AQA H Jun'23 P3

Do not write outside the box

Answer **all** questions in the spaces provided.

1 The line with equation $y = 2x + 7$ intersects the y-axis at A.

Complete the coordinates of A.

[1 mark]

$y = mx + c$

Answer (0 , 7)

2 Write down a fraction equivalent to 1.875

[1 mark]

Answer $\frac{1875}{1000}$ or $\frac{15}{8}$ or $1\frac{7}{8}$ etc

3 Solve $5x + 11 = 3x + 19$

[2 marks]

$2x = 8$

$x = 8 \div 2$

$x =$ 4

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4 A map has a scale of 1 : 5000

How many **metres** are represented by a length of 4.5 cm on the map?

[2 marks]

$4.5 \times 5000 = 22500$ cm

÷100

Answer 225 m

5 The number of hedgehogs in England is expected to **reduce** by 4% each year.
Assume there are now 1 000 000 hedgehogs in England.

Work out the expected number of hedgehogs in England after **five** years.
You **must** show your working.

[3 marks]

$1000000 \times 0.96^5 = 815372.7$

Answer 815373

[ms 800,000 → 820,000]

9

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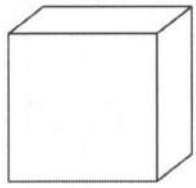
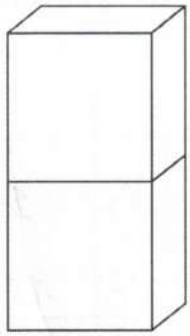
6 Here is cuboid A.

A



Cuboid B is made from **two** of cuboid A.

B



volume of A : volume of B = 1 : 2

Matthew says,

"surface area of A : surface area of B must be 1 : 2 because B is made of 2 of A."

Is Matthew correct?

Tick **one** box.

☐ Yes ☑ No ☐ Cannot tell

Give a reason for your answer.

[2 marks]

A = 6 faces
B = 10 faces (2 are hidden)

A : B
= 6 : 10
= 3 : 5

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7 (a) Complete the table of values for $y = x^2 + 2x$

[2 marks]

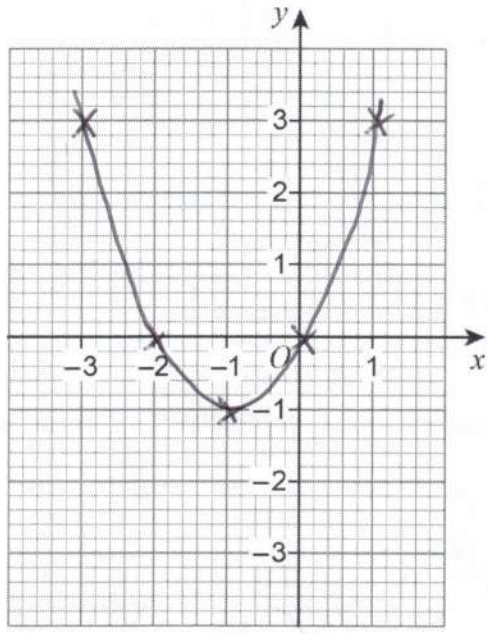
$y = 1^2 + 2 \times 1 = 3$

x	–3	–2	–1	0	1
y	3	0	–1	0	3

$y = (-2)^2 + 2(-2) = 0$

7 (b) Draw the graph of $y = x^2 + 2x$ for values of x from –3 to 1

[2 marks]



Turn over for the next question

6

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8 Jing has £2450

She saves some and gives the rest to her four brothers.

money saved : money given to brothers = 2 : 5

She gives each of her **four** brothers the **same** amount.

Does each brother receive more than £430 ?

You **must** show your working.

[4 marks]

$\frac{5}{7} \times 2450 = 1750$

$1750 \div 4 = £437.50$ each

so YES $> £430$

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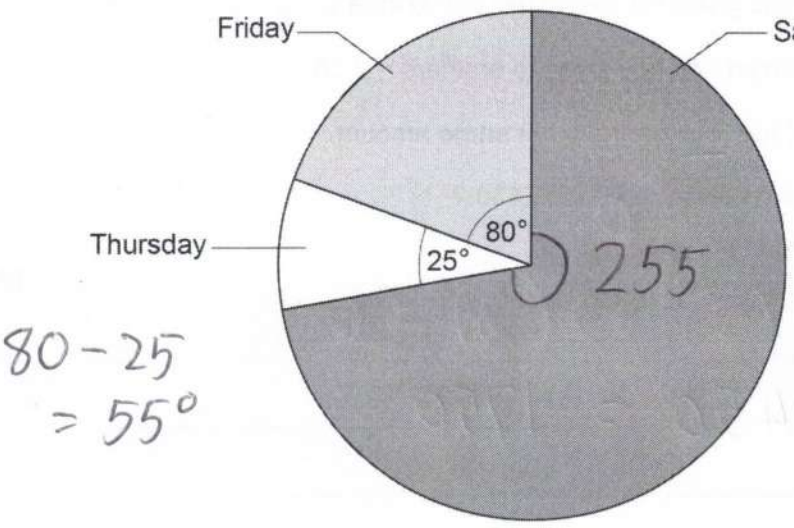
9 The pie chart shows information about people at a fair during three days.

Not drawn accurately



80 − 25
= 55°

There were 132 **more** people on Friday than on Thursday.

Work out the number of people on Saturday.

[3 marks]

55° = 132
5° = 12
360 = 864 total

Sat = $\frac{255}{360}$ × 864

612

Answer _____

Turn over for the next question

7

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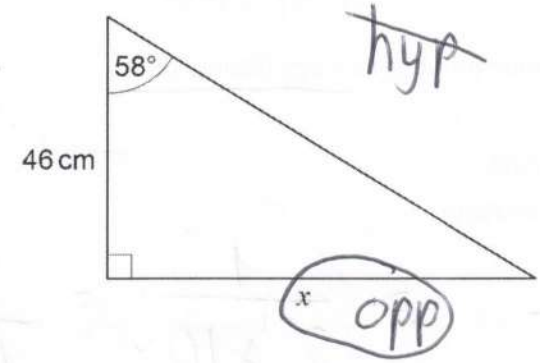
10 Use trigonometry to work out the value of x.

Not drawn accurately



[3 marks]

$x = \tan 58 \times 46$

$= 73.615...$

$x =$ 73.6 cm

[ms 73.6 → 74]

Do not write outside the box

11 Millie is estimating the value of $\dfrac{1}{\left(\sqrt[3]{8.34}\right)^2 \times 10.21}$

She rounds each decimal number to 1 significant figure.

11 (a) Work out Millie's estimate.

You **must** show your working.

[2 marks]

$\dfrac{1}{\sqrt[3]{8^2 \times 10}} = \dfrac{1}{2^2 \times 10} = \dfrac{1}{40}$

Answer $\dfrac{1}{40}$ (or 0.025)

11 (b) Millie says,

"My estimate must be more than the exact value."

Without working out the exact value, give a reason how she can know this.

[1 mark]

Both digits were rounded down → denominator became smaller making our answer larger than it actually is

6

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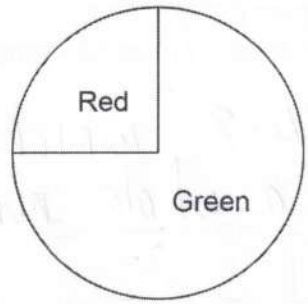
12 Here is a **biased** spinner.



12 (a) Ali, Ben and Cary want to know the probability of spinning red on the biased spinner.

They each spin it and count how many times it lands on red and divide by the total number of spins.

Ali says — I spun red the most times

Ben says — I spun the spinner the most times

Cary says — My relative frequency of red is 0.25

Who had the best estimate for the probability of spinning red?

Give a reason for your answer.

[1 mark]

Ben → most trials = most reliable

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12 (b) Dev spins the spinner 80 times.

He says,

"My relative frequency of red is 0.185"

Give a reason why his relative frequency must be wrong.

[1 mark]

$80 \times 0.185 = 14.8$ which should be a whole number

12 (c) Elena spins the spinner 125 times.

The relative frequency of red is 0.32

Work out how many times the spinner landed on **green**.

[2 marks]

$125 \times 0.68 = 0.68$

125×0.68

Answer 85

Turn over for the next question

4

Do not write outside the box

13 Charlie is driving 293 miles home.

He

- leaves at 9.00 am
- travels the first 176 miles at an average speed of 48 mph
- drives the rest of the way at an average speed of 65 mph

Will he be home by 2.30 pm?

You **must** show your working.

[4 marks]

(A) $T = \frac{176}{48} = 3\frac{2}{3}\text{hr} = 3\text{hr } 40\text{m}$

(B) $T = \frac{293 - 176}{65} = 1\frac{4}{5}\text{hr} = 1\text{hr } 48\text{m}$

9am + 3hr + 1hr = 1pm

1pm + 40m + 48m = 2:28pm

so YES he's home by 2:30pm

Do not write outside the box

14 Kiran paid Income Tax and National Insurance on her annual salary.

Income Tax
0% of the first £12 570 of her annual salary
20% of the rest of her annual salary

National Insurance
0% of the first £9880 of her annual salary
13.25% of the rest of her annual salary

Kiran paid £5186 Income Tax.

How much National Insurance did she pay?

[4 marks]

(I.T.) 5186 = 20%

25930 = 100% = taxed income

Total inc = 12570 + 25930 = £38500

NI to pay = $(38500 - 9880) \times \frac{13.25}{100}$

= 3792.15

Answer £ 3792.15

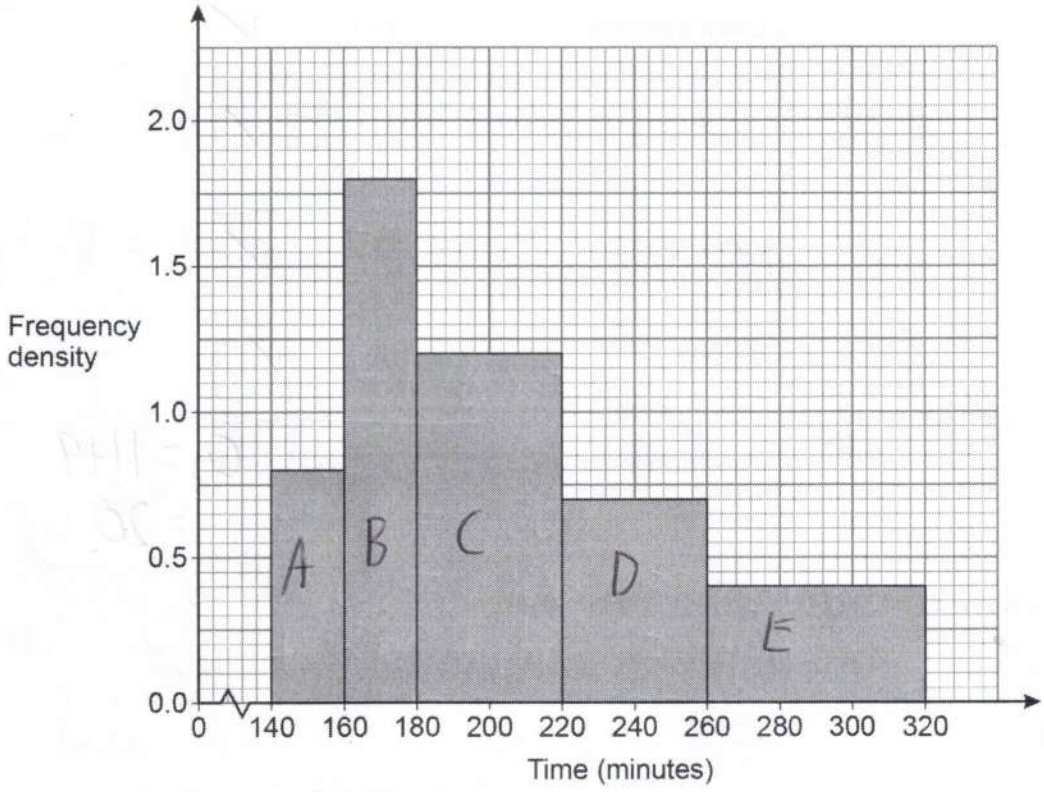
8

Do not write outside the box

15 180 runners **started** a marathon.

Some of the runners did not complete it.

15 (a) The histogram represents the times of the runners who did complete the marathon.



How many runners did **not** complete the marathon?

[3 marks]

A = 20 × 0·8 = 16
B = 20 × 1·8 = 36
C = 40 × 1·2 = 48
D = 40 × 0·7 = 28
E = 60 × 0·4 = 24

} 152

180 − 152

Answer 28

Do not write outside the box

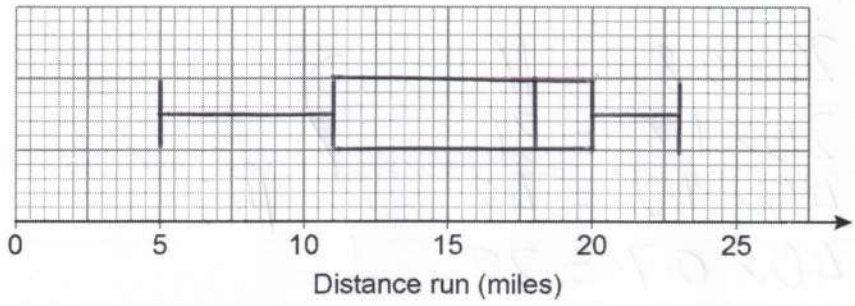
15 (b) The table shows information about the runners who did **not** complete the marathon.

	Distance run (miles)
Least distance	5
Greatest distance	23
Lower quartile	11
Median	18
Interquartile range	9

$Q_3 = 11 + 9$
$= 20$

Draw a box plot to represent the information.

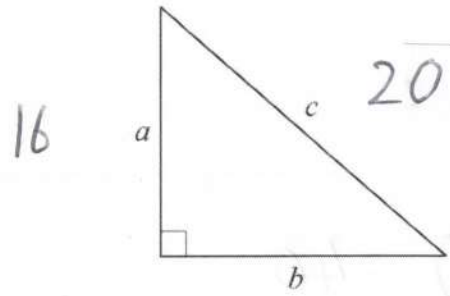
[3 marks]



$\pm \frac{1}{2}$ sq

6

16



Not drawn accurately

In this right-angled triangle,

$a = 16\,\text{cm}$

$a : c = 4 : 5$

Work out the area of the triangle. ×4

(16 20)

[4 marks]

$b = \sqrt{20^2 - 16^2} = \sqrt{144} = 12$

$\text{Area} = \frac{1}{2} \times 12 \times 16$

Answer 96 cm^2

Do not write outside the box

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17 Solve $\frac{x+8}{2} + \frac{9-x}{5} = 4$

[4 marks]

(×10)

$5(x+8) + 2(9-x) = 40$

$5x + 40 + 18 - 2x = 40$

$3x = -18$

$x = -18 \div 3$

$x = -6$

Turn over for the next question

8

Do not write outside the box

18 $f(x) = x^2 + 6x$

$g(x) = 2x + 4$

18 (a) Show that $fg(x) = 4x^2 + 28x + 40$ **[3 marks]**

$fg(x) = f(2x+4) = (2x+4)^2 + 6(2x+4)$

$= 4x^2 + 16 + 16x + 12x + 24$

$= 4x^2 + 28x + 40$

18 (b) Solve $fg(x) = -5$ **[3 marks]**

$4x^2 + 28x + 40 = -5$

$4x^2 + 28x + 45 = 0$

$(2x + 5)(2x + 9) = 0$

Answer $x = -\frac{5}{2}$, $x = -\frac{9}{2}$ (OE)

Do not write outside the box

19 A Two integers have a difference of 6

B The integers are multiplied together.

C 9 is then added.

D Prove algebraically that the result is always a square number.

[3 marks]

A x and $x-6$

B $x(x-6)$

C x^2-6x+9

D $\Rightarrow (x-3)^2 \Rightarrow$ always a square number

Turn over for the next question

9

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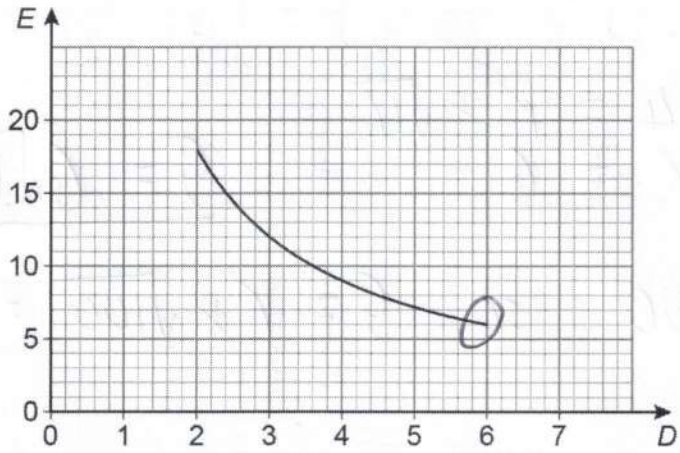
20 (a) Sunil thinks that E and D are linked by the equation $E = \frac{36}{D}$

The graph shows the values of D and E for $2 \leqslant D \leqslant 6$



(6, 6)

Choose **one** point on the graph and state if Sunil's equation is correct for that point.

[1 mark]

$6 = \frac{36}{6}$ YES, correct

Do not write outside the box

20 (b) G is directly proportional to the square root of H.

$G : H = 3 : 2$ when $H = 16$

Work out $G : H$ when $H = 100$

[4 marks]

$G = K \times \sqrt{H}$

$H = 16 \quad G = 3 \times 8 = 24$

so $24 = K \times \sqrt{16}$

$K = 6 \qquad G = 6\sqrt{H}$

$H = 100 \quad$ so $\quad G = 6 \times \sqrt{100} = 60$

$G : H$

$60 : 100$

OE

Answer 3 : 5

Turn over for the next question

5

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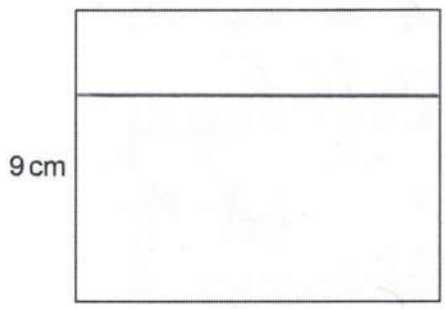
21 A solid shape is made from centimetre cubes.

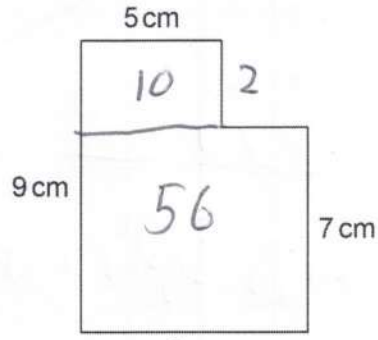
The front elevation and side elevation of the shape are shown.

Not drawn accurately

Front elevation



Side elevation



Work out

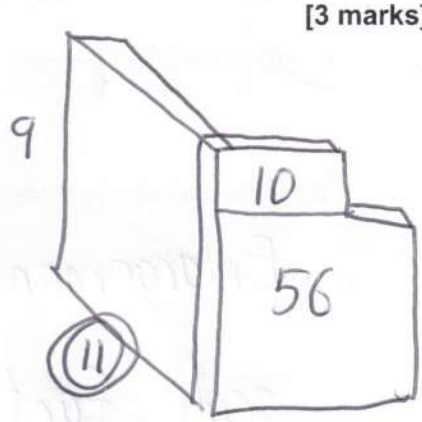
the **maximum** possible number of cubes in the shape

and

the **minimum** possible number of cubes in the shape.

[3 marks]

Full = (10+56)x12



Maximum 792 Minimum 165

Min = (9x11)+10+56

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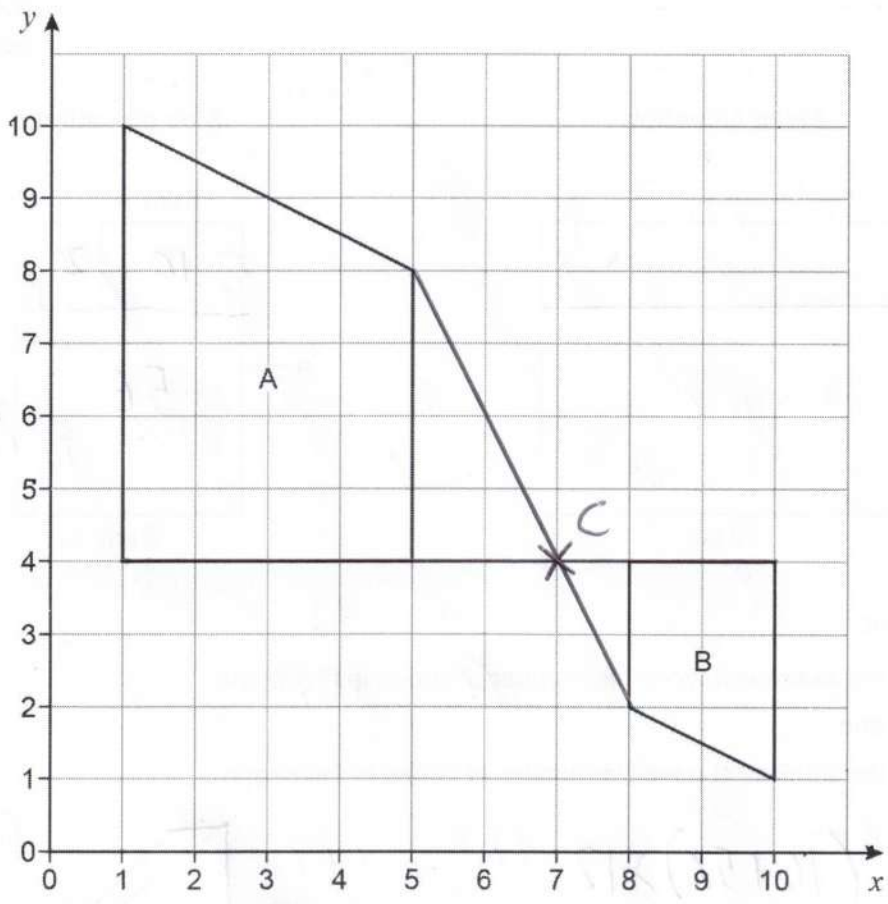
22 Shape A and shape B are shown on the grid.



Describe the **single** transformation that maps shape A to shape B.

[3 marks]

Enlargement ✓

scale factor = $-\frac{1}{2}$ ✓

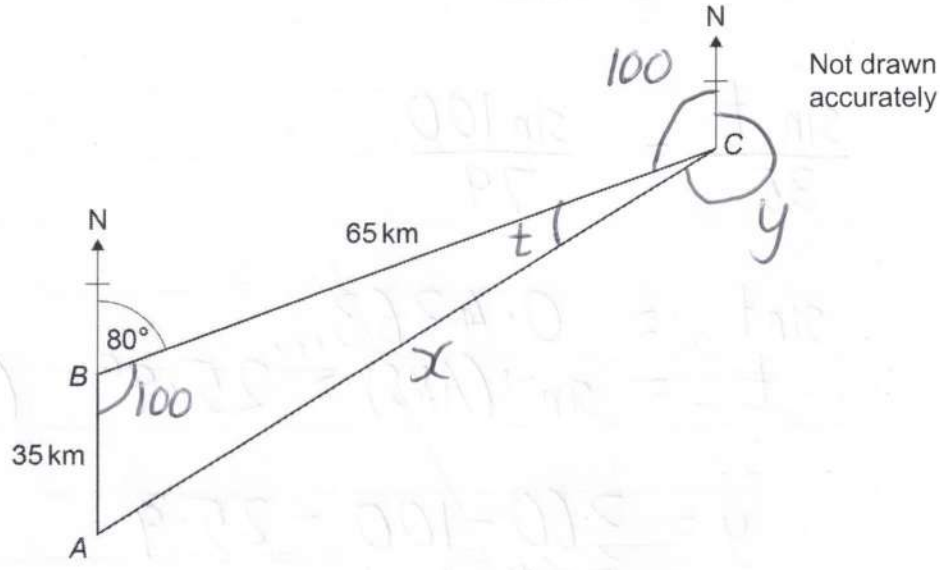
Centre (7,4) ✓

6

Turn over ▶

Do not write outside the box

23



A boat sails 35 km North from *A* to *B*.

From *B* the boat sails to *C* and then back to *A*.

23 (a) Show that the distance the boat sails from *C* to *A* is 79 km to the nearest km

You **must** show your working.

[2 marks]

$x^2 = 65^2 + 35^2 - 2 \times 65 \times 35 \times \cos 100$

$x^2 = 6240.099...$

$x = 78.994...$

$x = 79$ (nearest km)

Do not write outside the box

23 (b) Work out the bearing of A from C.

[4 marks]

$$\frac{\sin t}{35} = \frac{\sin 100}{79}$$

$$\sin t = 0.4363\ldots$$

$$t = \sin^{-1}(\text{ANS}) = 25.9^\circ \quad (1\text{dp})$$

$$y = 360 - 100 - 25.9$$

$$= 234.1$$

Answer 234 °

END OF QUESTIONS

6

Do not write outside the box

23 (b) Work out the bearing of A from C.

[4 marks]

$$\frac{\sin t}{35} = \frac{\sin 100}{79}$$

$$\sin t = 0.4363\ldots$$

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Answer 234 °

END OF QUESTIONS

6