## AQAE

## GCSE <br> MATHEMATICS

## Higher Tier

## Shadow paper based on June 2023 question paper

## Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- mathematical instruments

You must not use a calculator.


## Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or 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.

| For Examiner's Use |  |
| :---: | :---: |
| Pages | Mark |
| $2-3$ |  |
| $4-5$ |  |
| $6-7$ |  |
| $8-9$ |  |
| $10-11$ |  |
| $12-13$ |  |
| $14-15$ |  |
| $16-17$ |  |
| $18-19$ |  |
| $20-21$ |  |
| 22 |  |
| TOTAL |  | These must be tagged securely to this answer book.

## Advice

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


1 (a) Work out $0.3 \times 0.2$
(b) Work out $\frac{4}{5} \div 7$

1 (c) Work out $16 \div 0.2$

## Answer

Answer
3 Work out the value of $\left(\frac{5}{3}\right)^{2}$

Give your answer as a mixed number.
$\qquad$
$\qquad$

Answer
$4 \quad A B C, B D$ and $B E$ are straight lines.

angle $E B D=6 \times$ angle $A B E$
angle $D B C=3 \times$ angle $A B E$
Work out the size of angle $D B C$.
$\qquad$
$\qquad$
$\qquad$
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$\qquad$
$\qquad$

Answer -
$5 \quad$ Two prime numbers are multiplied together.
The answer is an even number between 40 and 50
Complete the calculation.


6 Chloe and Mikey share some money in the ratio $3: 4$ Mikey gets $£ 72$

Chloe gives $\frac{1}{6}$ of her share to Pippa.
Mikey gives $\frac{4}{9}$ of his share to Pippa.
How much money does Pippa receive?
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

Answer £


Work out the value of $a$.
You must show your working.
$9 \quad$ Erika tries to sketch the graph $\quad y=\frac{1}{x} \quad$ with $x \neq 0$


Make two different criticisms of her sketch.

Criticism 1
$\qquad$
$\qquad$
Criticism 2
$\left.\begin{array}{l}\text { Wenjie is } x \text { years old. } \\ \text { Megan is five years older than Wenjie. } \\ \text { Conor is three times as old as Wenjie. } \\ \text { The mean of their ages is } 35 . \\ \text { How old is Conor? } \\ \hline\end{array}\right]^{\square}$

Answer

Turn over for the next question

11 The Venn diagram represents 80 items.


11 (a) Write down $P(B)$

Answer

11 (b) Work out $P(A \cup B)$
[1 mark]
$\qquad$
$\qquad$

Answer $\qquad$

11 (c) Work out $P\left(A^{\prime} \cap B\right)$
$\qquad$
$\qquad$

Answer $\qquad$

12 (a) $a \times 10^{n}$ is a number in standard form.
Complete the inequality for the value of $a$.
[1 mark]
$\qquad$

$$
\leqslant a<
$$

$\qquad$

12 (b) $\quad b \times 10^{n}$ is the number 45000 written in standard form.
Work out $b \times 10^{-n}$
Write your answer as an ordinary number.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

Answer $\qquad$

## Turn over for the next question

13 (a) Here is a number machine.


Show that when the input decreases by 3 the output decreases by $3 a$.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

13 (b) $\mathrm{f}(x)=k x^{3}$ where $k$ is a constant.
Josh says that $f(2) \times f(1)$ is equal to $f(2)$ because $2 \times 1=2$
Is he correct?
Show working to support your answer.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

14 Here is a list of 11 whole numbers in numerical order.
The lower quartile, median, upper quartile and highest value are missing.

| 1 | 3 |  | 9 | 13 |  | 23 | 32 |  | 44 |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

- median $=3.5 \times$ lower quartile
- upper quartile $=6 \times$ lower quartile
- range $=1.5 \times$ interquartile range

Complete the list.
[2 marks]
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$ Turn over for the next question
rex

Complor
$15 \quad A B C D$ is a trapezium.
All four sides are different lengths.
$A B$ is parallel to $C D$.
The diagonals intersect at $X$.


Not drawn

For each statement, tick the correct box.

Triangles $A X D$ and $B C X$ are similar

Triangles $A B X$ and $C D X$ are congruent


Angle $B A C=$ angle $A C D$


Area of triangle $B C D=$ area of triangle $A C D$


16 Solve the simultaneous equations

$$
\begin{aligned}
& 5 x+3 y=9 \\
& 2 x-4 y=14
\end{aligned}
$$

$\qquad$
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$\qquad$
$x=\quad y=$ $\qquad$

Turn over for the next question

17 A solid hemisphere has radius $x$.
A solid cylinder has radius $2 x$ and height $x$.


Volume of a sphere $=\frac{4}{3} \pi r^{3}$
where $r$ is the radius

Work out the ratio
volume of the hemisphere: volume of the cylinder
Give your answer in its simplest form.
You must show your working.
$\qquad$
$\qquad$
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$\qquad$

Answer $\qquad$ :

| 18 | $4<\sqrt[3]{x}<5$ |  |  |
| :---: | :---: | :---: | :---: |
| Circle the possible value of $x$. |  |  |  |
| [1 mark] |  |  |  |
| 1.4 | 64 | 102 | 500 |

19 Work out how many 5-digit even numbers can be made using these digits once each.
2
4
6
7
9

Do not list them.

Answer $\qquad$

Turn over for the next question
$20 \quad K, L$ and $M$ are weights.
Both of the scales balance exactly.


How many $M$ weights are needed to balance one $L$ weight?
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
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$\qquad$
$\qquad$
$\qquad$

Answer
21 Express $x^{2}-8 x+9$ in the form $(x-a)^{2}-b \quad$ where $a$ and $b$ are integers.
Answer $\qquad$
22

$$
a=\sqrt{3} \quad \text { and } \quad b=\sqrt{12}
$$

Match each expression to its value.
One has been done for you.

Turn over for the next question

23 Write $0 . \dot{2} \dot{4}$ as a fraction in its simplest form.

Answer

24 Points $P, Q$ and $R(6,22)$ form a triangle.

$P Q$ is a horizontal line, with $P$ on the $y$-axis.
Angle $P R Q$ is a right angle.
The gradient of $P R$ is 3
Work out the coordinates of $Q$.
[5 marks]
$\qquad$
$\qquad$
$\qquad$
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$\qquad$
$\qquad$

Answer ( $\qquad$ , $\qquad$ )

25
Show that $\frac{5 \sin 60^{\circ}-\cos 30^{\circ}}{2 \tan 60^{\circ}}$
can be written as $\tan x$, where $x$ is an acute angle.
[4 marks]
$\qquad$
$\qquad$
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26 A circle, centre $O$, has an area of $36 \pi \mathrm{~cm}$
$Q$ is a point on the circle.
$O P Q R$ is a square.

area of the square : area of the circle $=\frac{1}{a}: \pi$ where $a$ is an integer.
Work out the value of $a$.
You must show your working.
Not drawn
[4 marks]
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
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$\qquad$
$\qquad$
$a=$ $\qquad$
$27 \quad$ Liquid $C$ is made by mixing liquid $A$ and liquid $B$.

|  | Mass (g) | Density <br> $\left(\mathbf{g} / \mathbf{c m}^{\mathbf{3}} \mathbf{)}\right.$ | Volume <br> $\left(\mathbf{c m}^{\mathbf{3}} \mathbf{)}\right.$ |
| :---: | :---: | :---: | :---: |
| Liquid A | 200 | $a$ | $\frac{200}{a}$ |
| Liquid B | 300 | $b$ | $\frac{300}{b}$ |

Show that the density of liquid C , in $\mathrm{g} / \mathrm{cm}^{3}$, is $\frac{5 a b}{3 a+2 b}$
$\qquad$
$\qquad$
$\qquad$
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$\qquad$

## END OF QUESTIONS

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