No part of the candidate's evidence in this exemplar material may be presented in an external assessment for the purpose of gaining an NZQA qualification or award.

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Mathematics and Statistics RAS 2023

91947 Demonstrate mathematical reasoning

EXEMPLAR

Achievement

TOTAL 07

QUESTION ONE

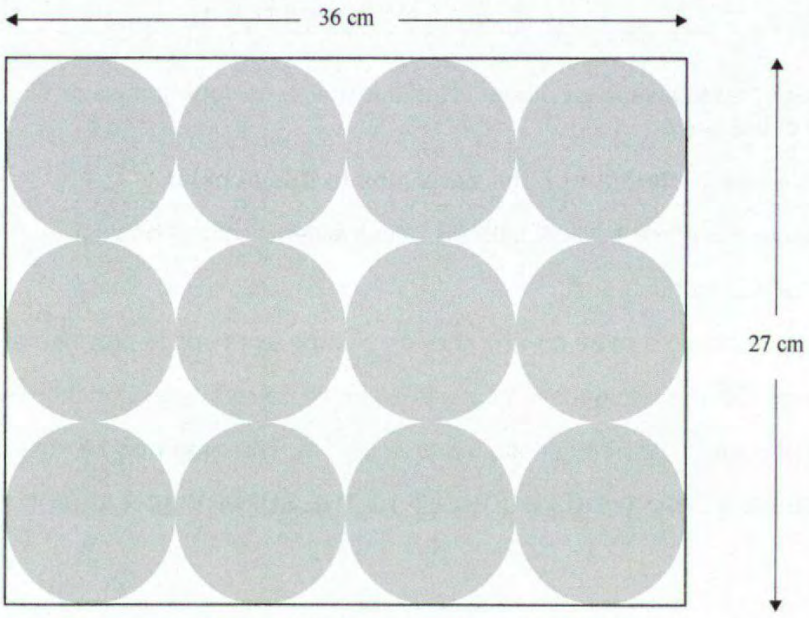
(a) Find the value of T in the formula $T = \pi\sqrt{\dfrac{h\sin x}{g}}$ when $h = 2.5$, $g = 9.81$, $x = 75°$,

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

$\pi\sqrt{\frac{2.5\sin 75}{9.81}} = T = 1.5587$ (4 d.p.)

(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



Source: https://www.thewarehouse.co.nz/p/watties-condensed-tomato-soup-420g/R930548.html

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

radius

36 cm ÷ 4 = 9 cm ÷ 2 = 4.5 cm

27 cm ÷ 3 = 9 cm

$2\pi r = 2 \times \pi \times 4.5 = 28.27$ cm (2 d.p.)

Base x height = area

area

28.27 cm x 15 cm = 424.05 cm^2 x 12

$A \times N = TA$ 424.05 x 12 = 5088.6 cm^2

area → A

N ↑ number of tins

TA ↑ total area

(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 $\frac{(4-\pi)}{4}$.

volume area of box

h x w x L = ~~ar~~ volume

15 x 27 x 36 = 14580 cm^2

$\pi r^2 h$ = ~~area~~ Volume of 1 can

$\pi \times 4.5^2 \times 15 = 954.26$ (2 d.p.) x 12 = 11451.11 (2 d.p.) cm^2

~~area~~ ~~cab-a~~

Vb − Vc = Vbwoc ← volume of box with out Cans

Vb ↑ volume of box

Vc ↑ volume of can

Can

14580 − 11451.11 = 3128.89

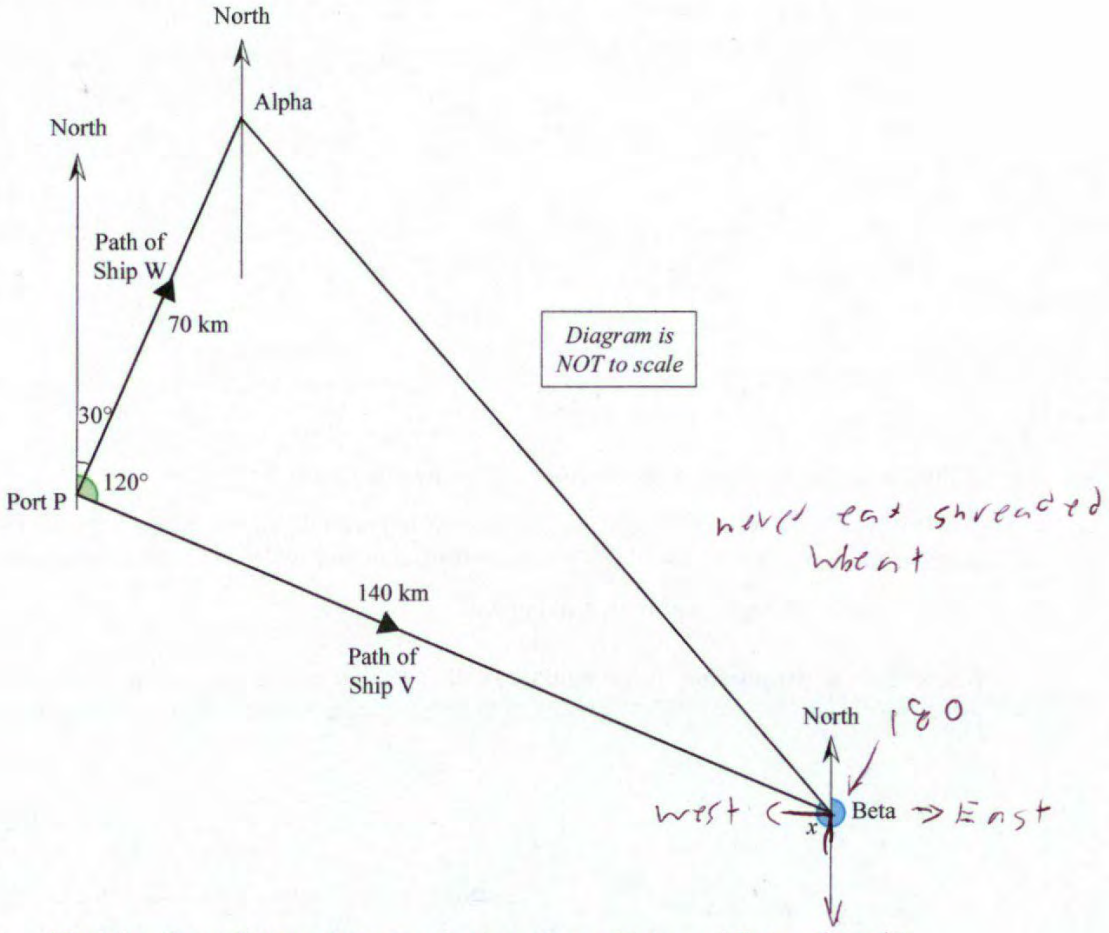
$\frac{(4-\pi)}{4} = 0.2146$

3128.89 x 10000 = 3128.89

(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.



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

$A^2 + B^2 = c^2$ $14^2 + 7^2 = \sqrt{24500} = 156.52$ (2 d.p.)

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

Show your working clearly.

$360 - 180 = 180 - 90 = 90 \div 3 = 30 = 120^\circ$ west

(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.

156.52 km/4 = 39.13 km/hour

V/hr = hours

distance

D/h = K

K + 140 = Time

T = K

D

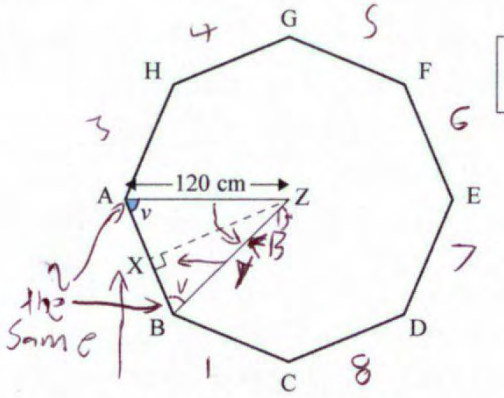
K × 140 = 5478.2

5478.2 = 39.13 km/hour

140

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.



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

Show your working clearly.

Area of all angles = 180° − 67.5° = 112.5°
67.5 ÷ 2 = 1.3.5° because the
line in the centre is 90° so the
angles have to be the same

(ii) Find the area of the octagon.

~~AZ = BZ~~ 120cm + 120cm = 240cm −
~~n = number of sides of a polygon~~
~~opposite = X adjacent~~
adjacent = B
opposite = adjacent × tan x ~~X~~ X
120 × tan x ~~X~~ 13.5 = ~~80cm~~ 28.8
~~80~~ × 28.8 ~~X~~ = ~~Area~~ 120 = 3456cm²
÷2 = 1728 cm²
× 8 = 13824
(n − 2) × 180° = 180

(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.

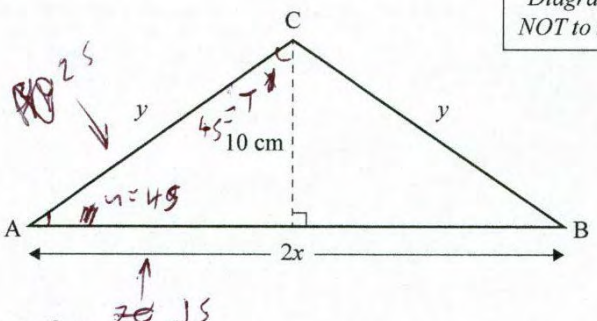
p x AB = Area ÷ 2 x n = area

(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



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

Give your answer in terms of x.

100 ÷ 2 = 50 - 10 = 40

180° - 90 = 90 ÷ 2 = 45°

y = 25 x = 15

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

Support your answer with full mathematical working.

15 x 2 = 30 ~~+ 30cm~~ 30cm x 10 = 300 ÷ 2 = 150cm²

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

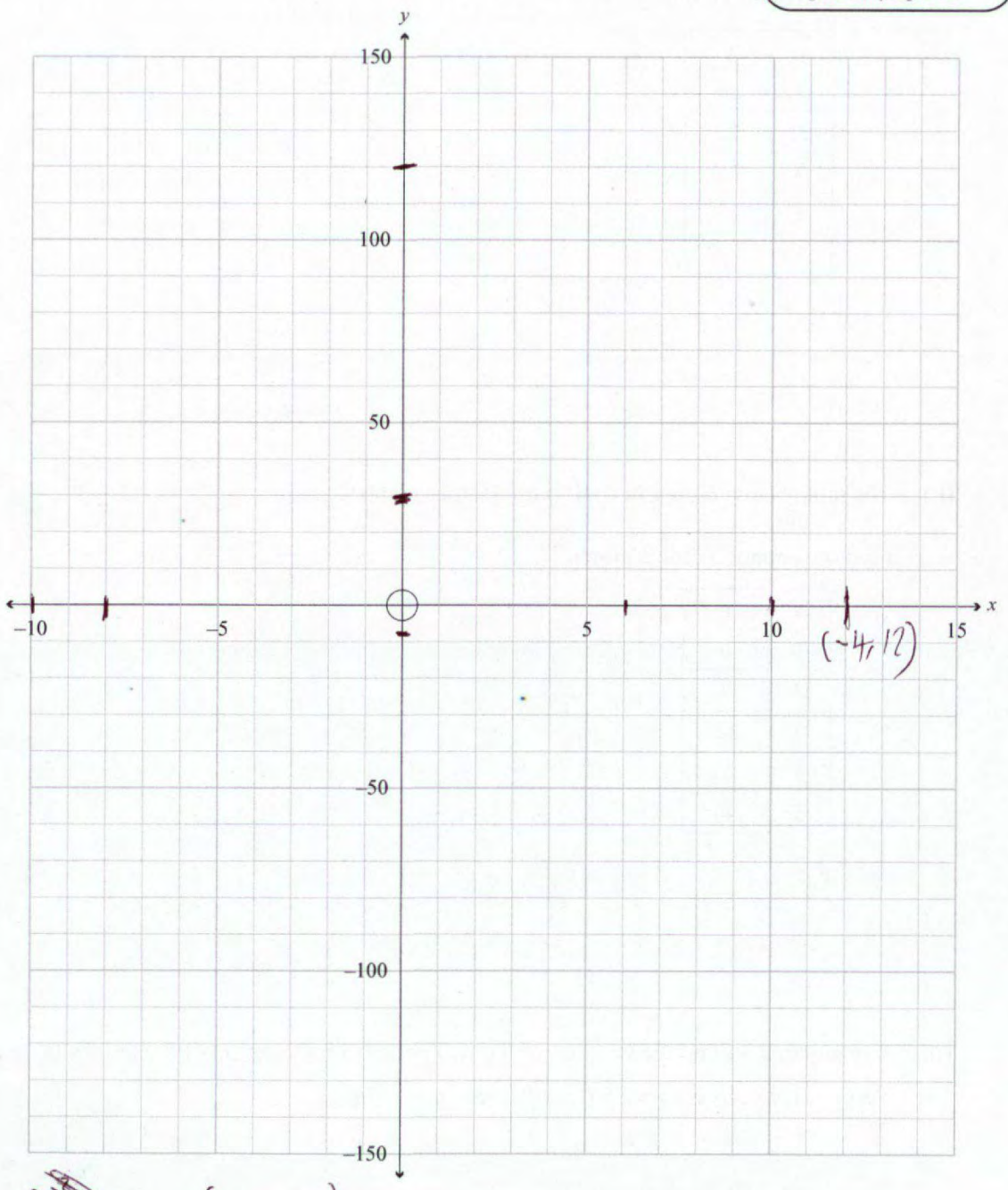
(iii) **Use algebra**, to find the x-values of the two points of intersection of the graphs G_2 and G_1.

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 $3x^2 - 14x - 120 = 10x + 24$.

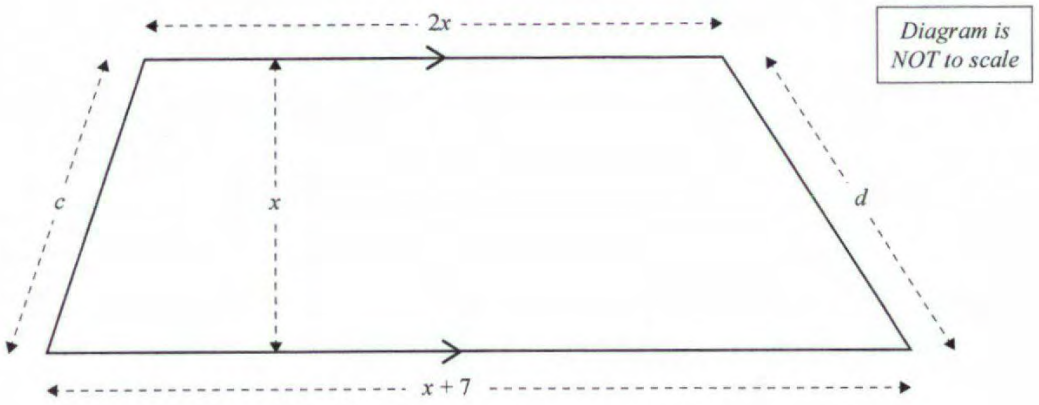
If you need to redraw your response, use the grid on page 12.



(−4, 12)

(c) The diagram below shows a trapezium with area of 20 m^2.

All lengths are in metres.



Find the value of x.

Support your answer with full mathematical working.

$\frac{1}{2}(a+b)h$ $20 \times 2 =$ ~~$20 \times 2 = 40$~~ $40 - 7 = 33$

Solve N

$\frac{1}{2}(2x + x + 7)x \approx -5, \frac{8}{3}$

$(x - 1)(x + 1)$

2 7

1×2 1×7

Achievement

Subject: Mathematics and Statistics

Standard: 91947

Total score: 07

Q	Grade score	Marker commentary
One	M5	(a) Correct answer. (b)(i) Correct answer. (b)(ii) Incorrect answer. (c)(i) Correct answer with appropriate working. (c)(ii) Incorrect answer. (c)(iii) Incorrect answer.
Two	N0	(a)(i) Incorrect answer. (a)(ii) Incorrect answer. (a)(iii) Incorrect answer. (b)(i) Incorrect answer. (b)(ii) Incorrect answer.
Three	N2	(a)(i) Correct answer. (a)(ii) Incorrect answer. (a)(iii) Incorrect answer. (b) Incorrect answer. (c) Did not set up correct equation or consistent factorisation (must show = 20).