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Draw a cross through the box (⊠)
if you have NOT written in this booklet

NZQA

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Mathematics and Statistics RAS 2023

91947 Demonstrate mathematical reasoning

Credits: Five

PILOT ASSESSMENT

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate mathematical reasoning.	Demonstrate mathematical reasoning with relational thinking.	Demonstrate mathematical reasoning with extended abstract thinking.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Pull out Resource Booklet 91947R from the centre of this booklet.

Show ALL working.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.
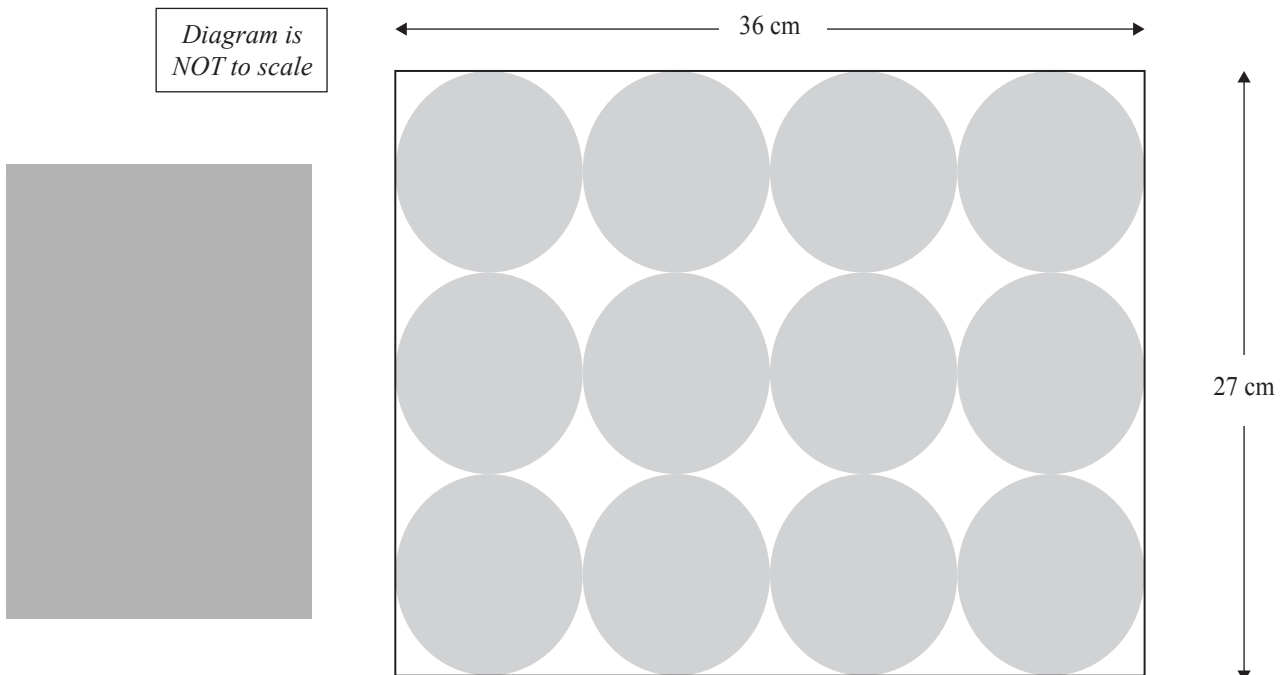
Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE

(a) Find the value of T in the formula $T = \pi\sqrt{\dfrac{h\sin x}{g}}$ when $h = 2.5$, $g = 9.81$, $x = 75°$,

giving your answer correct to **four decimal places**.

(b) The diagram below shows the top view of a rectangular box containing 12 cylindrical tins.
The tins are all just touching each other and the sides of the box. Each tin is 15 cm high.
Each tin has a label going all the way around its side, but not on the top or bottom.
The box has dimensions of 27 cm by 36 cm by 15 cm.

Diagram is NOT to scale

36 cm

27 cm

(i)   Find the **total area** of the labels of all of the tins in the box.

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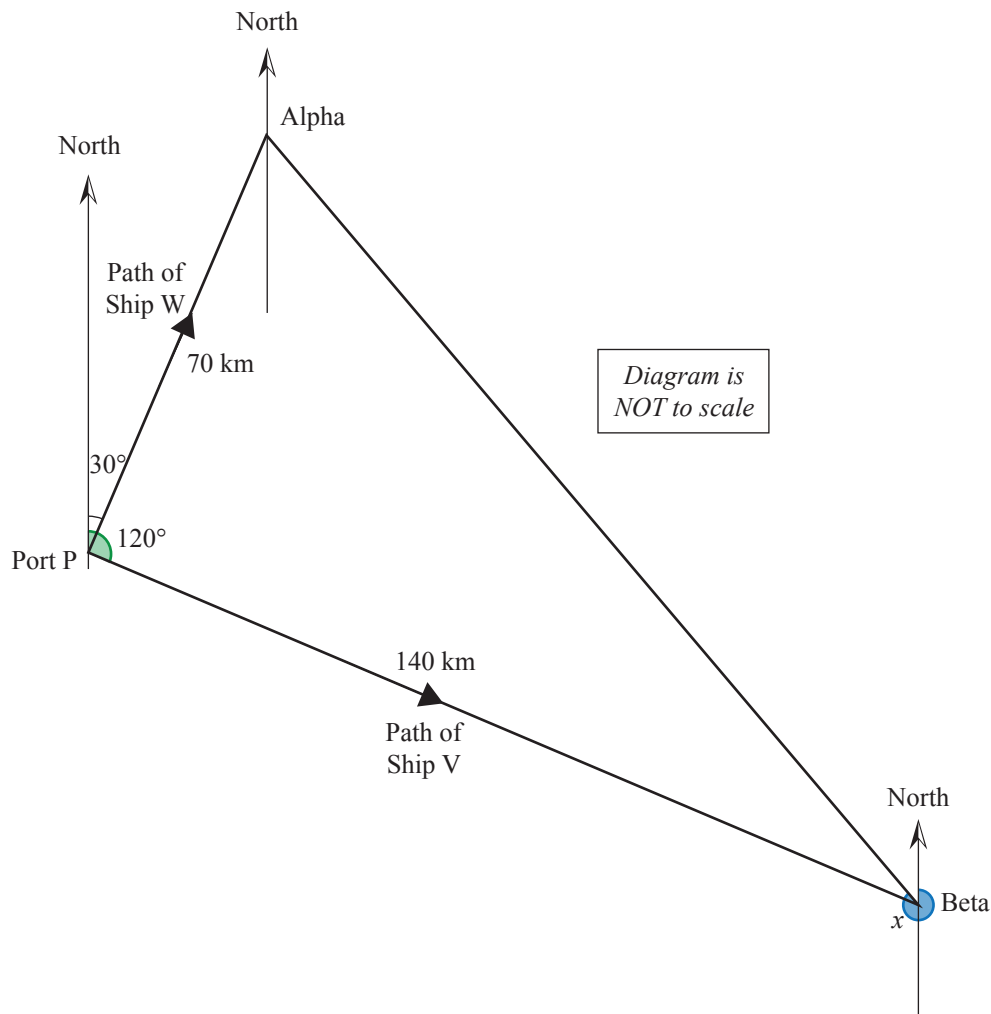(ii) A different size rectangular box to part (i) has height 15 cm.

The box will also contain 12 cylindrical tins, which are all just touching each other and the sides of the box. The layout of the 12 tins within this box will be the same as in part (i).

Each tin is 15 cm high, and with radius p cm.

Show that the **proportion** of the volume in the box that is NOT occupied by the tins is $\dfrac{(4-\pi)}{4}$.

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(c) Two ships leave Port P at the same time.

Ship W sails 70 km on a bearing of 030° to reach point Alpha.

Ship V sails 140 km on a bearing of 120° to reach point Beta.
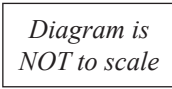
North

Alpha

North

Path of
Ship W

70 km

Diagram is
NOT to scale

30°

120°

Port P

140 km

Path of
Ship V

North

Beta

x

(i) Find the direct distance between the two places Alpha and Beta.

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(ii) Find the bearing of Alpha from Beta, shown as angle x in the diagram opposite.

Show your working clearly.

(iii) The speed of ship W is k km/hour, where k is a positive constant.

The total time taken for the ships to complete their journeys to Alpha and Beta was four hours.

Find the speed of ship V, giving your answer in terms of k.

QUESTION TWO

(a) The diagram below shows the top of a table which is in the shape of a regular octagon.

Length AZ = 120 cm. Point Z is at the centre of the octagon.

Diagram is NOT to scale

(i) Show that the size of *v*, angle ZAB, is 67.5°.

Show your working clearly.

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(ii) Find the area of the octagon.

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(iii)   Another table, made in the same style, has its top in the shape of an *n*-sided regular polygon.

The length AZ = *p* cm, where Z is at the centre of the table and A is one of the corners of the table.
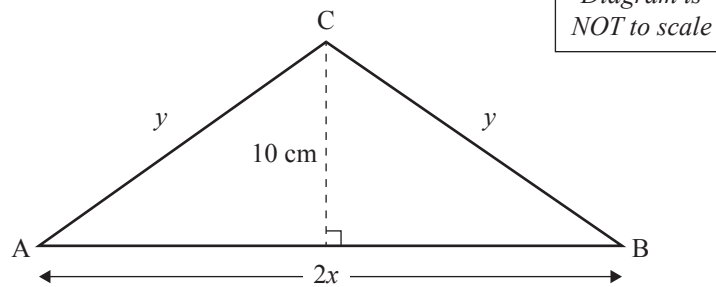
Find the area of this new table top, giving your answer in terms of *n* and *p*.

(b) An isosceles triangle ABC has AB = $2x$ cm and AC = BC = y cm.

The perimeter of the triangle ABC is 100 cm.

The length of the perpendicular from C to the line AB is 10 cm.

Diagram is
NOT to scale

C

y y

10 cm

A   B

$2x$

(i) Find the length, y, from A to C.

Give your answer in terms of x.

(ii) Using Pythagoras' theorem, find the area of the triangle ABC.

Support your answer with full mathematical working.

QUESTION THREE

(a) (i) The table below represents points on a particular graph, G_1.

Find the equation of this graph.

x	y
1	20
2	25
3	30
4	35
5	40

(ii) The table below represents points on another graph G_2.

Find the equation of this graph.

x	y
1	0
2	4
3	12
4	24
5	40

(iii) **Use algebra**, to find the *x*-values of the two points of intersection of the graphs G_2 and G_1.
Support your answer with full mathematical working.

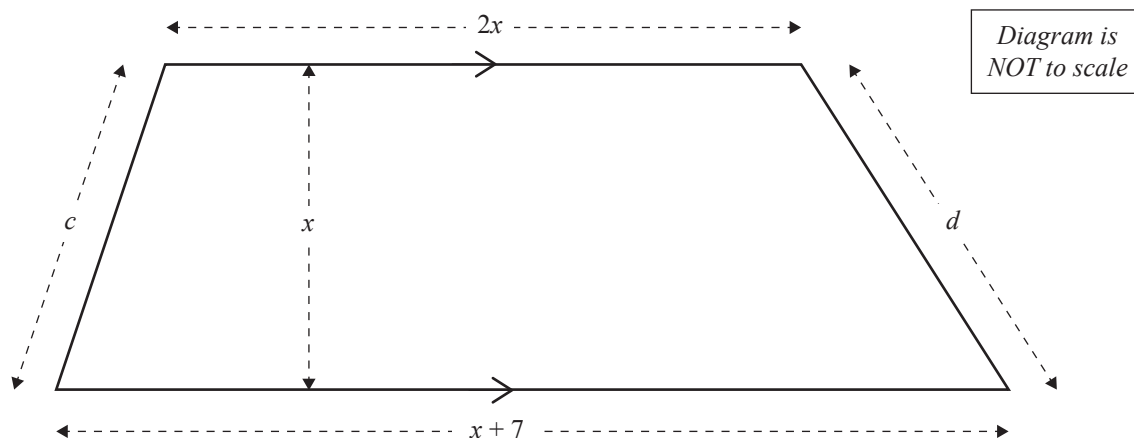(b) Using the set of axes provided below, draw the two graphs of $y = 3x^2 - 14x - 120$ and $y = 10x + 24$.

Using your graphs, solve the equation $3x^2 - 14x - 120 = 10x + 24$.

If you need to redraw your response, use the grid on page 12.
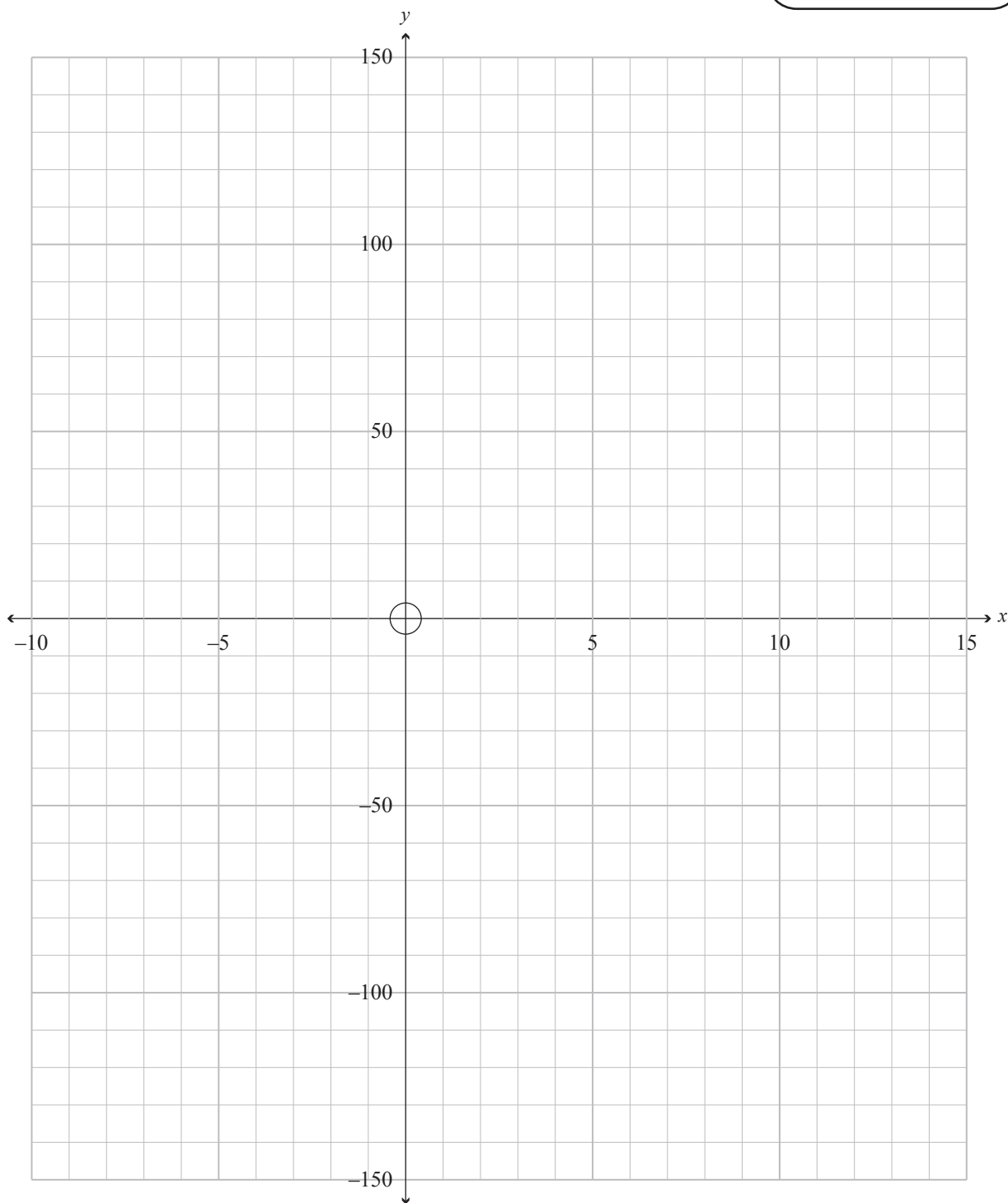
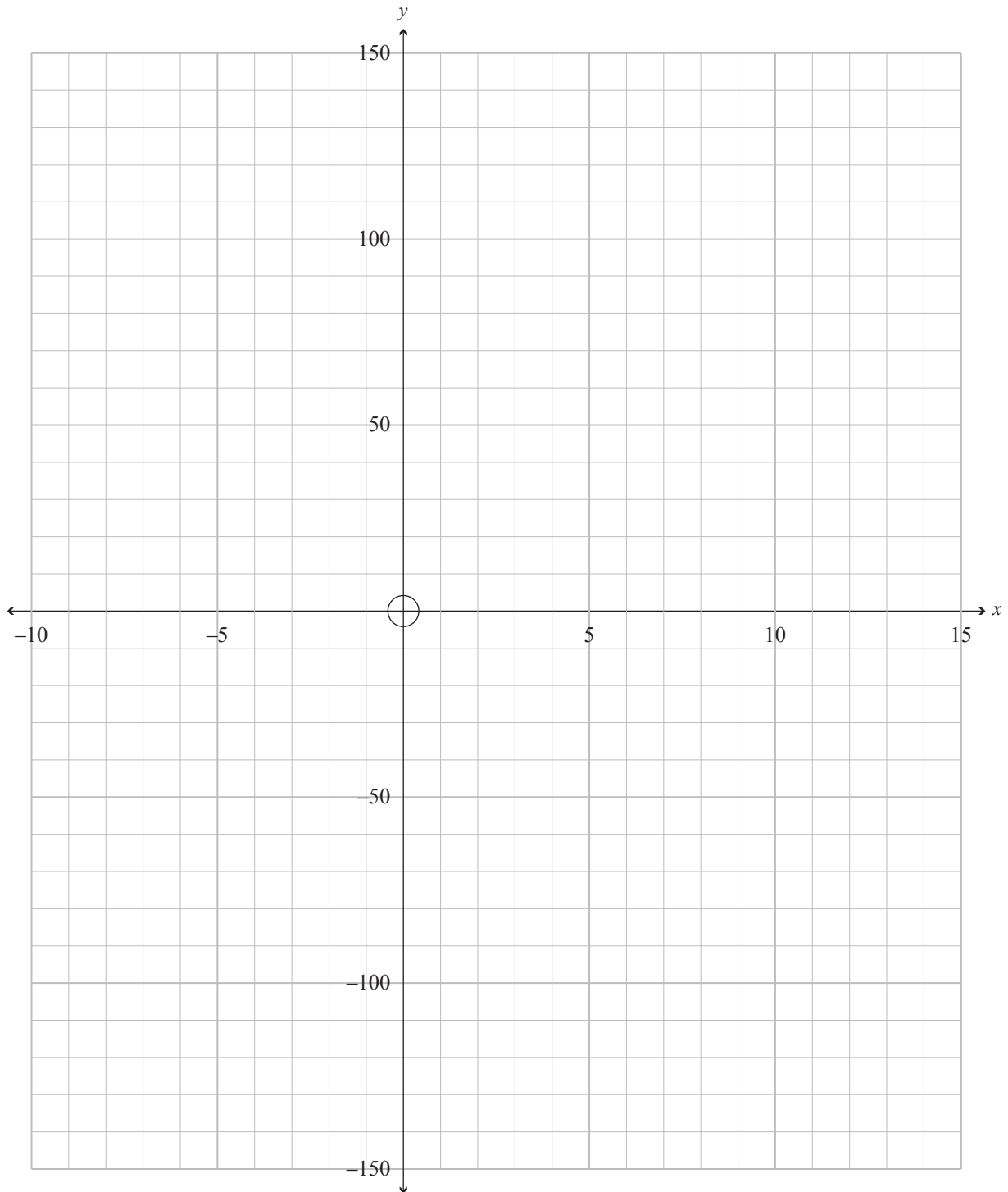(c)   The diagram below shows a trapezium with area of 20 m².

All lengths are in metres.

Diagram is NOT to scale

Find the value of x.

Support your answer with full mathematical working.

SPARE DIAGRAM

If you need to redraw your response to Question Three (b), use the diagram below. Make sure it is clear which answer you want marked.

Extra space if required.
Write the question number(s) if applicable.

QUESTION
NUMBER

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER	

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