Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2023

Mathematics

StemUp Model Solution

Unit M8 Paper 2
(With calculator)
Higher Tier

[GMC82]



GMC82

THURSDAY 23 NOVEMBER, 10.45 am – 12 NOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

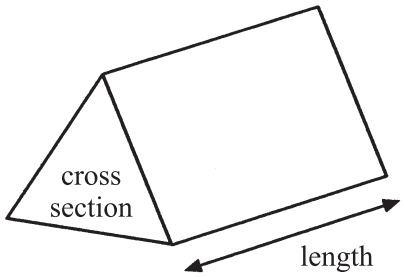
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all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

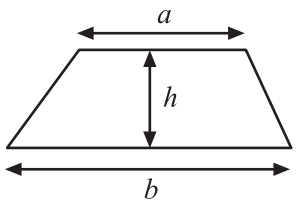
The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

Formula Sheet

Volume of prism = area of cross section × length

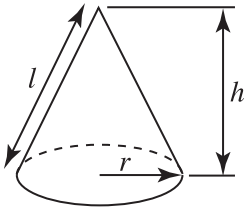


Area of trapezium = $\frac{1}{2}(a+b)h$



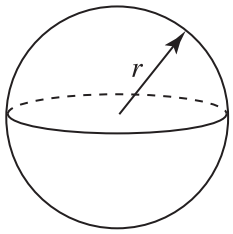
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

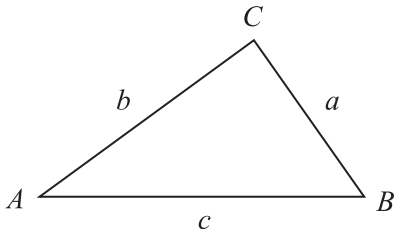


Volume of sphere = $\frac{4}{3}\pi r^3$

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

14124

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1 Simplify $(x^5)^3$

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

Answer x^{15} [1]

2 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.

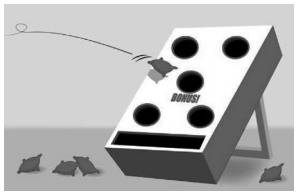
x	$x^2 + x \div 2$	
3	10.5	too small
4	18	too big
3.6	14.76	too small
3.7	15.54	too big
3.65	15.1475	too big

$x = 3.65$ gives too big, so x is between 3.6 and 3.65

Answer $x =$ 3.6 [4]

[Turn over

3 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 $\frac{104}{200}$

because *it uses the most throws (200);*

the more throws, the better the estimate of the probability [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.

$\frac{104}{200} \times 300 = 156$

Answer *156* [2]

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(Questions continue overleaf)

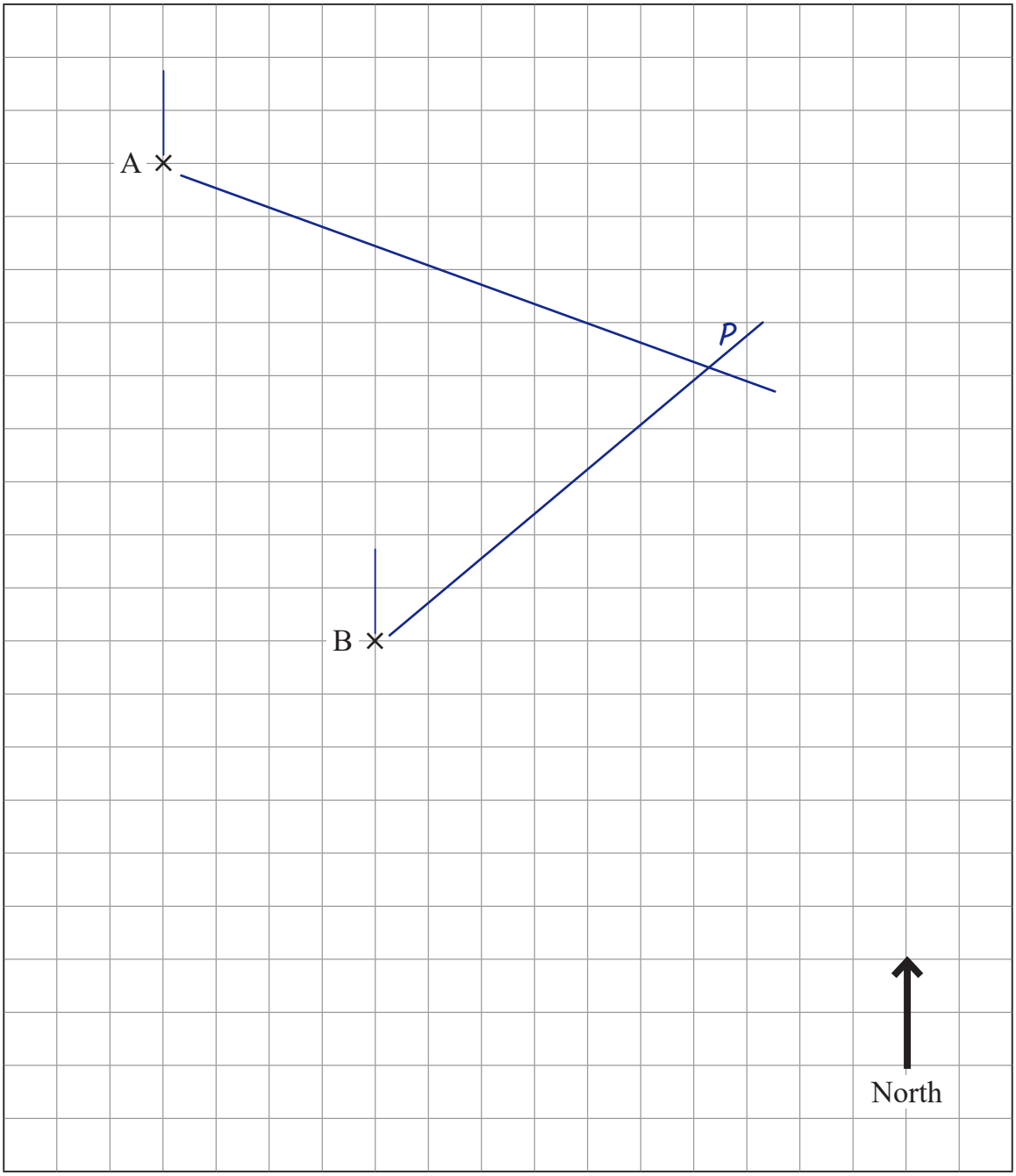
[Turn over

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

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

measured from North at 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

5 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: $52x = 182$

$x = 182 \div 52 = 3.5$

in (1): $16 \times 3.5 + 3y = 74$

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

Wednesday: $10 \times 3.50 + 8 \times 6$

$= 35 + 48 = 83$

Answer £ 83 [6]

6 Rearrange to make z the subject of

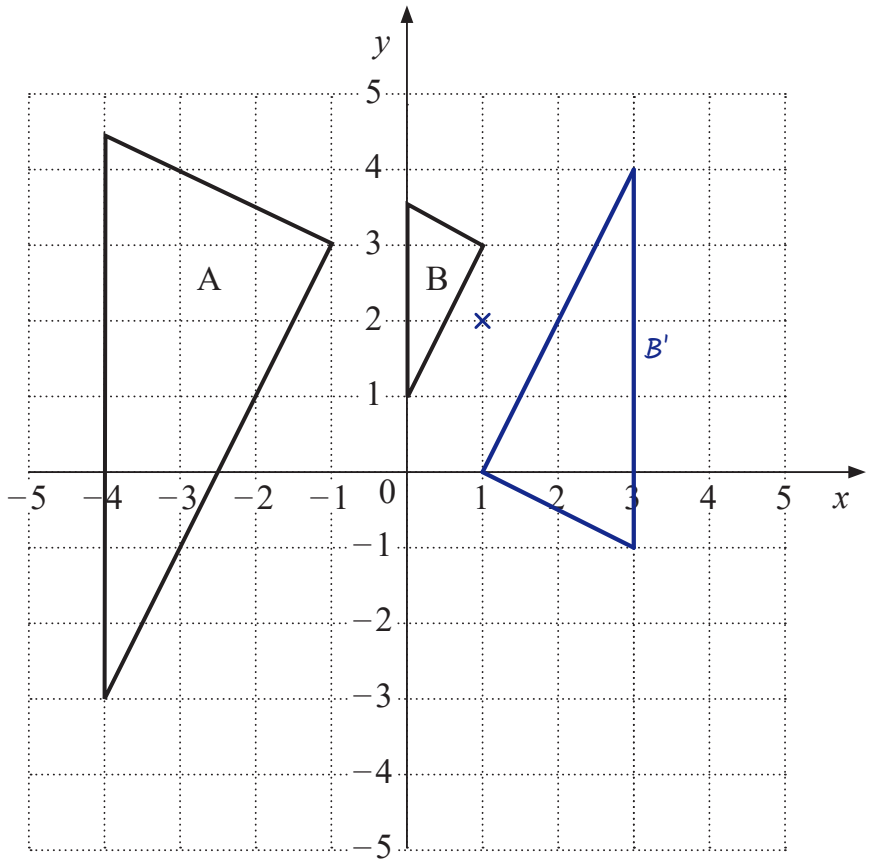
$$x = \sqrt{yz}$$

$x = \sqrt{(yz)}$

$x^2 = yz$

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

7



(a) Describe fully the transformation that maps A to B.

lines joining corresponding vertices meet at (2, 3); lengths of B are one third of lengths of A

Answer *Enlargement, scale factor $\frac{1}{3}$, centre (2, 3)* [3]

(b) On the grid above, draw the enlargement of triangle B using centre (1, 2) and scale factor –2 [3]

8 **(a)** £8000 is invested at 3% per annum compound interest.

Complete the formula for the amount £A after n years.

$A = 8000(\ \text{1.03}\ )^n$ [1]

(b) Calculate the total **interest** earned after 4 years.

$8000 \times 1.03^4 = 9004.07048...$

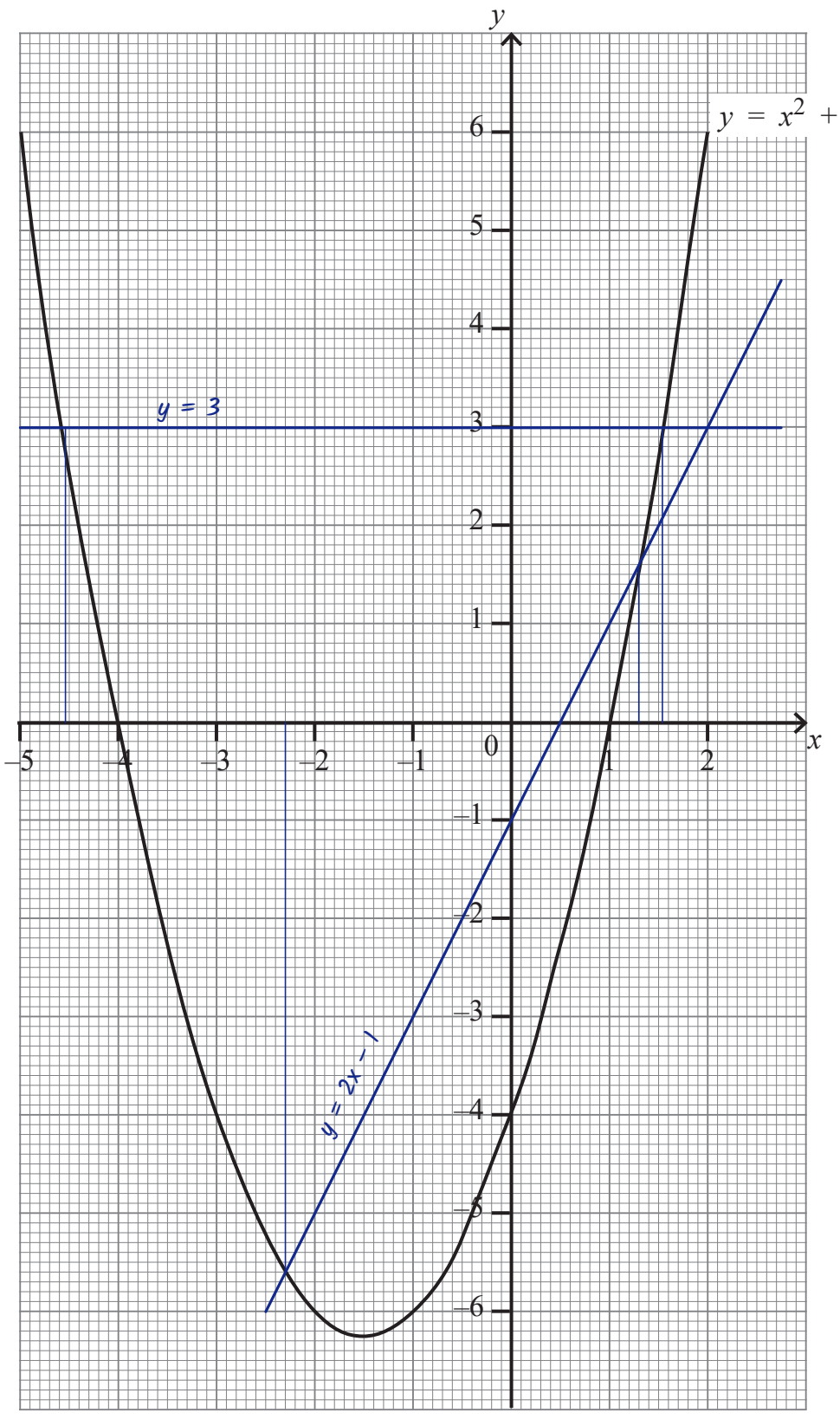
interest = 9004.07 − 8000 = 1004.07

Answer £ 1004.07 [2]

[Turn over

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9



The graph of $y = x^2 + 3x - 4$ is drawn opposite.

(a) (i) Use the graph to solve $x^2 + 3x - 4 = 2x - 1$

draw the line y = 2x − 1 on the graph;

it crosses the curve at x ≈ −2.3 and x ≈ 1.3

Answer *x = −2.3 or x = 1.3* [2]

(ii) In its simplest form, what quadratic equation has been solved in **(i)**?

$x^2 + 3x - 4 - 2x + 1 = 0$

Answer $x^2 + x - 3 = 0$ [1]

(b) Use the graph to solve the equation $x^2 + 3x - 7 = 0$

$x^2 + 3x - 7 = 0$ *so* $x^2 + 3x - 4 = 3$

draw y = 3; it crosses the curve at x ≈ −4.5 and 1.5

Answer *x = −4.5 or x = 1.5* [2]

(c) To solve the equation $x^2 - x - 5 = 0$, what line should be drawn?

$x^2 - x - 5 = 0$

add 4x + 1 to both sides:

$x^2 + 3x - 4 = 4x + 1$

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

[Turn over

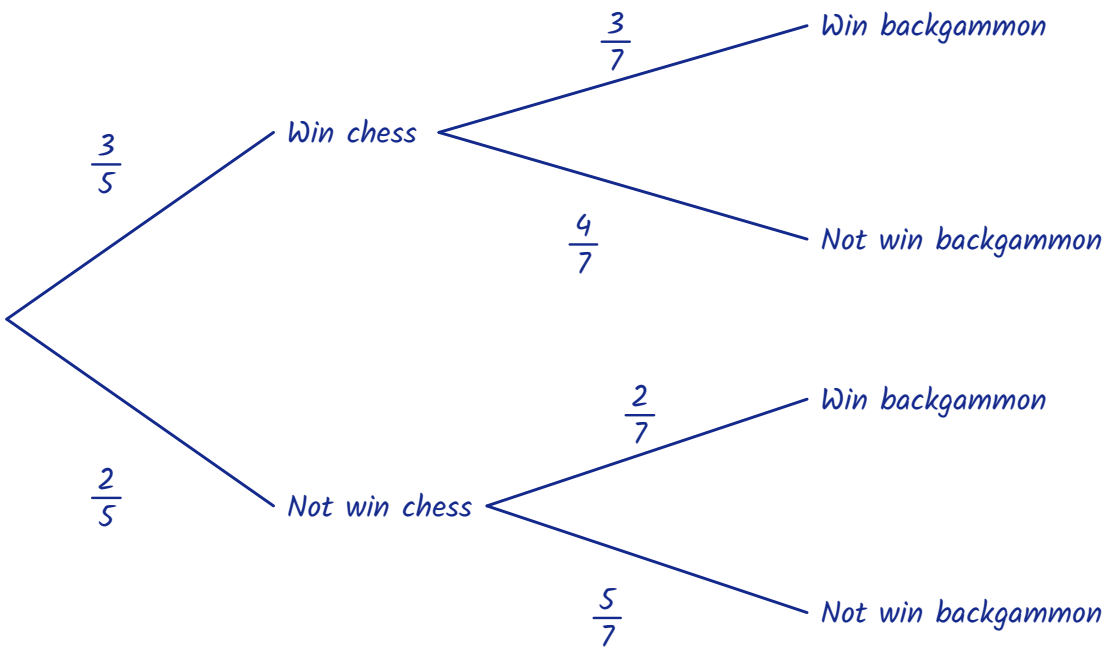
10 Each week Tom plays a game of chess and a game of backgammon.

The probability that he will win the chess game is $\frac{3}{5}$

When he wins the chess game, the probability that he will win the backgammon game is $\frac{3}{7}$

When he does not win the chess game, the probability that he will win the backgammon game is $\frac{2}{7}$

Draw a tree diagram to represent all the outcomes and use it to find the probability that he wins at least one of the games that he plays.



P(at least one win) = 1 − P(not win either)

$= 1 - \frac{2}{5} \times \frac{5}{7} = 1 - \frac{10}{35} = \frac{25}{35} = \frac{5}{7}$

Answer $\frac{5}{7}$ [4]

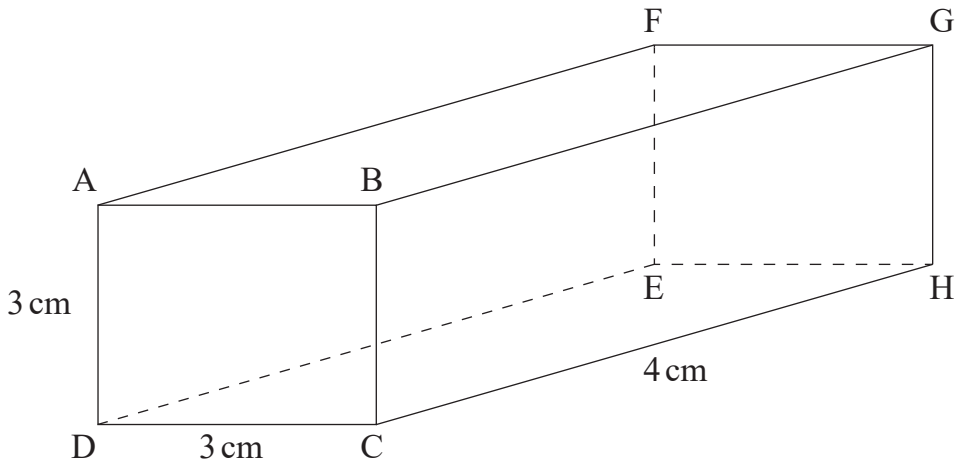
11 Simplify $(\sqrt{x})^4 \times x^{-\frac{3}{2}}$

$(\sqrt{x})^4 = (x^{1/2})^4 = x^2$

$x^2 \times x^{-3/2} = x^{2 - 3/2} = x^{1/2}$

Answer $x^{1/2}$ or $\sqrt{x}$ [2]

12 ABCDEFGH is a cuboid with sides 3 cm, 3 cm and 4 cm as shown.



Calculate the angle between the space diagonal DG and the base DCHE.

angle between DG and the base is angle GDH

$DH^2 = 3^2 + 4^2 = 25$, $DH = 5$ cm

$GH = 3$ cm

$\tan GDH = 3 \div 5 = 0.6$

$GDH = \tan^{-1}(0.6) = 30.96375653...°$

Answer 30.96 ° [3]

13

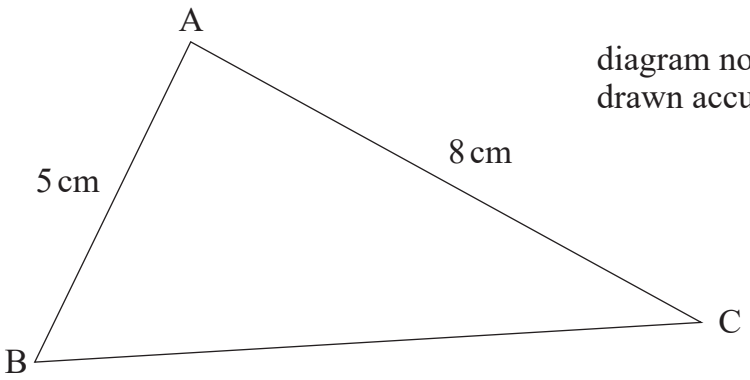


diagram not drawn accurately

The area of ABC is 16 cm^2

Find the length of BC.

Area = ½ × 5 × 8 × sin A = 16

20 sin A = 16, sin A = 0.8

A = $\sin^{-1}(0.8)$ = 53.13010235°

$BC^2 = 5^2 + 8^2 - 2 \times 5 \times 8 \times \cos 53.13010235°$

$BC^2 = 25 + 64 - 48 = 41$

$BC = \sqrt{41} = 6.403124237...$

Answer 6.40 cm [5]

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Question Number	**Marks**
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Examiner Number

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