Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2023

Mathematics

StemUp Model Solution

Unit M7 Paper 2
(With calculator)
Higher Tier



[GMC72]

GMC72

THURSDAY 23 NOVEMBER, 10.45 am – 12 NOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

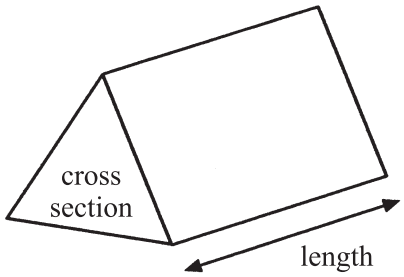
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all sixteen** 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

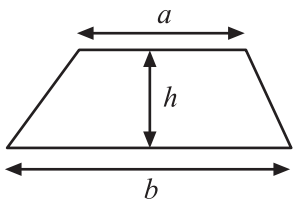
The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

Formula Sheet

Volume of prism = area of cross section × length

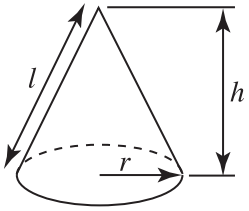


Area of trapezium = $\frac{1}{2}(a+b)h$



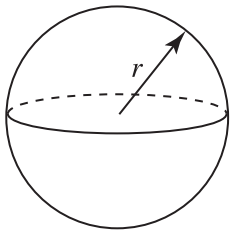
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

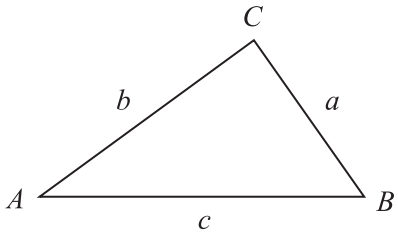


Volume of sphere = $\frac{4}{3}\pi r^3$

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

1 Here are some numbers.

12	8	29
18	30	46
49	2	21

From the numbers given, write down

(a) the square number,

Answer 49 [1]

(b) the cube number,

Answer 8 [1]

(c) the triangular number.

Answer 21 [1]

[Turn over

2



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It takes 2 days to paint the outside of 6 houses.

(a) How long would it take to paint the outside of 15 houses?

15 ÷ 6 = 2.5

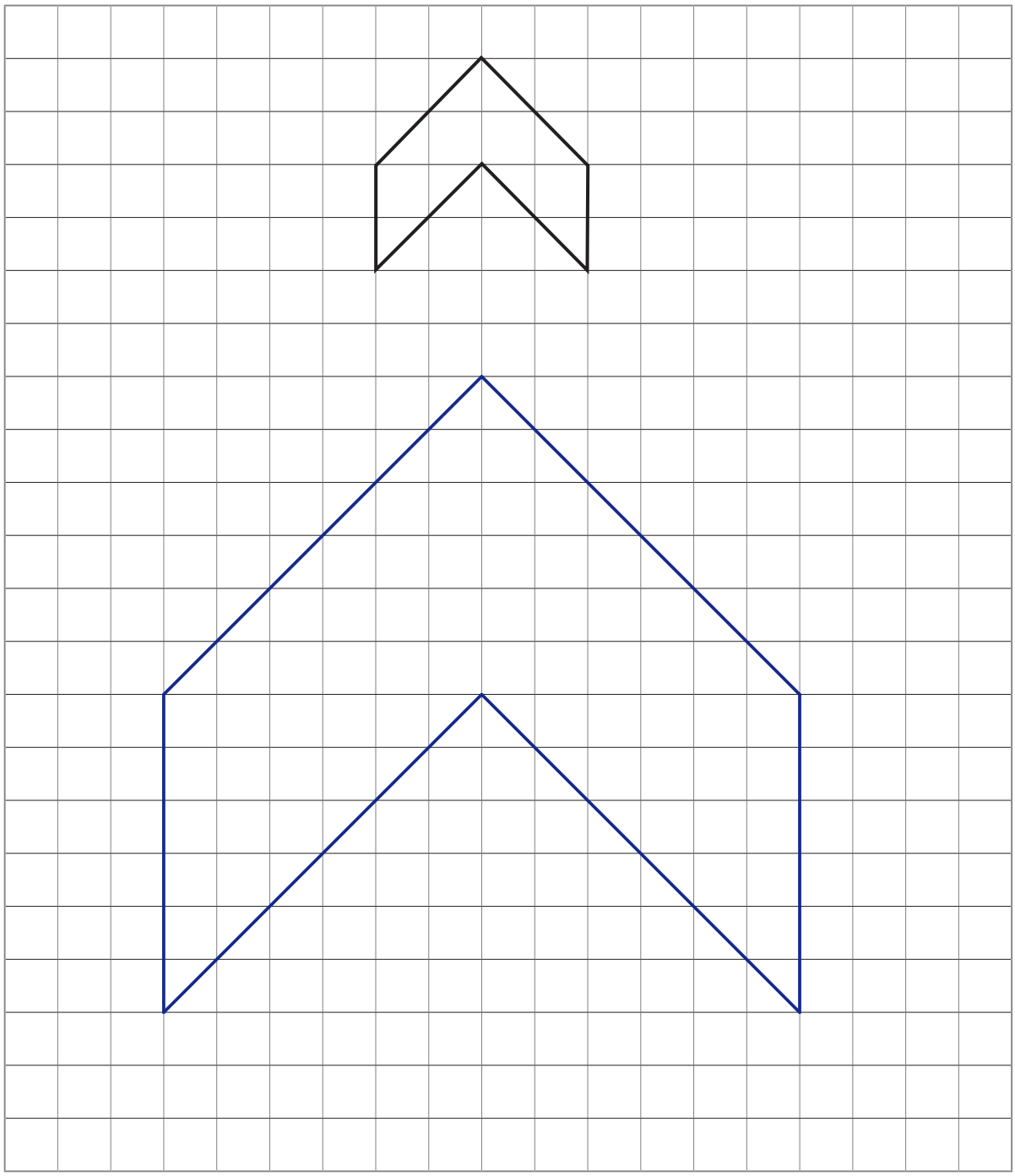
2.5 × 2 = 5 days

Answer 5 days [2]

(b) State one assumption you made in answering part **(a)**.

Answer All the painters work at the same rate and all the houses are the same size. [1]

3 Enlarge the shape on the grid below using a **scale factor of 3**



[3]

[Turn over

4 Conor mixes red, blue and yellow paint in the ratio 4 : 2 : 1

He uses 10 litres of blue paint.

He sells the mixed paint at a price of £18.25 per litre.

Work out the total price of the mixed paint.

red : blue : yellow = 4 : 2 : 1

2 parts = 10 litres, so 1 part = 5 litres

red = 4 × 5 = 20 litres, yellow = 1 × 5 = 5 litres

Total = 20 + 10 + 5 = 35 litres

Price = 35 × 18.25 = £638.75

Answer £ 638.75 [3]

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5



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A firm holds a Christmas raffle for its 20 employees.

The raffle tickets are numbered from 1 to 20

A ticket is drawn at random from a hat.

What is the probability that the ticket drawn is

(a) a number less than 10,

Less than 10: 1, 2, 3, ..., 9 → 9 numbers

Answer $\frac{9}{20}$ [1]

(b) a number more than 14,

More than 14: 15, 16, 17, 18, 19, 20 → 6 numbers

Answer $\frac{6}{20}$ [1]

(c) a prime number?

Primes: 2, 3, 5, 7, 11, 13, 17, 19 → 8 numbers

Answer $\frac{8}{20}$ [1]

[Turn over

6 Julie collects 50 p coins.

70 of these coins weigh 560 g.

What is the **value** of 880 g of these coins?

1 coin weighs 560 ÷ 70 = 8 g

Number of coins in 880 g = 880 ÷ 8 = 110 coins

Value = 110 × £0.50 = £55

Answer £ *55* [3]

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7 Ben and Orla share the cost of a meal in the ratio 3 : 1

The meal costs £64

Ben then pays the taxi fare.

Ben pays a total of £60

How much is the taxi fare?

Total parts = 3 + 1 = 4

1 part = 64 ÷ 4 = £16

Ben pays for the meal: 3 × 16 = £48

Taxi fare = 60 − 48 = £12

Answer £ 12 [3]

[Turn over

8 Data is recorded about the age and treatment received by patients who visit a dentist on a Monday.

	Patients aged 30 or under	**Patients aged over 30**
Filling	9	6
Extraction	5	13

(a) What is the probability that one of these patients selected at random is over 30 and has an extraction?

Total patients = 9 + 6 + 5 + 13 = 33

Over 30 and extraction = 13

Answer $\frac{13}{33}$ [1]

(b) One of the patients aged 30 or under is selected at random.

What is the probability that this patient has a filling?

Aged 30 or under = 9 + 5 = 14, filling = 9

Answer $\frac{9}{14}$ [1]

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9 A sketch of an irregular pentagon is shown.

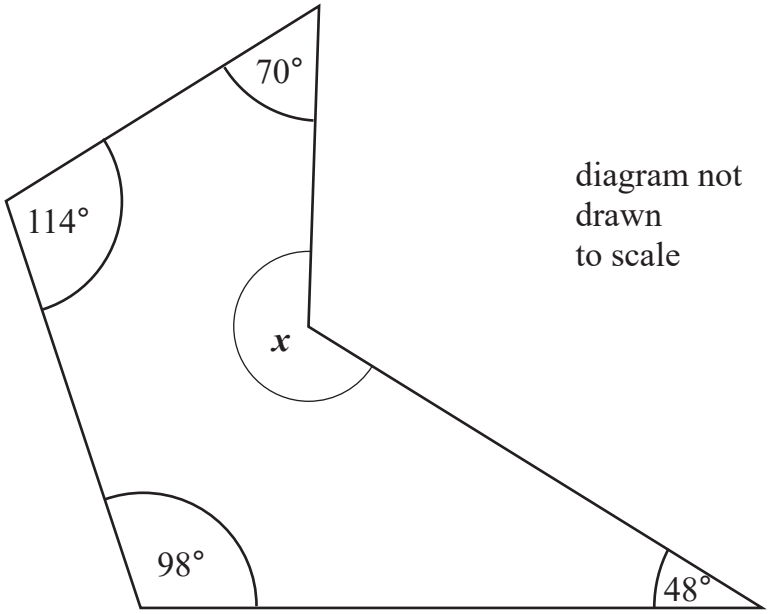


diagram not drawn to scale

Calculate the value of x.

Show all your working.

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

x = 540 − (114 + 98 + 48 + 70)

x = 540 − 330

x = 210°

Answer 210 ° [3]

[Turn over

10 Simplify $(x^5)^3$

$(x^5)^3 = x^{5 \times 3}$

Answer x^{15} [1]

11 Use trial and improvement to find a solution of the equation

$$x^2 + \frac{x}{2} = 15$$

Give your answer correct to 1 decimal place.

You must show all your working.

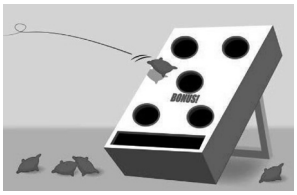
x	$x^2 + x \div 2$	
3	10.5	too small
4	18	too big
3.6	14.76	too small
3.7	15.54	too big
3.65	15.1475	too big

3.65 is too big, so x lies between 3.6 and 3.65: x = 3.6 (1 d.p.)

Answer $x =$ 3.6 [4]

12 Kate plays the game "throw the bean bag".

She records the number of times she gets the bean bag in the bonus hole.



Total number of throws	10	30	100	200
Total number of times in the bonus hole	2	8	49	104

(a) Write down the best estimate of the probability that Kate gets the bean bag in the bonus hole if she continues throwing.

Give a reason for your answer.

Answer 0.52

because the more throws, the better the estimate, and

200 throws is the largest number of trials. [2]

(b) Kate continues with her game and throws it a total of 300 times.

Calculate the number of times you would expect her to get the bean bag in the bonus hole.

$$\text{Expected} = \frac{104}{200} \times 300$$

$$= 0.52 \times 300 = 156$$

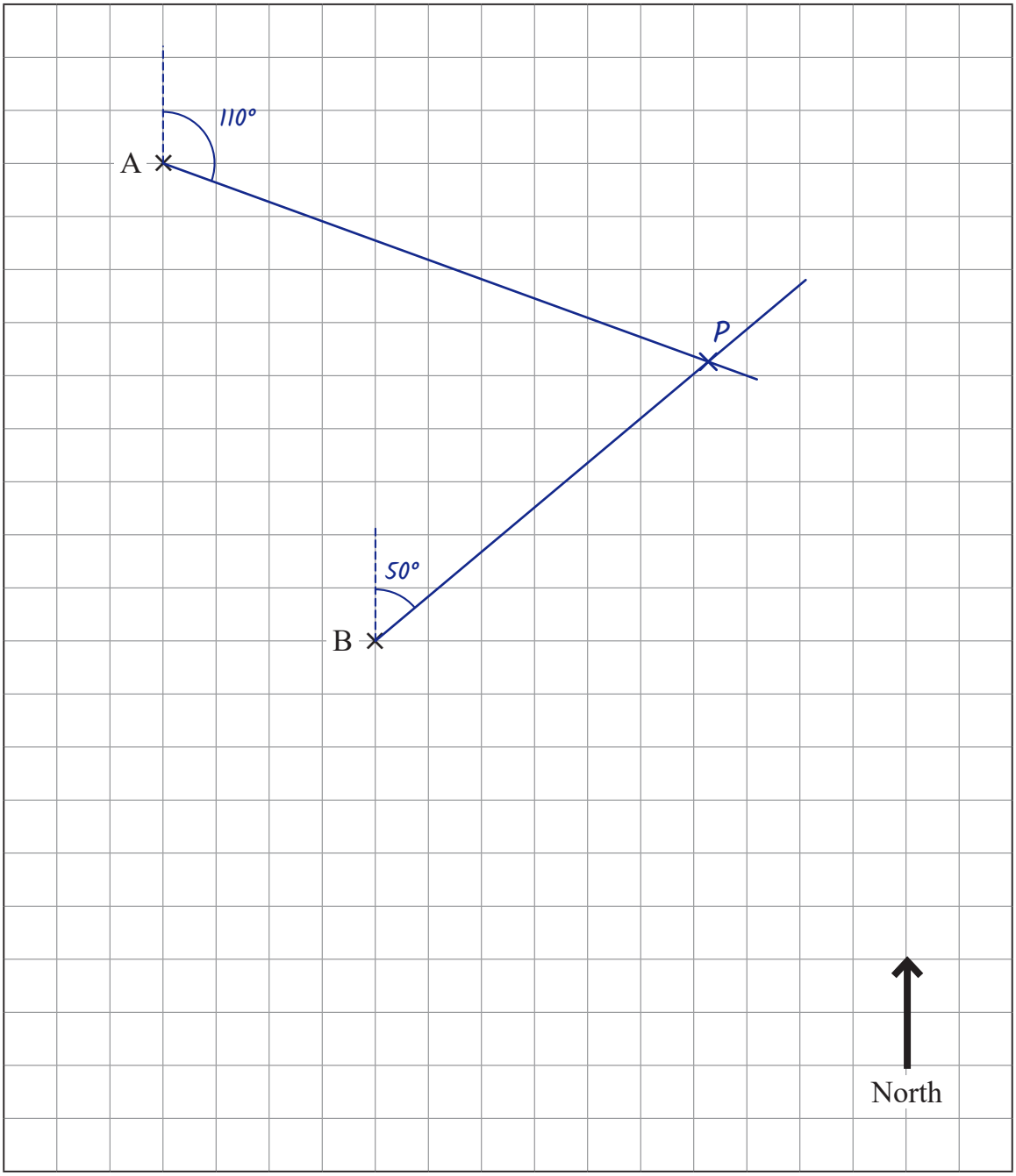
Answer 156 [2]

[Turn over

13 The position of two Airport Control Towers, A and B, are shown.

(a) What is the bearing of B **from A**?

Answer 156 ° [1]



(b) The two towers pick up a distress signal from a plane.

The bearing of the plane from A is 110°

The bearing of the plane from B is 050°

Find and mark the position of the plane with a P on the diagram. [2]

[Turn over

14 Pete orders cold meals and hot meals on Monday, Tuesday and Wednesday.

On Monday he got 16 cold meals and 3 hot meals.

He paid £74

On Tuesday he got 20 cold meals and 7 hot meals.

He paid £112

On Wednesday he got 10 cold meals and 8 hot meals.

Work out what Pete paid for the meals on Wednesday.

A solution by trial and improvement will not be accepted.

Let x = cost of a cold meal (£), y = cost of a hot meal (£)

16x + 3y = 74 (1)

20x + 7y = 112 (2)

(1) × 7: 112x + 21y = 518

(2) × 3: 60x + 21y = 336

Subtract: 52x = 182

x = 182 ÷ 52 = 3.5

In (1): 16 × 3.5 + 3y = 74

56 + 3y = 74, 3y = 18, y = 6

Cold meal £3.50, hot meal £6

Wednesday: 10 × 3.50 + 8 × 6 = 35 + 48 = £83

Answer £ 83 [6]

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15 Rearrange to make z the subject of

$$x = \sqrt{yz}$$

$x = \sqrt{(yz)}$

$x^2 = yz$

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

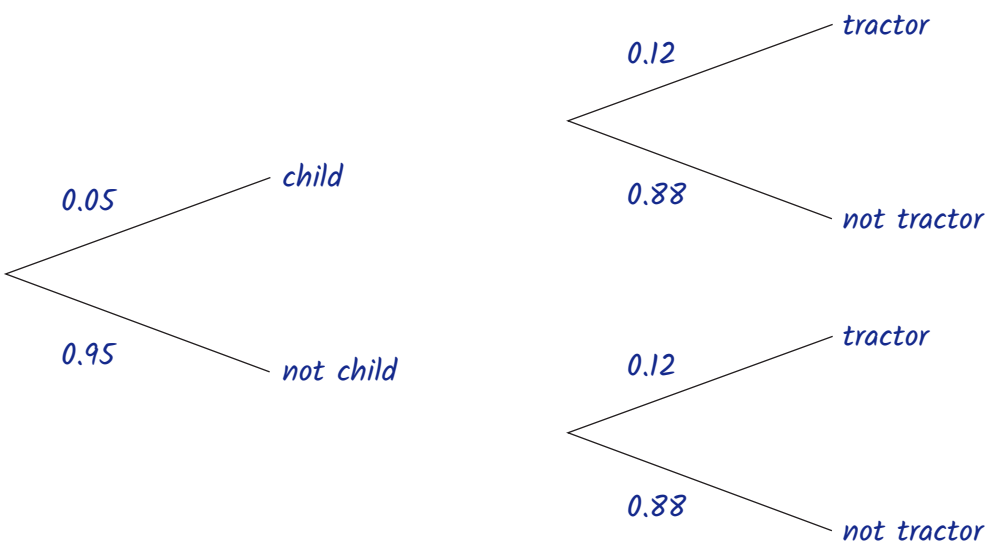
Answer $z = \frac{x^2}{y}$ [2]

[Turn over

16 The probability that the first person to cross a footbridge in the morning is a child is 0.05

The probability that the first vehicle to pass under the footbridge is a tractor is 0.12

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



[3]

(b) What is the probability that the first person to cross is a child and the first vehicle to pass under is **not** a tractor.

P(child and not tractor) = 0.05 × 0.88

= 0.044

Answer 0.044 [1]

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Question Number	**Marks**
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Examiner Number

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