AQA H | Jun '23 | P2

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

Do not write outside the box

1 Write 30 : 12 in the form n : 1

[1 mark]

30 ÷ 12

Answer 2.5 : 1

2 Four consecutive triangular numbers are 6 10 15 21

Write down the next triangular number.

[1 mark]

+4, +5, +6, +7

Answer 28

Do not write outside the box

3 Write down the reciprocal of $\frac{4}{7}$

[1 mark]

Answer $\frac{7}{4}$ or $1\frac{3}{4}$ or 1.75

4 The price of a toy increases by 12.5% to £19.53

Work out the **original** price of the toy.

[2 marks]

19.53 ÷ 1.125

Answer £ 17.36

Turn over for the next question

5

Do not write outside the box

5 Jess saves 2p, 5p and 10p coins.

She has

- 45 10p coins
- 8 times as many 2p coins as **10p coins**
- £17.70 in total.

Work out total **value** of 2p coins : total **value** of 5p coins

Give your answer in its simplest form.

[4 marks]

(10) $45 \times 10 = 450$

(2) $45 \times 8 \times 2 = 720$ } 1170p

(5) $17.70 - 11.70 = 600p$

2p : 5p

720 : 600

÷120

Answer 6 : 5

Do not write outside the box

6 (a) Part of a regular polygon is shown.

Not drawn accurately

Assume that the polygon is an octagon. 8

Work out the size of an **exterior** angle.

[2 marks]

360 ÷ 8

Answer 45 °

6 (b) In fact, the polygon has **more** sides than an octagon.

What does this mean about the size of an exterior angle?

Tick **one** box.

[1 mark]

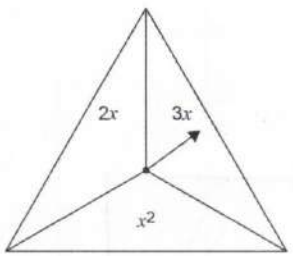
- ☐ It is more than the answer to part (a)
- ☐ It is the same as the answer to part (a)
- ☑ It is less than the answer to part (a)
- ☐ It could be any of the above

7

Do not write outside the box

7 In a game,

- an ordinary fair six-sided dice is rolled
- the fair spinner shown is spun.



The score is the dice number **substituted** into the spinner expression.

7 (a) Complete the table to show all of the possible scores.

[2 marks]

	1	2	3	4	5	6
$2x$	2	4	6	8	10	12
$3x$	3	6	9	12	15	18
x^2	1	4	9	16	25	36

Do not write outside the box

7 (b) A player wins the game if their score is 10 or more.

Work out the probability that they win the game.

[1 mark]

Answer $\frac{8}{18}$ or $\frac{4}{9}$ etc

7 (c) The game is played 711 times.

Estimate the number of games that are won.

[2 marks]

$711 \times \frac{4}{9}$

Answer 316

8 $(a-3)x^2 + 2b \equiv 5x^2 + 12$

Work out the values of a and b.

[2 marks]

$a-3=5$ $\quad 2b=12$

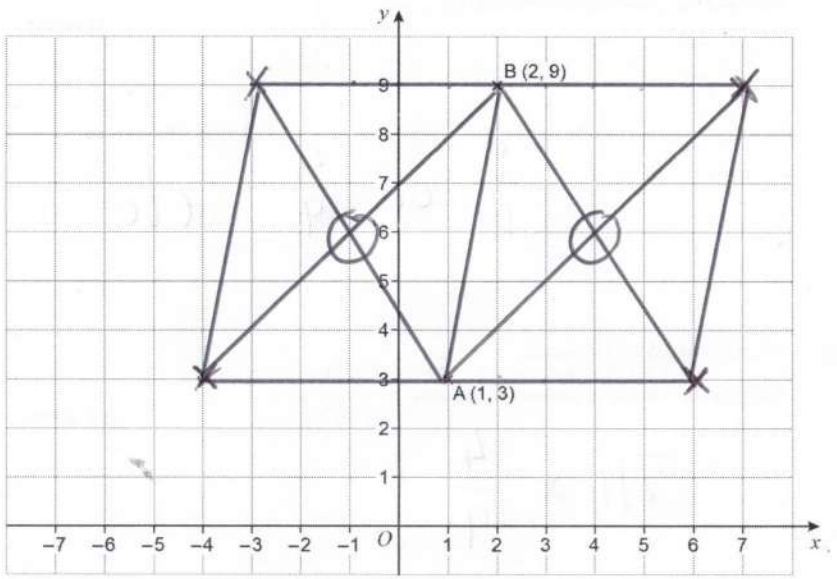
$a =$ 8 $\quad b =$ 6

7

Turn over ►

Do not write outside the box

9 A (1, 3) and B (2, 9) are points on a centimetre grid.



ABCD is a parallelogram.

AD and BC are **horizontal** and each has length 5 cm

The diagonals of ABCD cross at E.

Work out the **two** possible pairs of coordinates of E.

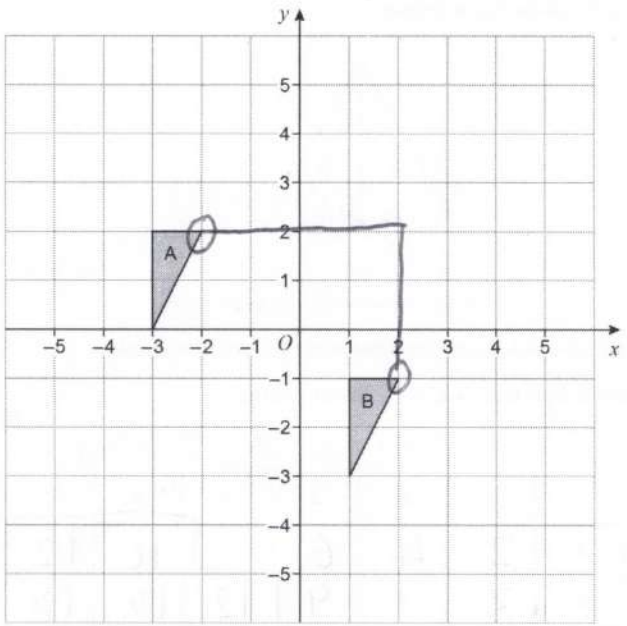
[4 marks]

Answer (-1 , 6) and (4 , 6)

Do not write outside the box

10 Write down the translation vector that maps shape A onto shape B.

[2 marks]



Answer $\begin{bmatrix} 4 \\ -3 \end{bmatrix}$

6

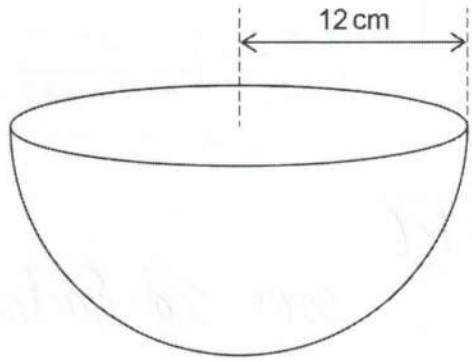
Turn over ▶

Do not write outside the box

11

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

A bowl is a hemisphere with radius 12 cm



Water is poured into the bowl

at a rate of 325 cm^3 per second

for 8 seconds.

Does the water fill **more than** 70% of the bowl?

You **must** show your working.

[4 marks]

$V = \frac{1}{2} \times \frac{4}{3} \times \pi \times 12^3 = 1152\pi \text{ cm}^3$

$0.7 \times 1152\pi = \frac{4032}{5}\pi \text{ cm}^3$

$= 2533.38 \text{ cm}^3$

$8 \times 325 = 2600 \text{ cm}^3$

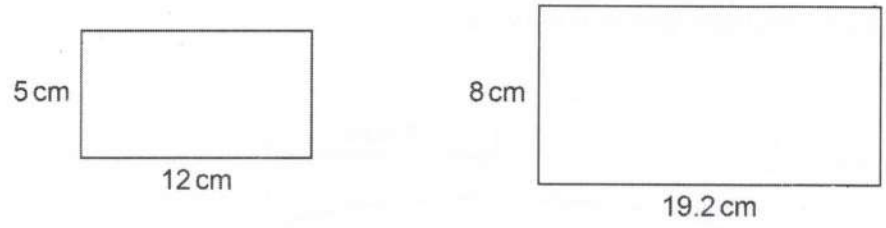
SO YES

Do not write outside the box

12 Show that these two rectangles are similar.

[2 marks]

Not drawn accurately



$8 \div 5 = 1.6$

$19.2 \div 8 = 1.6$

same scale factor hence similar

13 A factory packs x boxes of teabags per hour.

Each box contains 80 teabags.

Show that the factory packs $\frac{4x}{3}$ teabags per minute.

[2 marks]

x boxes $= 60$ min

so $80x = 60$ min

$8x = 6$ min

1 min $= \frac{8x}{6} = \frac{4x}{3}$

Turn over for the next question

8

Do not write outside the box

14 A company has 123 employees.

Information about their hourly rates of pay is shown in the table.

Hourly rate, £p	Number of employees
$10 \leqslant p < 14$	66
$14 \leqslant p < 20$	32
$20 \leqslant p < 40$	15
$40 \leqslant p < 100$	10
	Total = 123

The owner of the company uses the data to make two statements.

Statement A

"Over 30% of employees have an hourly rate that is more than £17"

Statement B

"The average hourly rate of pay is more than £20"

14 (a) Show working that supports **Statement A**.

[3 marks]

(>17) = 10 + 15 + $\frac{1}{2}$ x 32 = 41

$\frac{41}{123}$ x 100 = 33.3%

Do not write outside the box

14 (b) Why might **Statement A not** be true?

[1 mark]

The 32 people in the $14 \leqslant p < 20$ group could earn 14, 15, or 16 £

14 (c) Work out an estimate of the mean to support **Statement B**.

[3 marks]

$12 \times 66 = 792$

$+$

$17 \times 32 = 544$ $= 2486$

$+$

$30 \times 15 = 450$ $\frac{2486}{123}$ £20·21...

$+$

$70 \times 10 = 700$

14 (d) Why is the mean **not** the best average to represent the data?

[1 mark]

Over half earned $10 \leqslant p < 14$ so the median is in this group

or

The mean is skewed by the high earners

. etc

8

Do not write outside the box

15 Expand $(x^2 - 9xy)(2x + 5y)$

[2 marks]

$2x^3 + 5x^2y - 18x^2y - 45xy^2$

Answer $2x^3 - 13x^2y - 45xy^2$

16 Line A

has equation $y = ax - 1$

passes through the point (7, 13)

Line B has equation $5y - 3x = 4$

Show that line A has a greater gradient than line B.

[3 marks]

(A) $13 = 7a - 1$

$14 = 7a$ so $a = 2$

$y = 2x - 1$ so $m = 2$

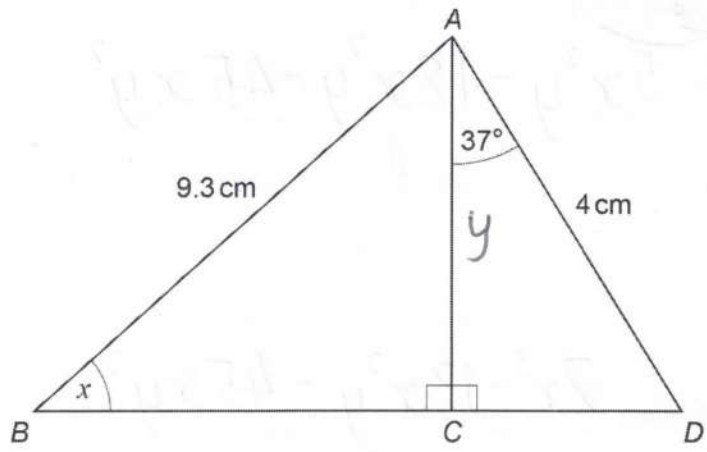
(B) $5y = 3x + 4$

$y = \frac{3}{5}x + \frac{4}{5}$ so $m = \frac{3}{5}$

$2 > \frac{3}{5}$

Do not write outside the box

17



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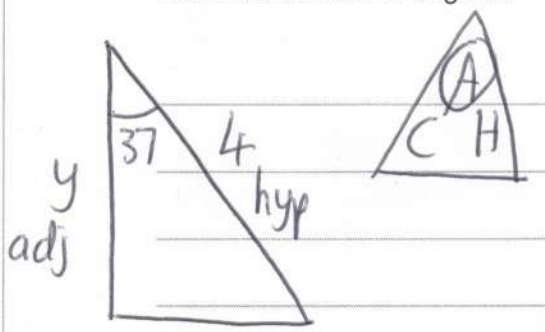
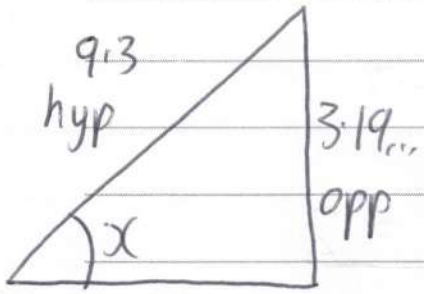
Work out the size of angle x.

[4 marks]



$y = \cos 37 \times 4$

$= 3.1945...$



$x = \sin\left(\frac{3.1945...}{9.3}\right)$

$= 20.090...$

$x =$ 20.1° (1dp)

9

Do not write outside the box

18 Rearrange $y = \frac{x+8}{x}$ to make x the subject.

[3 marks]

$xy = x + 8$

$xy - x = 8$

$x(y-1) = 8$

Answer $x = \frac{8}{y-1}$

Do not write outside the box

19 Here are the first four terms of a quadratic sequence.

S = 3 20 47 84

Work out an expression for the nth term of the sequence.

[4 marks]

17 27 37

10 10 (10 ÷ 2 = 5)

$5n^2$ = 5 20 45 80

$5 - 5n^2$ = -2 0 2 4

+2 +2 +2 -4

$2n$ = 2 4 6 8

Answer $5n^2 + 2n - 4$

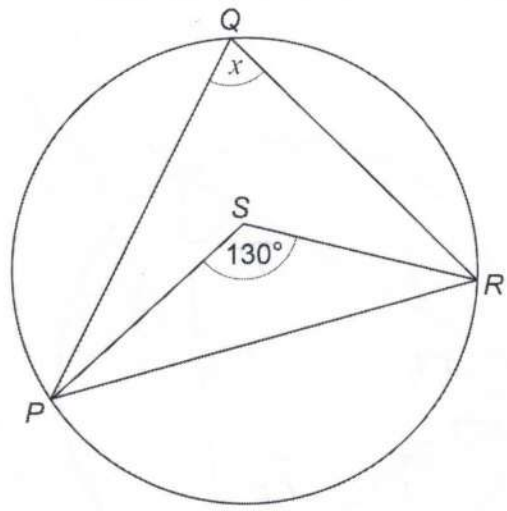
7

Do not write outside the box

20 (a) *P*, *Q* and *R* are points on a circle.

S is a point inside triangle *PQR*.

Not drawn accurately



Assume that *S* is the centre of the circle.

Work out the size of angle x.

[1 mark]

130 ÷ 2

$x =$ 65 °

20 (b) In fact, the centre of the circle is on *PS* but **not** at *S*.

What does this mean about the size of angle x ?

Tick **one** box.

[1 mark]

- ☐ It is the same as the answer to part (a)
- ☑ It is greater than the answer to part (a)
- ☐ It is smaller than the answer to part (a)
- ☐ It is impossible to tell

Do not write outside the box

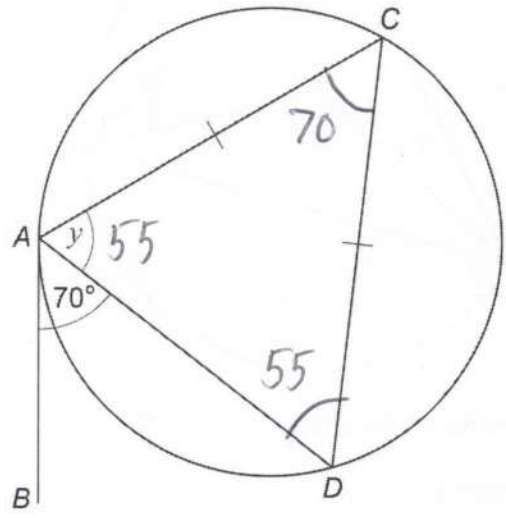
20 (c) For a different circle,

AB is a tangent at A

C and D are on the circumference of the circle

$AC = CD$

Not drawn accurately



180−70 = 110

$\frac{110}{2} = 55$

Here is Simon's method to work out the size of angle y.

Angle $ADC = 70°$ (alternate segment theorem)
Therefore $y = 70°$ (angles in an isosceles triangle)

Is he correct? NO

Give a reason for your answer.

[1 mark]

<ACD = 70 (alt. segment theorem)

y = 55 (isosceles)

3

Do not write outside the box

21 Magana decides to put £500 into an account that pays compound interest.

She wants to have **at least** £560 in the account after 3 years.

Work out to 1 decimal place the **minimum** annual interest rate she needs.

[3 marks]

$500 \times x^3 = 560$

$x = \sqrt[3]{\frac{560}{500}} = 1.03849...$

$\times 100$

$= 103.84$

needs MORE than 3.8%

Answer 3.9 %

Do not write outside the box

22 An approximate value of a root of an equation, x, can be found using the iterative formula

$$x_{n+1} = \sqrt[3]{5(x_n)^2 - 2x_n - 3}$$

The starting value is $x_1 = 4$

22 (a) Work out the values of x_2 and x_3

[2 marks]

$x_2 = \sqrt[3]{5 \times 16 - 2 \times 4 - 3}$

$x_3 = \sqrt[3]{5 \times ANS^2 - 2 \times ANS - 3}$

$x_2 =$ 4·101 (3dp)

$x_3 =$ 4·178 (3dp)

22 (b) By continuing the iteration, show that the value of x is more than 4.25

[1 mark]

$x_4 = 4{\cdot}23$ (2dp)

$x_5 = 4{\cdot}27$ (2dp)

6

Do not write outside the box

Which option gives a better chance of winning?

Option 1 ✓ Option 2 ☐

Show working to support your answer.

[4 marks]

① need 5,5 $\Rightarrow \frac{3}{8} \times \frac{2}{7} = \frac{3}{28} = 0.10714...$

② B4/C6 or B6/C4

$\Rightarrow \left(\frac{1}{7} \times \frac{1}{4}\right) + \left(\frac{1}{7} \times \frac{1}{4}\right) = \frac{2}{28} = 0.0714...$

Turn over for the next question

4

Do not write outside the box

24 $a = 65$ to the nearest integer

$b = 30$ to 1 significant figure

Work out the **upper bound** for $2a^2 - b^2$

You **must** show your working.

[3 marks]

(a) $65 \begin{cases} 65.5 \\ 64.5 \end{cases}$ (b) $30 \begin{cases} 35 \\ 25 \end{cases}$

$UB = 2(+a)^2 - (-b)^2$

$= 2 \times 65.5^2 - 25^2$

Answer 7955.5

Do not write outside the box

25 Show that $\frac{x-5}{x-2} + \frac{x+5}{x+2}$

simplifies to $\frac{ax^2-b}{x^2-4}$ where a and b are integers.

[3 marks]

$$= \frac{(x-5)(x+2)}{(x-2)(x+2)} + \frac{(x+5)(x-2)}{(x-2)(x+2)}$$

$$= \frac{x^2-5x+2x-10+x^2+5x-2x-10}{x^2-2x+2x-4}$$

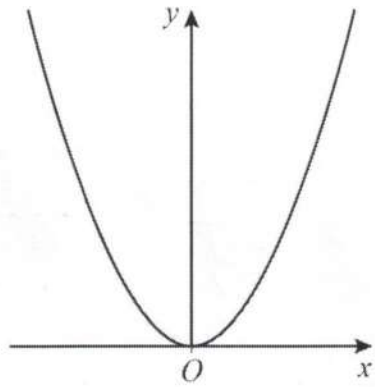
$$= \frac{2x^2-20}{x^2-4}$$

Turn over for the next question

6

Do not write outside the box

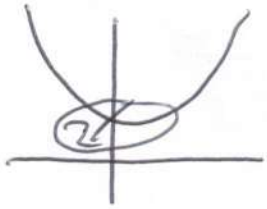
26 Here is a sketch of $y = x^2$



26 (a) The minimum point of $y = x^2$ is at (0, 0)

Write down the coordinates of the minimum point of $y = x^2 + 2$

[1 mark]



Answer (0 , 2)

26 (b) The graph $y = x^2$ is reflected in the x axis.

Write down the equation of the graph after this transformation.

[1 mark]

Answer $y = -x^2$

26 (c) $y = x^2$ is now transformed to give $y = (x + 3)^2$

Describe fully this single transformation.

[2 marks]

Translation with vector $\begin{bmatrix} -3 \\ 0 \end{bmatrix}$

END OF QUESTIONS

4