 **(a)** Work out the size of an exterior angle of a 24-sided regular polygon.

Exterior angle = 360 ÷ 24 = 15

Answer ___15___° [2]

(b) The sum of the interior angles of a regular polygon is 1800°

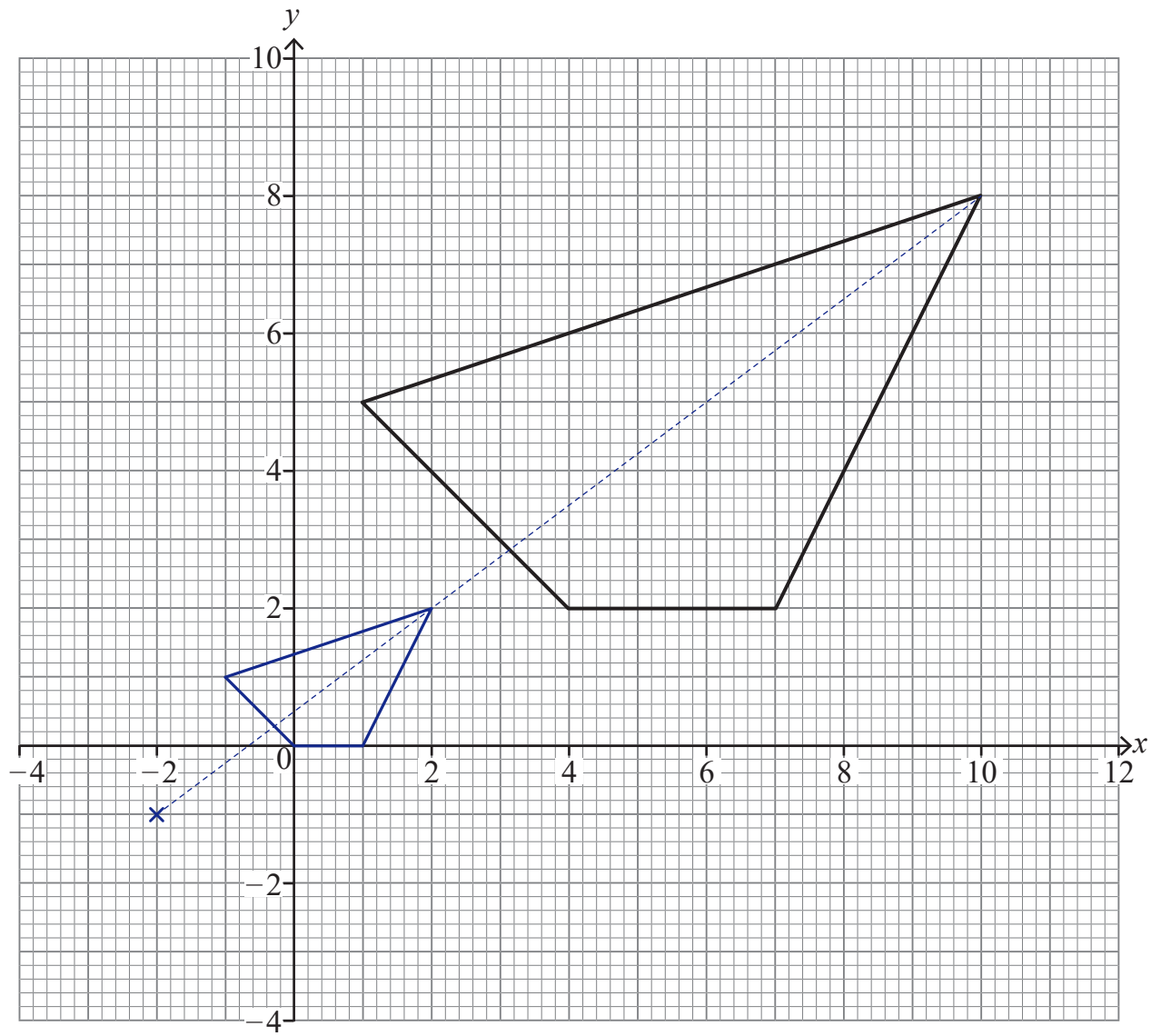
Work out how many sides this polygon has.

180(n − 2) = 1800
n − 2 = 10
n = 12

Answer ___12___ [2]

[Turn over

4 On the grid, draw the enlargement of the quadrilateral using a scale factor of $\frac{1}{3}$ and centre $(-2, -1)$.



[3]

Image vertices: (−1, 1), (0, 0), (1, 0), (2, 2)

5 Gina made a model of a pyramid.

The model has a height of 5.4 cm and a volume of 300 cm^3

She now plans to make a similar pyramid, four times as large, with a height of 21.6 cm.

What will the volume of this new pyramid be?

Length scale factor = 21.6 ÷ 5.4 = 4

Volume scale factor = 4^3 = 64

Volume = 300 × 4^3 = 300 × 64 = 19 200

Answer *19 200* cm^3 [2]

6 Rob plans to travel to Australia by air.

His choice of destinations in Australia are Adelaide, Brisbane, Melbourne, Perth and Sydney.

He plans to make just one stop on his journey to Australia.

For each of these, he can choose to stop in Singapore, Hong Kong, Bangkok or Dubai.

How many different choices does he have for flying to Australia?

5 destinations × 4 stops

= 4 × 5 = 20

Answer *20* [2]

[Turn over

7 **(a)** The probability that it will snow in Enniskillen on Christmas Day in any year is 0.09

The probability that it will snow in Tokyo on Christmas Day in any year is 0.11

Work out the probability that it will snow in Enniskillen and in Tokyo on Christmas Day 2021

$0.09 \times 0.11 = 0.0099$

Answer 0.0099 [2]

(b) A survey of patients in a GP surgery found that

9% were seen within 5 minutes of their appointed time,

63% had to wait between 5 and 10 minutes and

28% had to wait longer than 10 minutes.

Work out the probability that a patient chosen at random was seen within 10 minutes of their appointed time.

$0.09 + 0.63 = 0.72$

Answer 0.72 [2]

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8 T varies as the square of d

When $d = 0.3$, $T = 10.8$

(a) Express T in terms of d

$T = kd^2$

$10.8 = k \times 0.3^2$

$10.8 = 0.09k$

$k = 10.8 \div 0.09 = 120$

Answer $T = 120d^2$ [3]

(b) Find a value of d for which $T = 30$

$30 = 120d^2$

$d^2 = 30 \div 120 = 0.25$

$d = \sqrt{0.25} = 0.5$

Answer 0.5 [2]

[Turn over

9 £1000 is invested at 2% per annum compound interest.

(a) Circle the formula which gives the value of the investment after n years.

$V = (1000(1.2))^n$ $V = 1000(1.2)^n$ $V = (1000(1.02))^n$ $V = 1000(1.02)^n$

[1]

(b) Calculate the compound interest earned on £1000 invested at 2% per annum for 8 years.

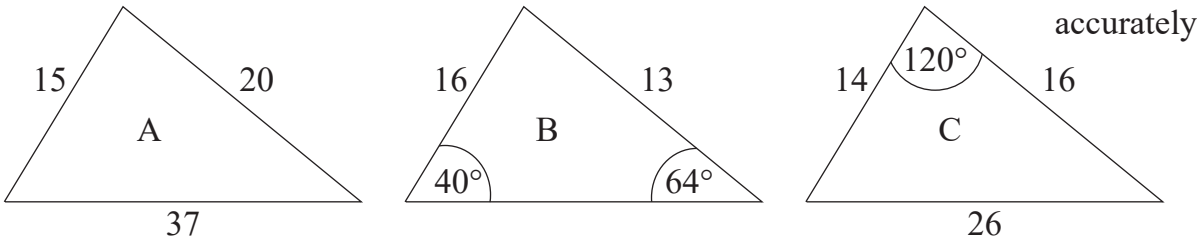
$V = 1000 \times 1.02^8 = 1171.659381...$

Interest = 1171.659381... − 1000

Answer £ 171.66 [2]

10 Explain clearly which of the diagrams below can represent triangles.

diagrams not drawn accurately



A: 15 + 20 = 35, which is less than 37, so the two shorter sides cannot meet. A is not a triangle.

B: if B were a triangle the sine rule would hold.

$\frac{16}{\sin 64°} = 17.80...$ $\frac{13}{\sin 40°} = 20.22...$

These are not equal, so B is not a triangle.

C: cosine rule for the side opposite 120°:

$a^2 = 14^2 + 16^2 - 2 \times 14 \times 16 \times \cos 120°$

$= 196 + 256 + 224 = 676$

$a = \sqrt{676} = 26$, which matches the 26 shown, so C is a triangle.

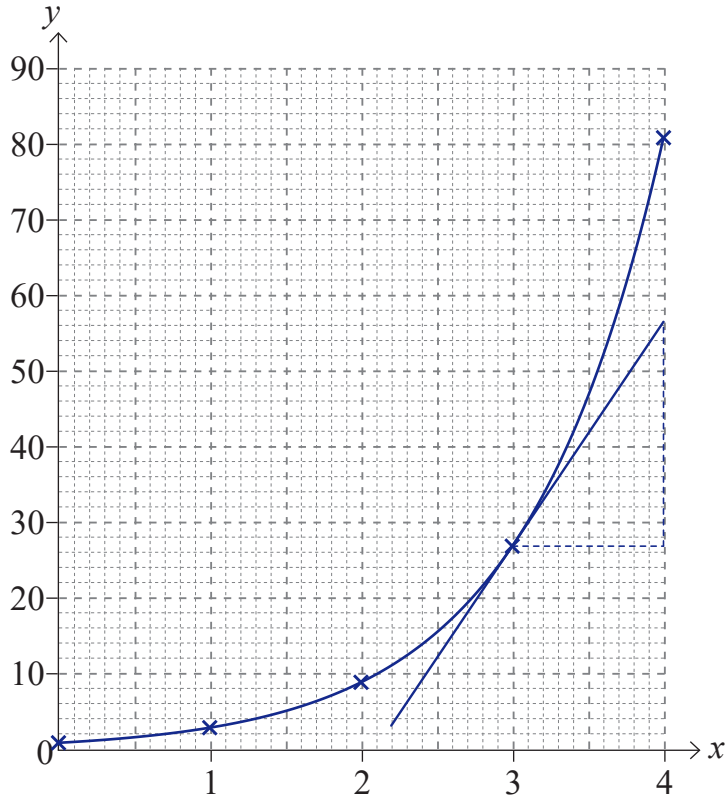
Only diagram C can represent a triangle.

[5]

[Turn over

11 **(a)** Draw the graph of $y = 3^x$ for values of x between 0 and 4

x:	0	1	2	3	4
y:	1	3	9	27	81



[3]

(b) In the graph above, £y represents the value of one share in a company x years after purchase.

(i) What is the initial value of one share?

Answer £ 1 [1]

(ii) Describe what is happening to the value of the share each year.

Answer it is trebling (multiplied by 3) each year [1]

(c) By drawing a suitable line on the graph, estimate the instantaneous rate of increase in the value of the share when $x = 3$

Answer 30 £/year [2]

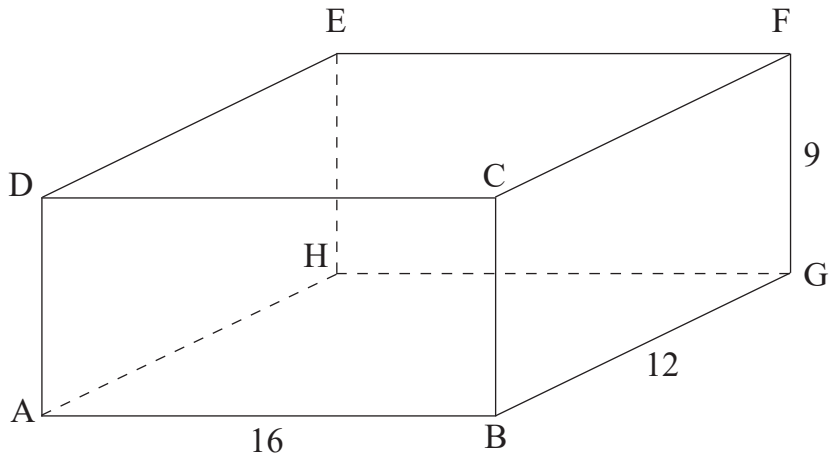
Tangent drawn at (3, 27) on the graph.

It passes through (3, 27) and (4, 57).

$$\text{gradient} = \frac{57 - 27}{4 - 3} = \frac{30}{1} = 30$$

[Turn over

12



ABCDEFGH is a cuboid with sides 9 cm, 12 cm and 16 cm as shown.

Calculate the size of the angle AEC.

Use triangle ACE.

$AC^2 = 9^2 + 16^2 = 81 + 256 = 337$

$AE^2 = 9^2 + 12^2 = 81 + 144 = 225, \quad AE = 15$

$EC^2 = 12^2 + 16^2 = 144 + 256 = 400, \quad EC = 20$

$$\cos AEC = \frac{AE^2 + EC^2 - AC^2}{2 \times AE \times EC} = \frac{225 + 400 - 337}{2 \times 15 \times 20}$$

$$= \frac{288}{600} = 0.48$$

$AEC = \cos^{-1}(0.48) = 61.3146...°$

Answer 61.3 ° [6]

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Question Number	**Marks**
1	
2	
3	
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8	
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11	
12	
Total Marks	

Examiner Number

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