Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2024

Mathematics

StemUp Model Solution

Unit M8 Paper 2
(With calculator)
Higher Tier



[GMC82]

GMC82

THURSDAY 21 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 fourteen** questions.

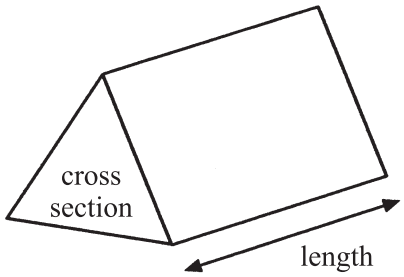
INFORMATION FOR CANDIDATES

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

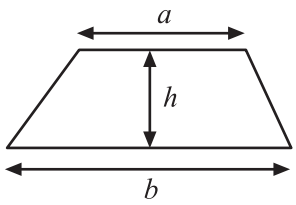
14872

Formula Sheet

Volume of prism = area of cross section × length

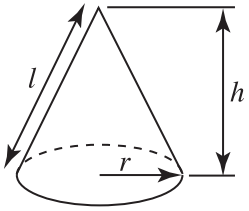


Area of trapezium = $\frac{1}{2}(a+b)h$



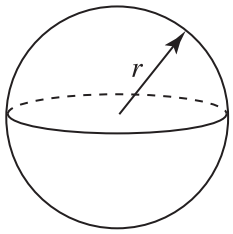
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

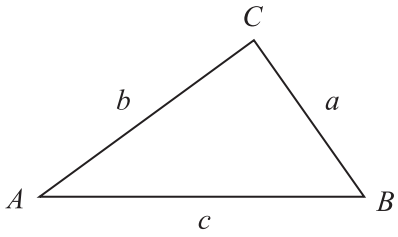


Volume of sphere = $\frac{4}{3}\pi r^3$

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

14872

1 There are 55 girls and 20 boys in Year 13

The probability that a girl in Year 13 has a part-time job is $\frac{2}{5}$

The probability that a boy in Year 13 has a part-time job is $\frac{3}{4}$

Work out the probability that a student in Year 13 has a part-time job.

Girls with a job = 55 ÷ 5 × 2 = 22

Boys with a job = 20 ÷ 4 × 3 = 15

Total with a job = 22 + 15 = 37

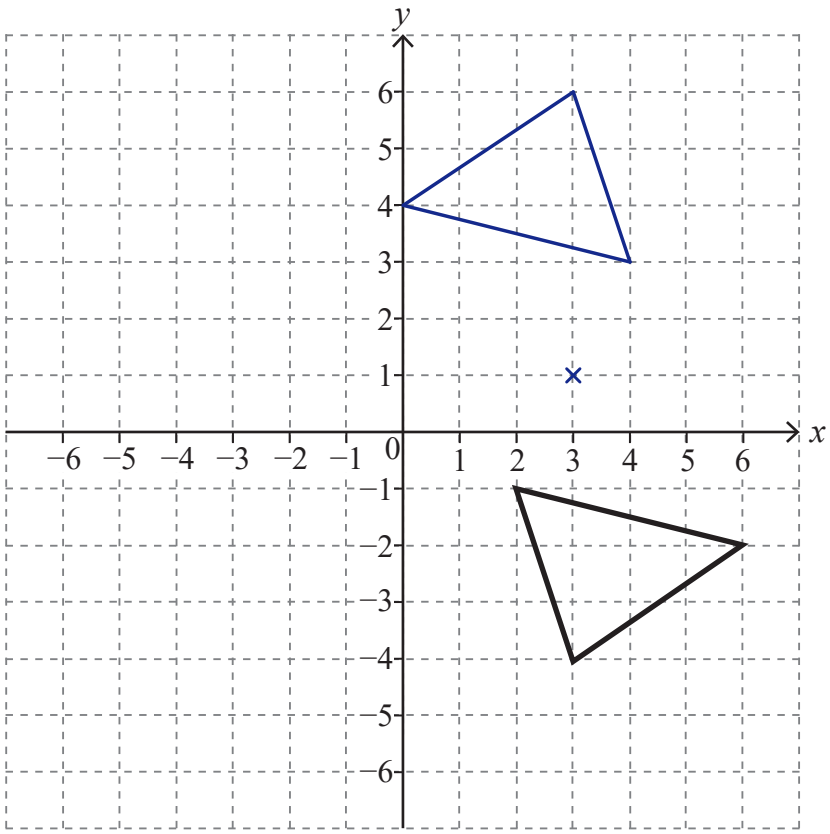
Total students = 55 + 20 = 75

P(part-time job) = $\frac{37}{75}$

Answer *$\frac{37}{75}$* [4]

[Turn over

2 Rotate the triangle 180° about the point (3,1)



[2]

3 The equation $x^2 - \frac{6}{x} = 16$ has a solution between 2 and 5

Use a trial and improvement method to find this solution.

Give your answer to 1 decimal place.

You must show all your working out.

x	$x^2 - \frac{6}{x}$	Comment
4	14.5	too low
5	23.8	too high
4.1	15.346...	too low
4.2	16.211...	too high
4.15	15.776...	too low

Solution lies between 4.15 and 4.2,
so x = 4.2 to 1 decimal place

Answer $x =$ 4.2 [4]

[Turn over

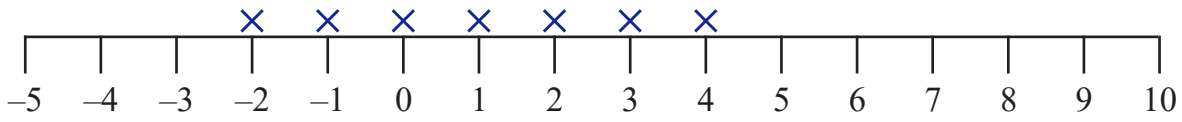
4 Solve the inequality

$$-5 < 2n \leqslant 8$$

showing all possible **integer** values for n on the number line below.

$-5 < 2n \leq 8$

$-2\frac{1}{2} < n \leq 4$ $\quad\quad$ $n = -2, -1, 0, 1, 2, 3, 4$



[2]

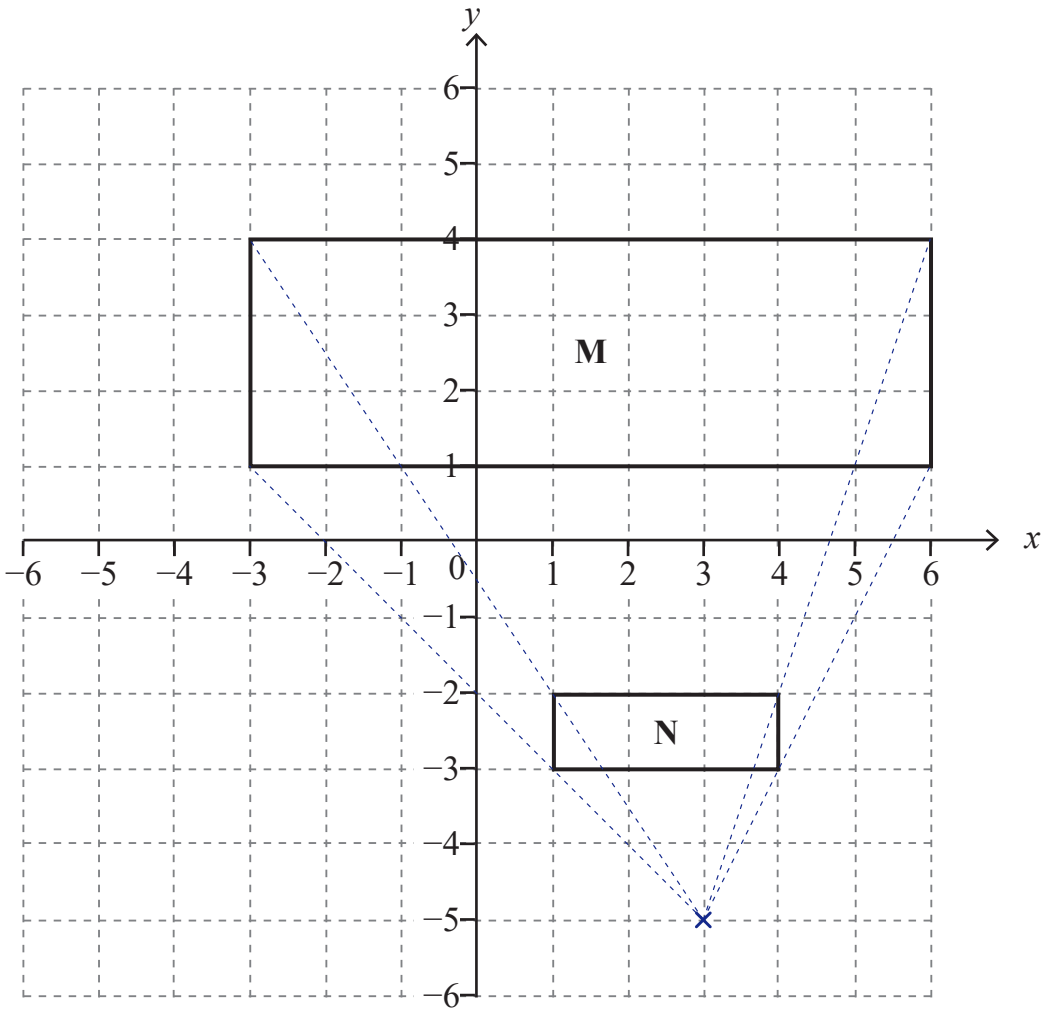
5 Fill in the blank below.

The dimensions of a large cylinder are twice the dimensions of a small cylinder.

The large cylinder will hold 8 times as much as the small cylinder.

[1]

6 Describe fully the single transformation that maps **M to N**.



Answer Enlargement, scale factor $\frac{1}{3}$,
centre (3, −5)

[3]

[Turn over

7 A restaurant has three courses on its menu

Starter	Main	Dessert
Soup	Beef	Apple tart
Brie	Chicken	Pavlova
Prawns	Salmon	Lemon cake
Pâté	Lasagne	Ice cream
	Pork	Rhubarb crumble
		Fruit salad

There is a special deal when any two courses are ordered.

How many options are there when **any two different** courses are ordered?

Starter and main: 4 × 5 = 20

Starter and dessert: 4 × 6 = 24

Main and dessert: 5 × 6 = 30

Total = 20 + 24 + 30 = 74

Answer 74 [3]

8 Find the nth term of the sequence

$$\frac{1}{2}, \quad \frac{8}{3}, \quad \frac{27}{4}, \quad \frac{64}{5}, \quad \frac{125}{6}, \quad \ldots\ldots$$

Numerators 1, 8, 27, 64, 125 are cubes: n^3

Denominators 2, 3, 4, 5, 6 are $n + 1$

Answer $\frac{n^3}{n+1}$ [2]

9 The probability that Eric will win his next darts match is $\frac{1}{7}$

The probability that Fiona will win her next darts match is $\frac{1}{5}$

What is the probability that they will both lose their next match?

P(Eric loses) $= 1 - \frac{1}{7} = \frac{6}{7}$

P(Fiona loses) $= 1 - \frac{1}{5} = \frac{4}{5}$

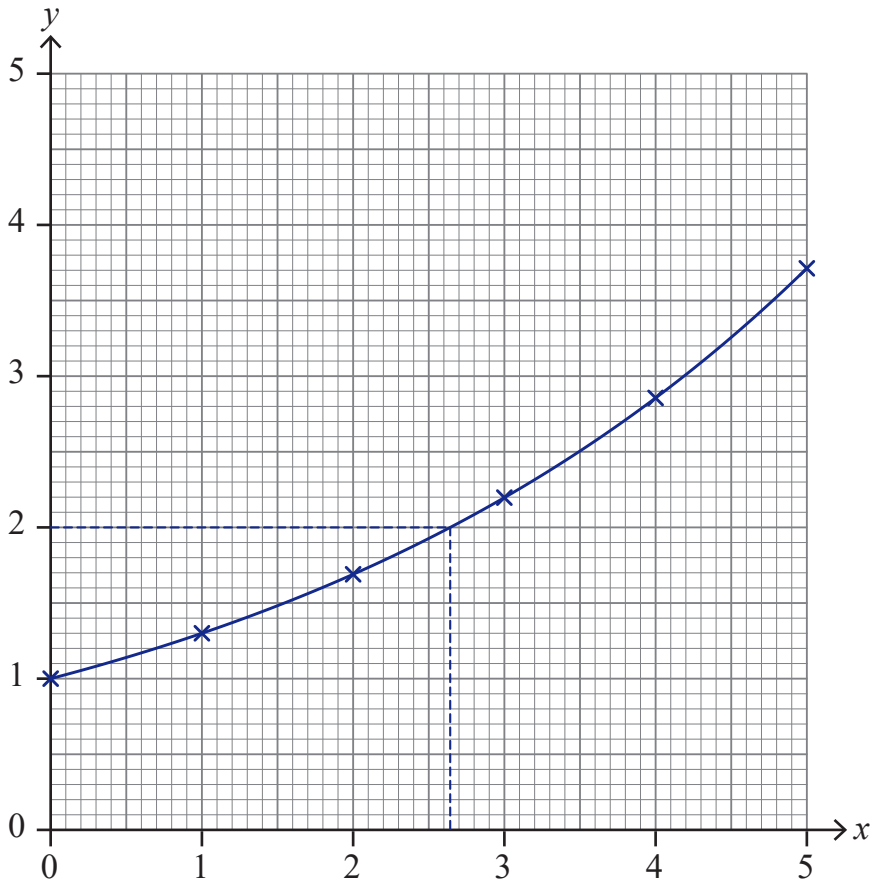
P(both lose) $= \frac{6}{7} \times \frac{4}{5} = \frac{24}{35}$

Answer $\frac{24}{35}$ [2]

[Turn over

10 (a) Sketch the graph of $y = (1.3)^x$ for values of x between 0 and 5

x	0	1	2	3	4	5
y	1	1.3	1.69	2.197	2.856	3.713



[3]

(b) Use your graph to estimate the increase in x required to double the value of y.

At $x = 0$, $y = 1$

$y = 2$ when $x = 2.65$ (read from graph)

Increase $= 2.65 - 0 = 2.65$

Answer 2.65 [1]

(c) Which of the following is represented by the graph, where x is the number of years?

A y increases in value by 3% each year.
B y increases in value by 1.3% each year.
C y increases in value by 13% each year.
D y increases in value by 30% each year.

Answer D [1]

[Turn over

11 **(a)** y is inversely proportional to the square of x.

When $x = 15$, $y = 4$

Write y in terms of x.

$y = \frac{k}{x^2}$

$4 = \frac{k}{15^2} = \frac{k}{225}$

$k = 4 \times 225 = 900$

Answer $y =$ $\frac{900}{x^2}$ [3]

(b) Hence find the values of x for which $y = 10\,000$

$10\,000 = \frac{900}{x^2}$

$x^2 = \frac{900}{10\,000} = 0.09$

$x = \pm\sqrt{0.09} = \pm 0.3$

Answer 0.3 or −0.3 [2]

12

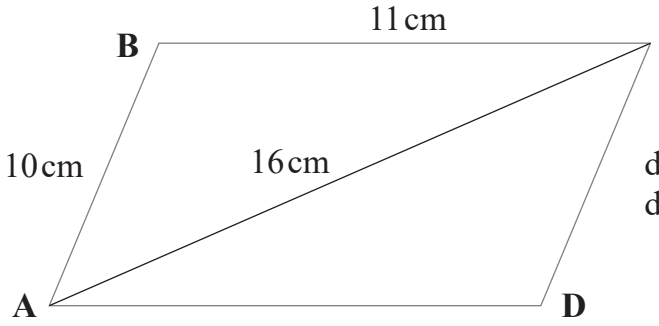


diagram not drawn accurately

The parallelogram ABCD has sides AB = 10 cm, BC = 11 cm and diagonal AC = 16 cm.

Find the area of the parallelogram.

$\cos B = \frac{10^2 + 11^2 - 16^2}{2 \times 10 \times 11}$

$\cos B = \frac{-35}{220} = -0.159090909...$

$B = 99.15413328...°$

Area ABC $= \frac{1}{2} \times 10 \times 11 \times \sin 99.154...°$

$= 54.29951657...$

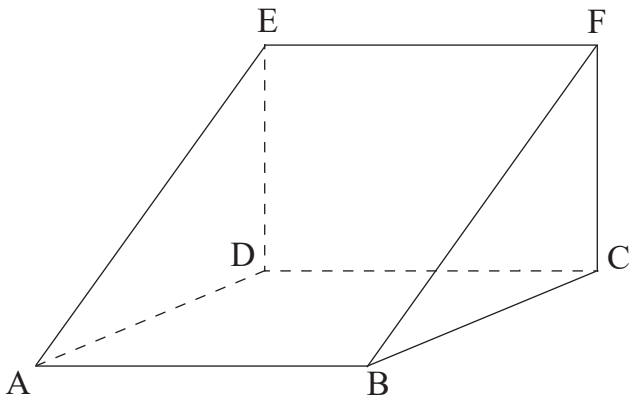
Area ABCD $= 2 \times 54.29951657...$

$= 108.5990... = 108.6$

Answer 108.6 cm^2 [5]

[Turn over

13



ABCDEF is a right-angled triangular prism.

BC = 5 cm, BF = 10 cm and AC = 15 cm.

Show that the angle between AF and ABCD is half the angle between ABCD and ABFE.

Angle between ABCD and ABFE is angle FBC

$\cos FBC = \frac{BC}{BF} = \frac{5}{10} = 0.5$ so angle FBC = 60°

$FC^2 = 10^2 - 5^2 = 75$ so $FC = \sqrt{75} = 8.660...$

Angle between AF and ABCD is angle FAC

$\tan FAC = \frac{FC}{AC} = \frac{\sqrt{75}}{15} = 0.57735...$ so angle FAC = 30°

30° = ½ × 60°, so the angle between AF and ABCD is half the angle between ABCD and ABFE

[6]

14 A box contains eight cards numbered 1, 2, 3, 4, 5, 6, 7, 8 (a different number on each card).

One card is taken at random from the box and not replaced.

A second card is taken at random from the box.

The numbers on the two cards are multiplied together.

What is the probability that the answer is

(a) a prime number;

Prime products: (1,2) (1,3) (1,5) (1,7)

or (2,1) (3,1) (5,1) (7,1)

$P = \frac{1}{8} \times \frac{4}{7} + \frac{4}{8} \times \frac{1}{7} = \frac{4}{56} + \frac{4}{56} = \frac{8}{56} = \frac{1}{7}$

Answer $\frac{1}{7}$ [3]

(b) a square number?

Square products: (1,4) (4,1) (2,8) (8,2)

$P = \frac{1}{8} \times \frac{1}{7} + \frac{1}{8} \times \frac{1}{7} + \frac{1}{8} \times \frac{1}{7} + \frac{1}{8} \times \frac{1}{7}$

$= \frac{4}{56} = \frac{1}{14}$

Answer $\frac{1}{14}$ [3]

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THIS IS THE END OF THE QUESTION PAPER

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Question Number	**Marks**
1	
2	
3	
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9	
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11	
12	
13	
14	
Total Marks	

Examiner Number

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