A

AQA

Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

MATHEMATICS

H

Higher Tier   **Paper 2 Calculator**

8300/2H

Wednesday 7 June 2023   **Morning**

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.
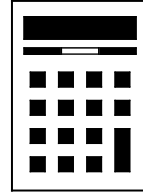
[Turn over]

MATERIALS

For this paper you must have:

- **a calculator**

- **mathematical instruments**

- **the Formulae Sheet (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen. Draw diagrams in pencil.**

- **Answer ALL questions.**

- **You must answer the questions in the spaces provided. Do not write on blank pages.**

- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**

- **Do all rough work in this book. Cross through any work you do not want to be marked.**

INFORMATION

- **The marks for questions are shown in brackets.**

- **The maximum mark for this paper is 80.**

- **You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.**

ADVICE

In all calculations, show clearly how you work out your answer.

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

1 Write 30 : 12 in the form $n : 1$ [1 mark]

_____

_____

_____

Answer _____ **: 1**

2 **Four consecutive triangular numbers are**

6   10   15   21

Write down the next triangular number. [1 mark]

_____

_____

_____

Answer _____

3   Write down the reciprocal of $\frac{4}{7}$ [1 mark]

Answer _____

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

Work out the ORIGINAL price of the toy. [2 marks]

_____

_____

_____

_____

_____

Answer £ _____

[Turn over]

5

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]

Answer _____ : _____

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

The diagram is not drawn accurately.

Assume that the polygon is an octagon.

Work out the size of an EXTERIOR angle.
[2 marks]

_____

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Answer _____ **°**

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)
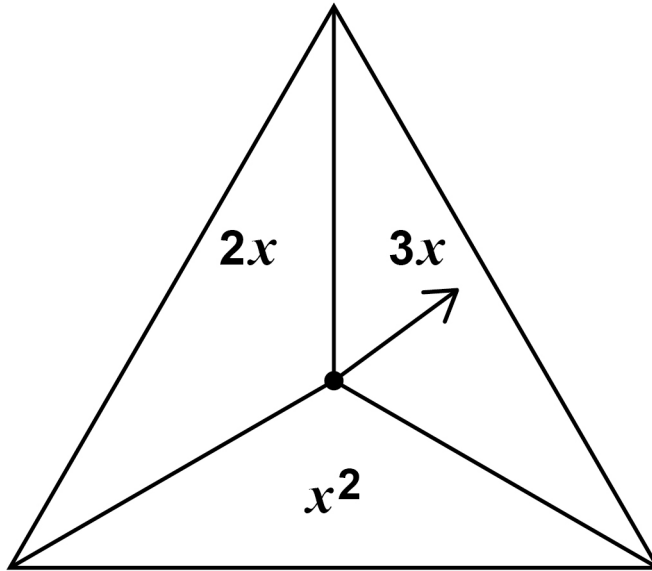
☐ It could be any of the above

[Turn over]

7

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
$2x$				8		
$3x$		6				
x^2					25	

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 _____

[Turn over]

7 (c)   **The game is played 711 times.**

Estimate the number of games that are won.
[2 marks]

Answer _____

8      $(a - 3)x^2 + 2b \equiv 5x^2 + 12$
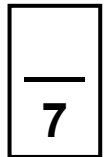
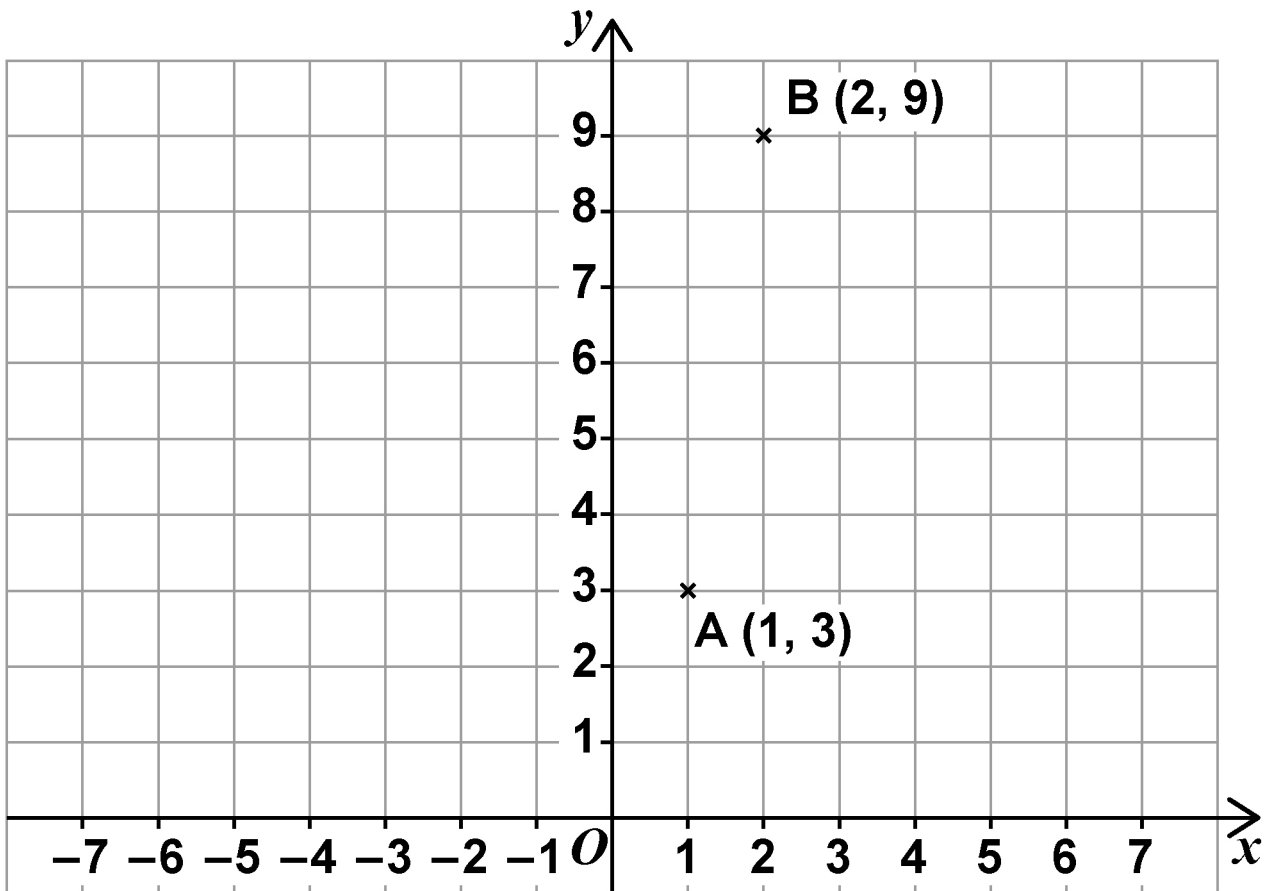**Work out the values of a and b.**   **[2 marks]**

_____

_____

_____

$a =$ _____ $b =$ _____

7

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

ABCD is a parallelogram.

AD and BC are HORIZONTAL and each is 5 squares wide.

The diagonals of ABCD cross at E.

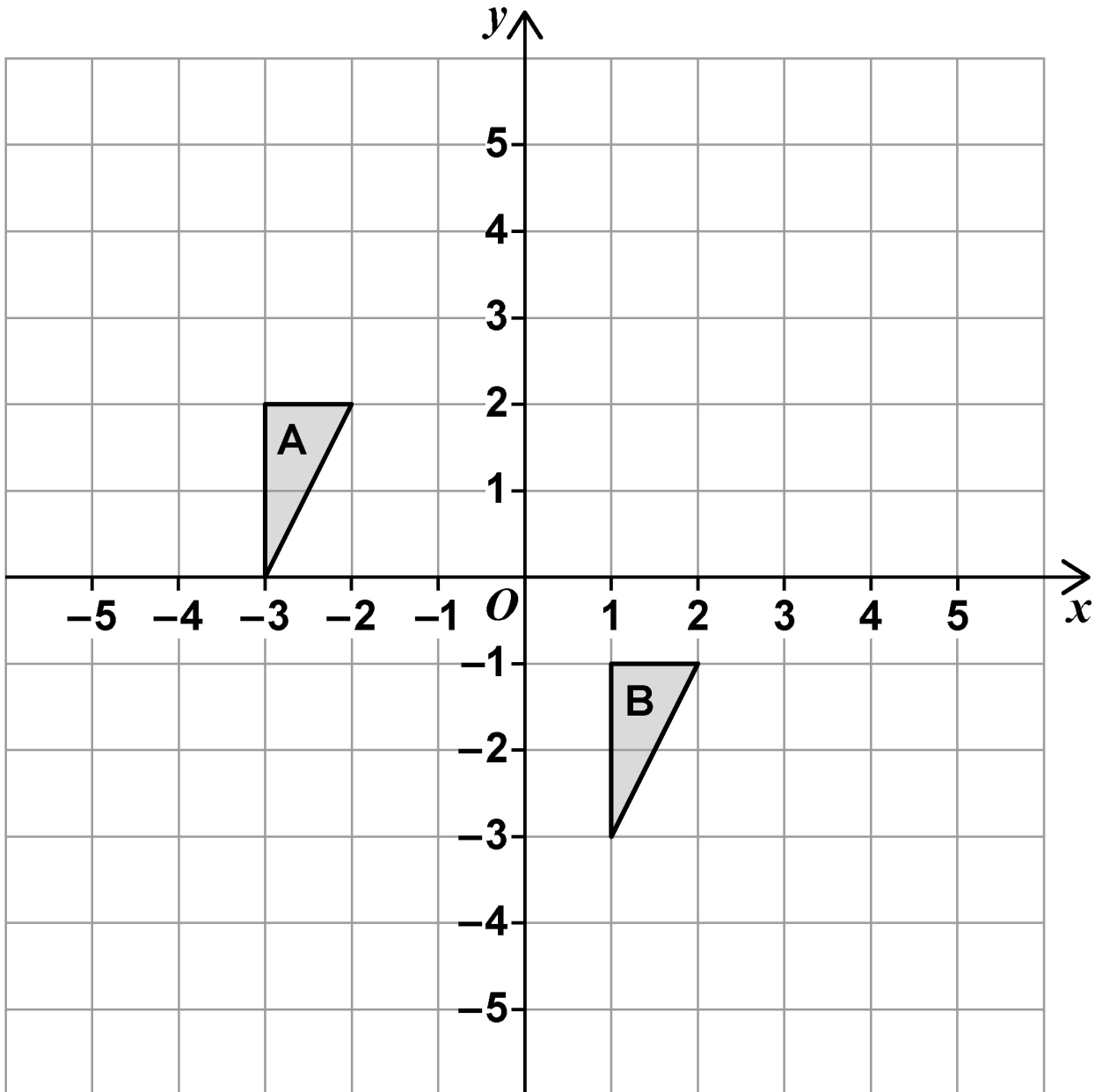**Work out the TWO possible pairs of coordinates of E. [4 marks]**

_____

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Answer (_____ , _____) and (_____ , _____)

10 Write down the translation vector that maps shape
A onto shape B. [2 marks]

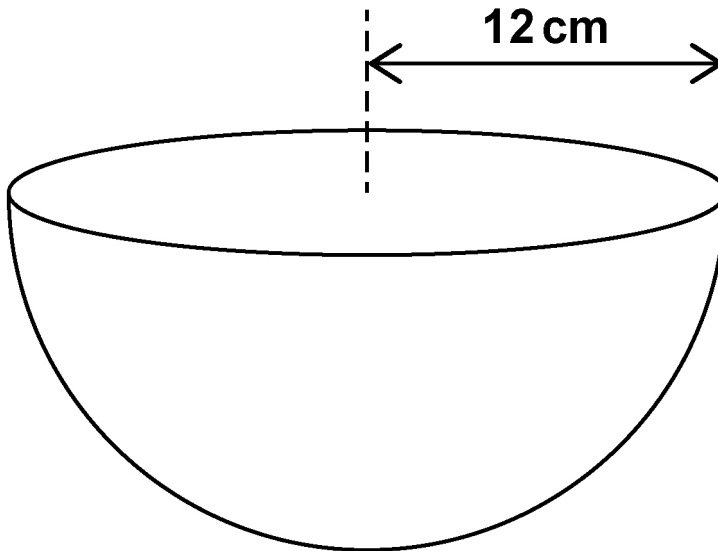**Answer** _____

—
6

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

A bowl is a hemisphere with radius 12 cm

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]

_____

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_____

12 **Show that these two rectangles are similar.**

The diagrams are not drawn accurately. [2 marks]

5 cm
12 cm

8 cm
19.2 cm
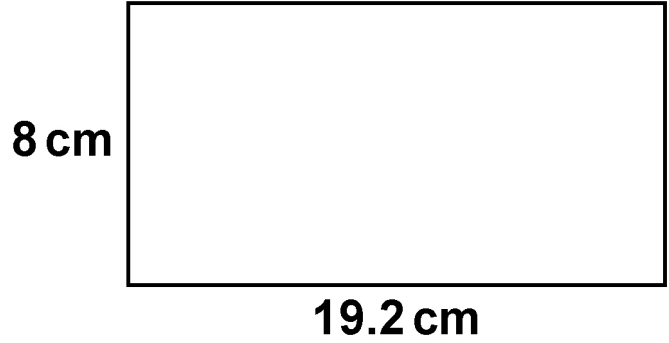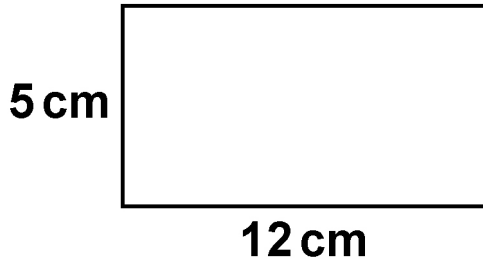
13 **A factory packs x boxes of teabags per hour.**

Each box contains 80 teabags.

Show that the factory packs $\dfrac{4x}{3}$ teabags per minute. [2 marks]

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[Turn over]

8

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]

_____

_____

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14 (b) **Why might STATEMENT A NOT be true? [1 mark]**

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[Turn over]

14 (c) **Work out an estimate of the mean to support STATEMENT B. [3 marks]**

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14 (d) **Why is the mean NOT the best average to represent the data? [1 mark]**

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[Turn over]

8

15 Expand $(x^2 - 9xy)(2x + 5y)$ **[2 marks]**

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Answer _____

16 **Line A**

has equation $y = ax - 1$

passes through the point (7, 13)

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

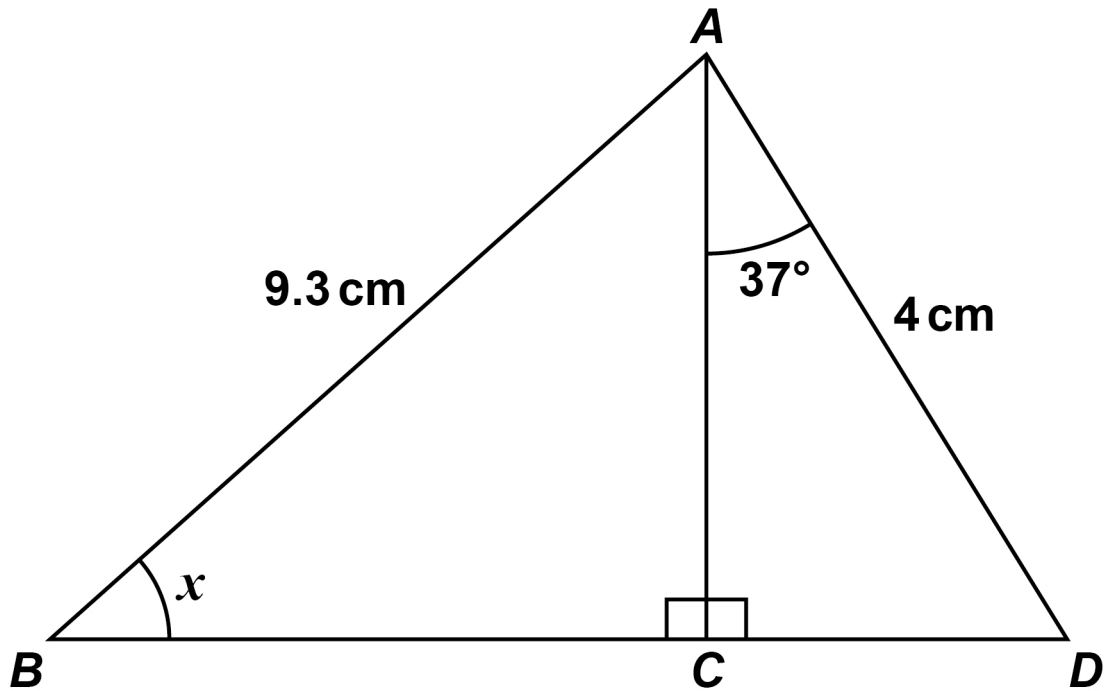**Show that line A has a greater gradient than line B. [3 marks]**

_____

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17 **The diagram is not drawn accurately.**

Work out the size of angle x. [4 marks]

_____

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_x =_ _____ °

[Turn over]

9

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

[3 marks]

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Answer

[Turn over]

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

3   20   47   84

Work out an expression for the nth term of the sequence. [4 marks]

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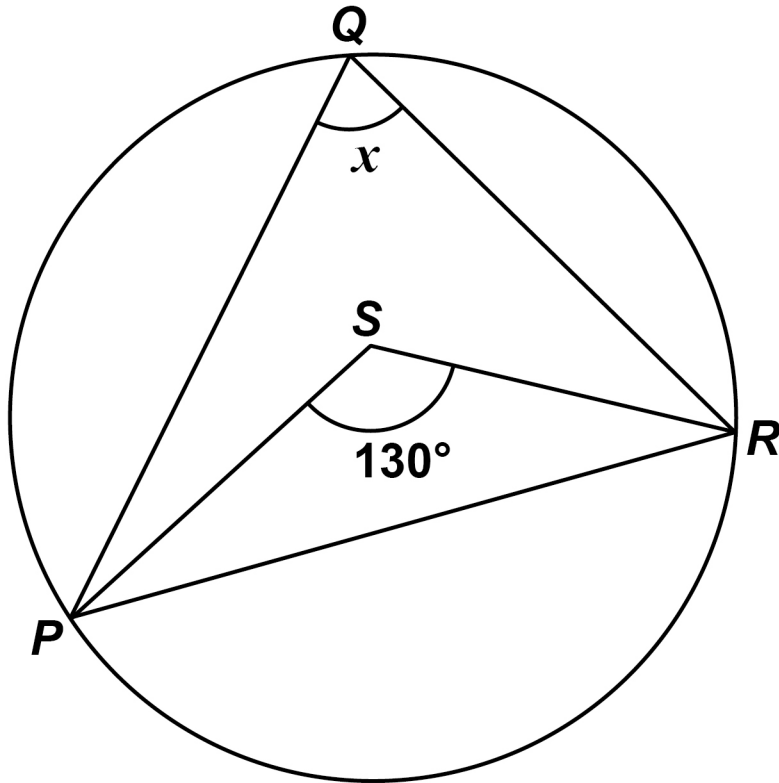
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Answer

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

S is a point inside triangle *PQR*.

The diagram is not drawn accurately.

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

Work out the size of angle x. [1 mark]

_____

_____

$x =$ _____ °

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)

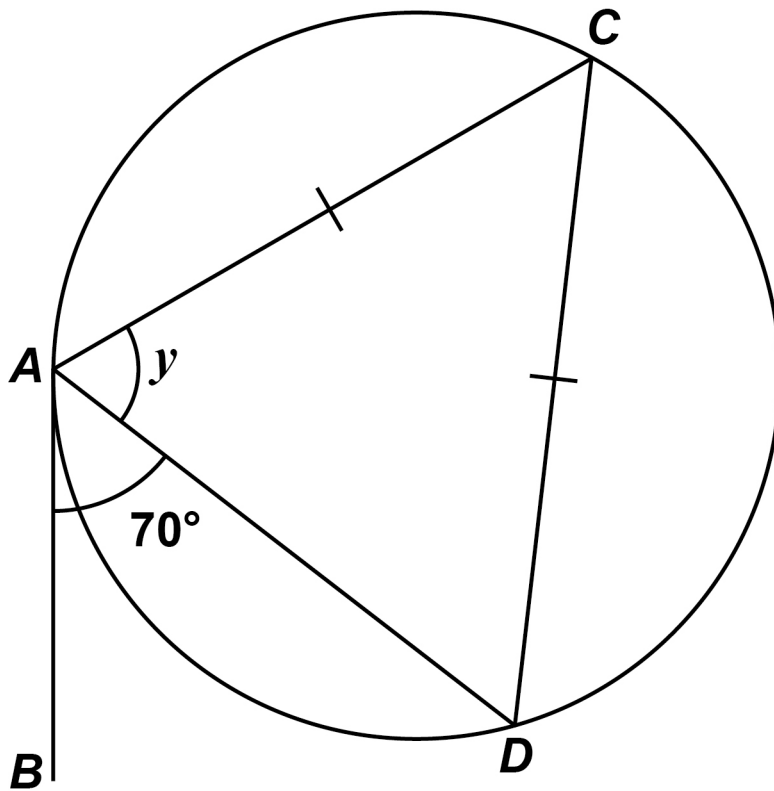☐ It is impossible to tell

[Turn over]

20 (c) For a different circle,

AB is a tangent at *A*

C and *D* are on the circumference of the circle

AC = CD

The diagram is not drawn accurately.

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?

Give a reason for your answer. [1 mark]

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[Turn over]

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]

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Answer _____ **%**

[Turn over]

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]

_____

_____

_____

_____

$x_2 =$ _____

$x_3 =$ _____

22 (b) **By continuing the iteration, show that the value of x is more than 4.25 [1 mark]**

_____

_____

_____

_____

[Turn over]

6

23   Here are three sets of cards.

SET A | 1 | | 1 | | 3 | | 5 | | 5 | | 5 | | 6 | | 8 |

SET B | 1 | | 2 | | 4 | | 6 | | 8 | | 8 | | 9 |

SET C | 3 | | 4 | | 5 | | 6 |

In a game, a player has two options.

OPTION 1

Pick two cards from Set A

OPTION 2

Pick one card from Set B

and

pick one card from Set C

The cards are picked at random.

The player wins if the total of their two cards is exactly 10

Which option gives a better chance of winning?

☐   **Option 1**

☐   **Option 2**

Show working to support your answer.   [4 marks]

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[Turn over]

4

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[Turn over]

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]

Answer _____

[Turn over]

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

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

[3 marks]

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6

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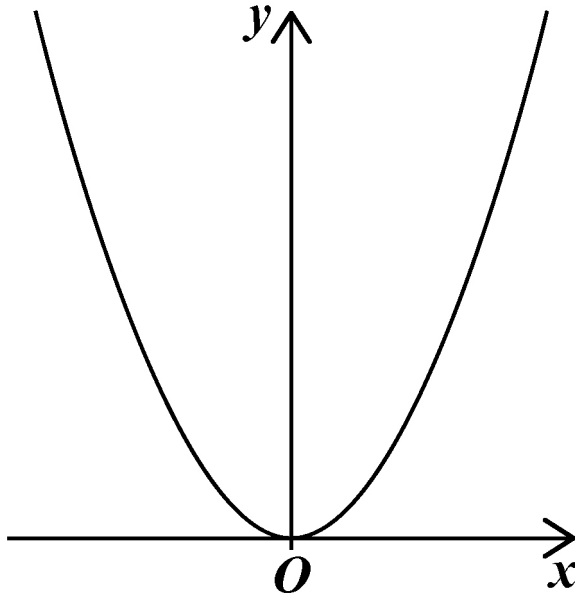
26 (a)   **The minimum point of** $y = x^2$ **is at (0, 0)**

Write down the coordinates of the minimum point of $y = x^2 + 2$ **[1 mark]**

Answer (_____ , _____)

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 _____

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

Describe fully this single transformation.
[2 marks]

_____

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END OF QUESTIONS

$\boxed{\dfrac{}{4}}$

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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