AQA

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier

Paper 1 Non-Calculator

Shadow paper based on June 2023 question paper

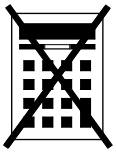
Time allowed: 1 hour 30 minutes

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. These must be tagged securely to this answer book.

Advice

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

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	

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

Do not write outside the box

1 (a) Work out 0.3×0.2

[1 mark]

Answer _____

1 (b) Work out $\frac{4}{5} \div 7$

[1 mark]

Answer _____

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

[1 mark]

Answer _____

2 Solve $5x < 60$

[1 mark]

Answer _____

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

Do not write outside the box

1 (a) Work out 0.7×0.5

[1 mark]

Answer _____

1 (b) Work out $\frac{5}{6} \div 3$

[1 mark]

Answer _____

1 (c) Work out $27 \div 0.6$

[1 mark]

Answer _____

Do not write outside the box

2 Solve $2x < 26$

[1 mark]

Answer _____

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

Give your answer as a mixed number.

[1 mark]

Answer _____

Turn over for the next question

5

Do not write outside the box

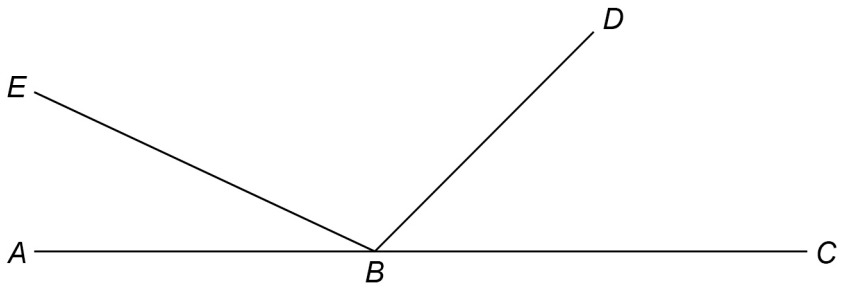
3 Work out the value of $\left(\frac{5}{3}\right)^2$

Give your answer as a mixed number.

[1 mark]

Answer _____

4 *ABC*, *BD* and *BE* are straight lines.



Not drawn accurately

angle *EBD* = 6 × angle *ABE*

angle *DBC* = 3 × angle *ABE*

Work out the size of angle *DBC*.

[3 marks]

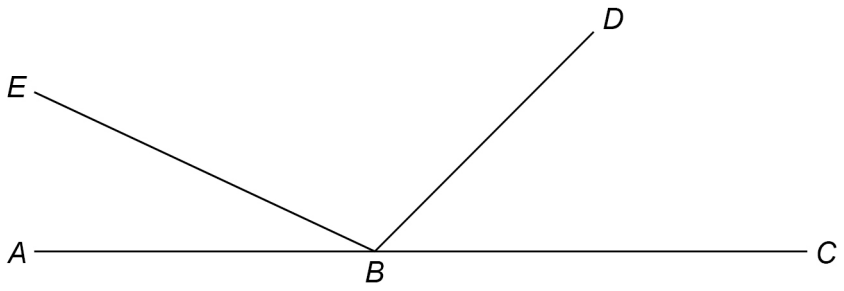
Answer _____ °

8

Turn over ►

Do not write outside the box

4 *ABC*, *BD* and *BE* are straight lines.



Not drawn accurately

angle *EBD* = 5 × angle *ABE*

angle *DBC* = 3 × angle *ABE*

Work out the size of angle *EBD*.

[3 marks]

Answer _____ °

Do not write outside the box

5 Two prime numbers are multiplied together.

The answer is an **even** number between 40 and 50

Complete the calculation.

[3 marks]

$\square \times \square = \square$

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?

[4 marks]

Answer £ _____

Do not write outside the box

5 Two prime numbers are multiplied together.

The answer is an **even** number between 50 and 60

Complete the calculation.

[3 marks]

$\square \times \square = \square$

6 Andrew and Bruce share some money in the ratio 5 : 6

Bruce gets £96

Andrew gives $\frac{1}{4}$ of his share to Carl.

Bruce gives $\frac{2}{3}$ of his share to Carl.

How much money does Carl receive?

[4 marks]

Answer £ _____

10

Do not write outside the box

7 $2^a \times 3^2 \times 5 = 360$

Work out the value of a.

You **must** show your working.

[3 marks]

$a =$ _____

8 Expand and simplify fully $2(5x + 6) - 3(x - 2)$

[2 marks]

Answer _____

Turn over for the next question

12

Do not write outside the box

7 $2^a \times 3 \times 5^2 = 600$

Work out the value of a.

You **must** show your working.

[3 marks]

$a =$ _____

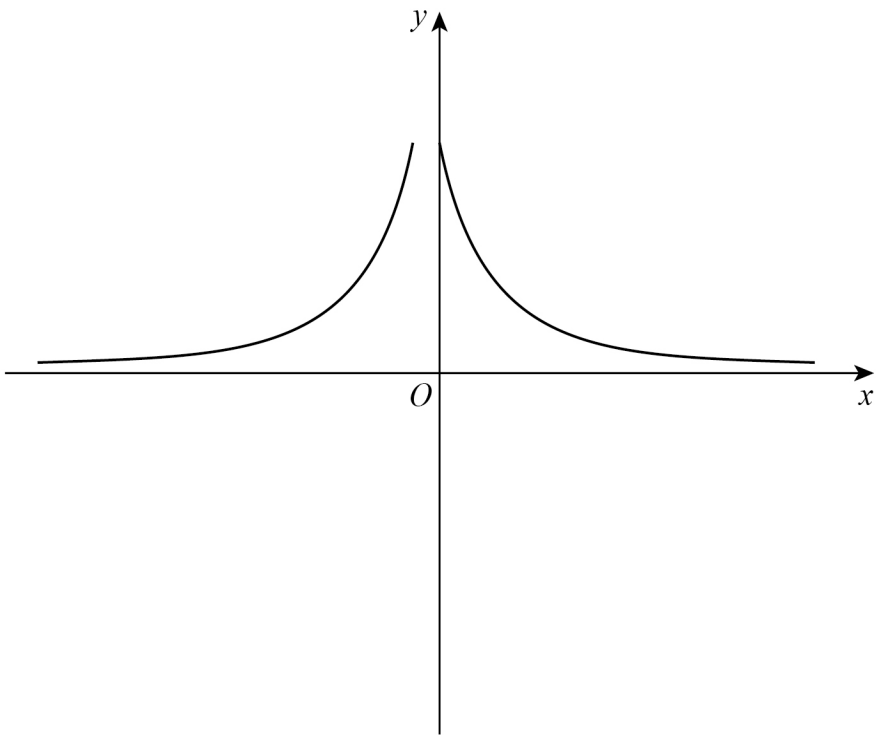
8 Expand and simplify fully $5(3x + 4) - 2(x - 1)$

[2 marks]

Answer _____

Do not write outside the box

9 Erika tries to sketch the graph $y = \frac{1}{x}$ with $x \neq 0$



Make **two** different criticisms of her sketch.

[2 marks]

Criticism 1 _____

_____

_____

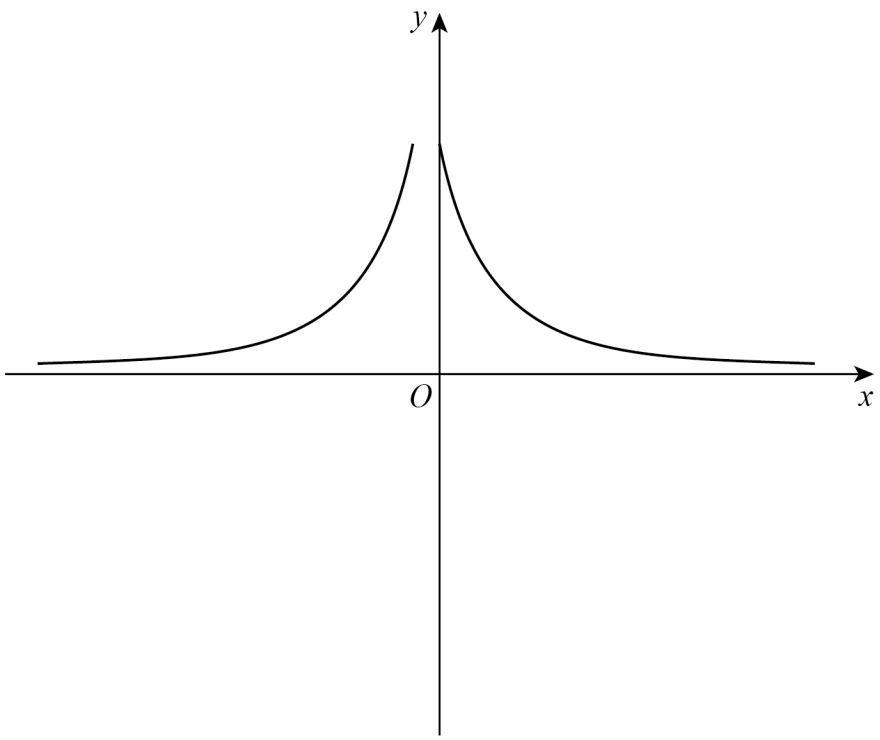
Criticism 2 _____

_____

_____

Do not write outside the box

9 Erika tries to sketch the graph $y = \frac{1}{x}$ with $x \neq 0$



Make **two** different criticisms of her sketch.

[2 marks]

Criticism 1 _____

_____

_____

Criticism 2 _____

_____

_____

7

Turn over ►

Do not write outside the box

10 Wenjie is x years old.

Megan is five years older than Wenjie.

Conor is three times as old as Wenjie.

The mean of their ages is 35.

How old is **Conor**?

[5 marks]

Answer _____

Turn over for the next question

7

Do not write outside the box

10 Sunita is x years old.

Beth is one year younger than Sunita.

Joel is double Sunita's age.

The mean of their ages is 5

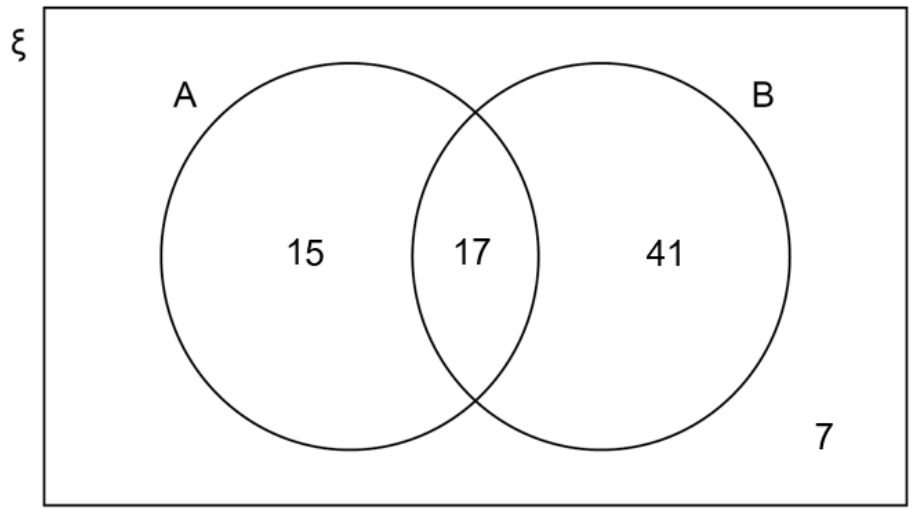
How old is **Joel**?

[5 marks]

Answer _____

Do not write outside the box

11 The Venn diagram represents 80 items.



11 (a) Write down P(B)

[1 mark]

Answer _____

11 (b) Work out P(A U B)

[1 mark]

_____

_____

Answer _____

11 (c) Work out P(A' ∩ B)

[1 mark]

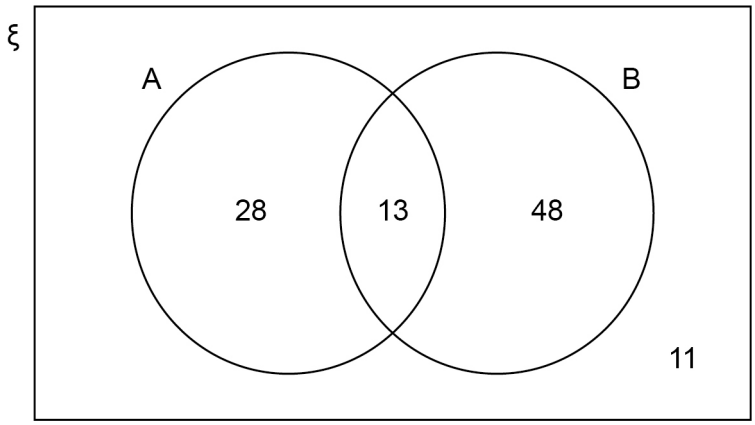
_____

_____

Answer _____

Do not write outside the box

11 The Venn diagram represents 100 items.



11 (a) Write down $P(A \cap B)$

[1 mark]

Answer _____

11 (b) Work out $P(A')$

[1 mark]

_____

_____

Answer _____

11 (c) Work out $P(A \cup B)$

[1 mark]

_____

_____

Answer _____

8

Do not write outside the box

12 (a) $a \times 10^n$ is a number in standard form.

Complete the inequality for the value of a.

[1 mark]

_____ $\leqslant a <$ _____

12 (b) $b \times 10^n$ is the number 45 000 written in standard form.

Work out $b \times 10^{-n}$

Write your answer as an ordinary number.

[2 marks]

Answer _____

Turn over for the next question

6

Do not write outside the box

12 (a) $a \times 10^n$ is a number in standard form.

Complete the inequality for the value of a.

[1 mark]

_____ $\leqslant a <$ _____

12 (b) $b \times 10^n$ is the number 7200 written in standard form.

Work out $b \times 10^{-n}$

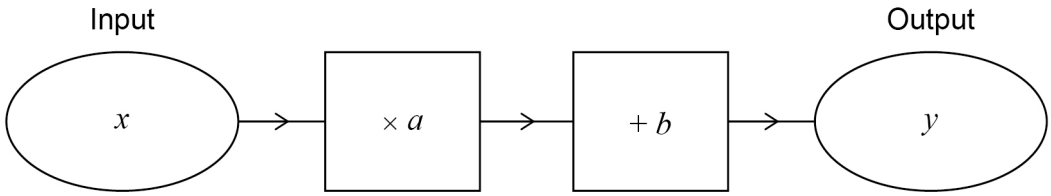
Write your answer as an ordinary number.

[2 marks]

Answer _____

Do not write outside the box

13 (a) Here is a number machine.



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

[2 marks]

13 (b) $f(x) = kx^3$ where k is a constant.

Josh says that $f(2) \times f(1)$ is equal to $f(2)$ because $2 \times 1 = 2$

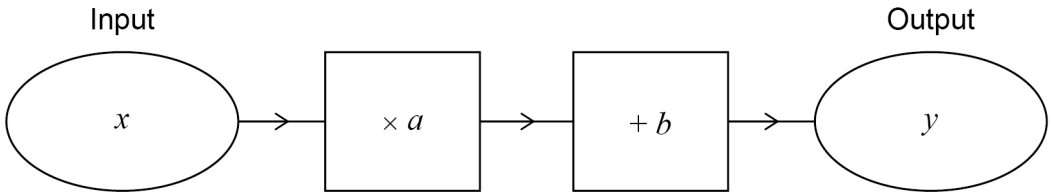
Is he correct?

Show working to support your answer.

[2 marks]

Do not write outside the box

13 (a) Here is a number machine.



Show that when the input increases by 2 the output increases by $2a$.

[2 marks]

13 (b) $f(x) = kx^2$ where k is a constant.

Kai says that $\frac{f(6)}{f(2)}$ is equal to f(3) because $\frac{6}{2} = 3$

Is he correct?

Show working to support your answer.

[2 marks]

7

Turn over ►

Do not write outside the box

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 × lower quartile
- upper quartile = 6 × lower quartile
- range = 1.5 × interquartile range

Complete the list.

[2 marks]

Turn over for the next question

6

Do not write outside the box

14 Here is a list of 11 whole numbers in numerical order.

The lower quartile, median, upper quartile and highest value are missing.

5	8		13	19		25	28		34	

- median = 2 × lower quartile
- upper quartile = 2.5 × lower quartile
- range = 2 × interquartile range

Complete the list.

[2 marks]

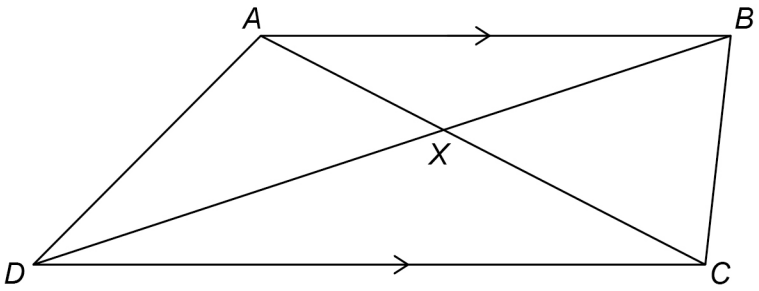
Do not write outside the box

15 *ABCD* is a trapezium.

All four sides are different lengths.

AB is parallel to *CD*.

The diagonals intersect at *X*.



Not drawn accurately

For each statement, tick the correct box.

[4 marks]

	True	**May be true**	**Not true**
Triangles *AXD* and *BCX* are similar	☐	☐	☐
Triangles *ABX* and *CDX* are congruent	☐	☐	☐
Angle *BAC* = angle *ACD*	☐	☐	☐
Area of triangle *BCD* = area of triangle *ACD*	☐	☐	☐

Do not write outside the box

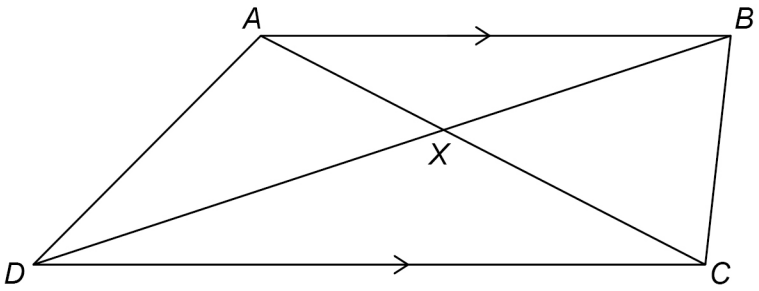
15 *ABCD* is a trapezium.

All four sides are different lengths.

AB is parallel to *CD*.

The diagonals intersect at *X*.

Not drawn accurately



For each statement, tick the correct box.

[4 marks]

	True	May be true	Not true
Triangles *AXB* and *CXD* are similar	☐	☐	☐
Triangles *AXD* and *BXC* are congruent	☐	☐	☐
Angle *ADB* = angle *BDC*	☐	☐	☐
Area of triangle *ABC* = area of triangle *ABD*	☐	☐	☐

Turn over for the next question

6

Do not write outside the box

16 Solve the simultaneous equations

$5x + 3y = 9$

$2x - 4y = 14$

[4 marks]

$x =$ _____ $y =$ _____

Turn over for the next question

8

Do not write outside the box

16 Solve the simultaneous equations

$2x - 5y = 13$

$3x + 4y = 8$

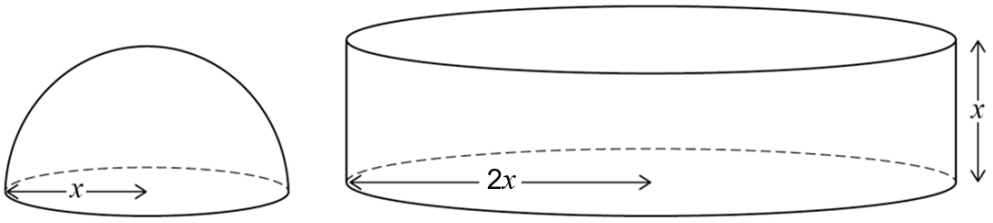
[4 marks]

$x =$ _____ $y =$ _____

Do not write outside the box

17 A solid hemisphere has radius x.

A solid cylinder has radius $2x$ 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.

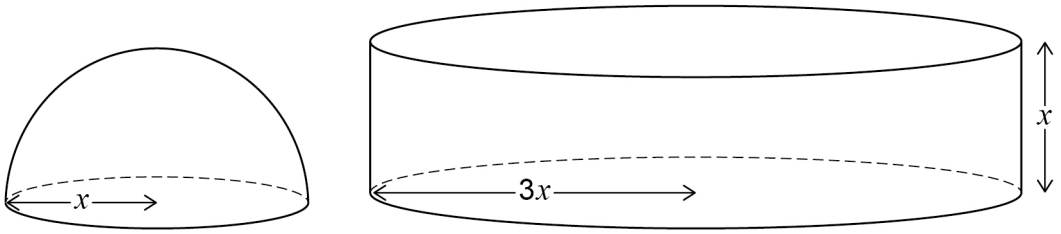
[3 marks]

Answer _____ : _____

Do not write outside the box

17 A solid hemisphere has radius x.

A solid cylinder has radius $3x$ and height x.



Surface area of a sphere $= 4\pi r^2$

where r is the radius

Work out the ratio

total surface area of the hemisphere : total surface area of the cylinder

Give your answer in its simplest form.

You **must** show your working.

[3 marks]

Answer _____ : _____

7

Turn over ►

Do not write outside the box

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.

[2 marks]

Answer _____

Turn over for the next question

6

Do not write outside the box

18 $6 < \sqrt[3]{x} < 7$

Circle the possible value of x.

[1 mark]

1.9 20 45 290

19 Work out how many 5-digit **odd** numbers can be made using these digits **once** each.

2 4 6 7 9

Do **not** list them.

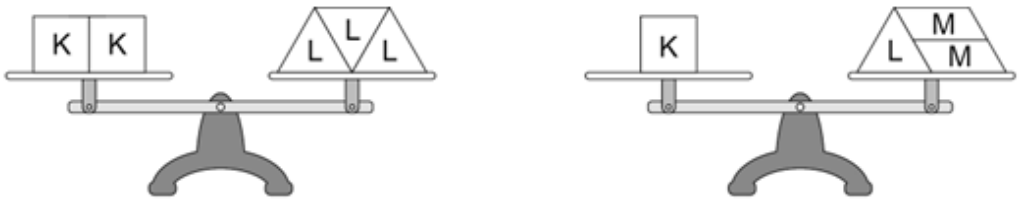
[2 marks]

Answer _____

Do not write outside the box

20 K, L and M are weights.

Both of the scales balance exactly.



How many M weights are needed to balance **one** L weight?

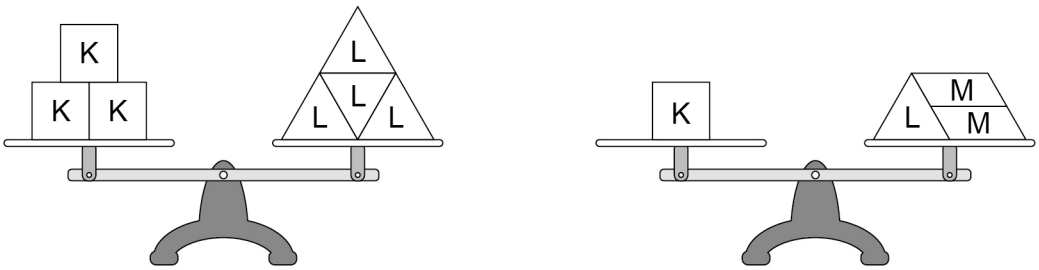
[3 marks]

Answer _____

Do not write outside the box

20 K, L and M are weights.

Both of the scales balance exactly.



How many M weights are needed to balance **one** L weight?

[3 marks]

Answer _____

Turn over for the next question

6

Do not write outside the box

21 Express $x^2 - 8x + 9$ in the form $(x - a)^2 - b$ where a and b are integers.

[2 marks]

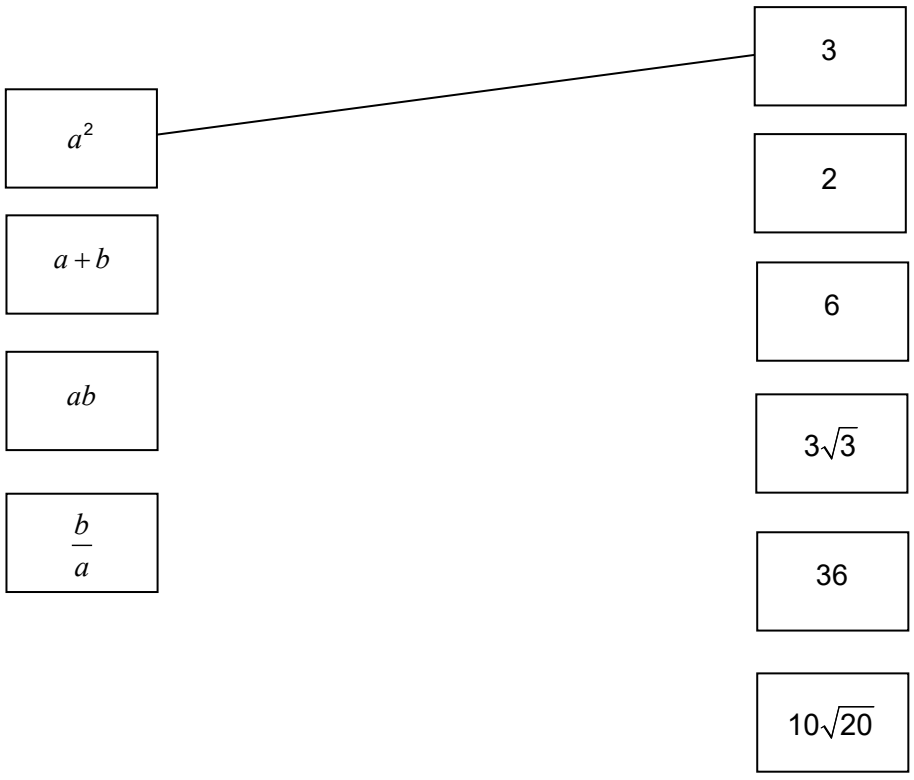
Answer _____

22 $a = \sqrt{3}$ and $b = \sqrt{12}$

Match each expression to its value.

One has been done for you.

[3 marks]



Turn over for the next question

8

Do not write outside the box

21 Express $x^2 - 6x - 15$ in the form $(x - a)^2 - b$ where a and b are integers.

[2 marks]

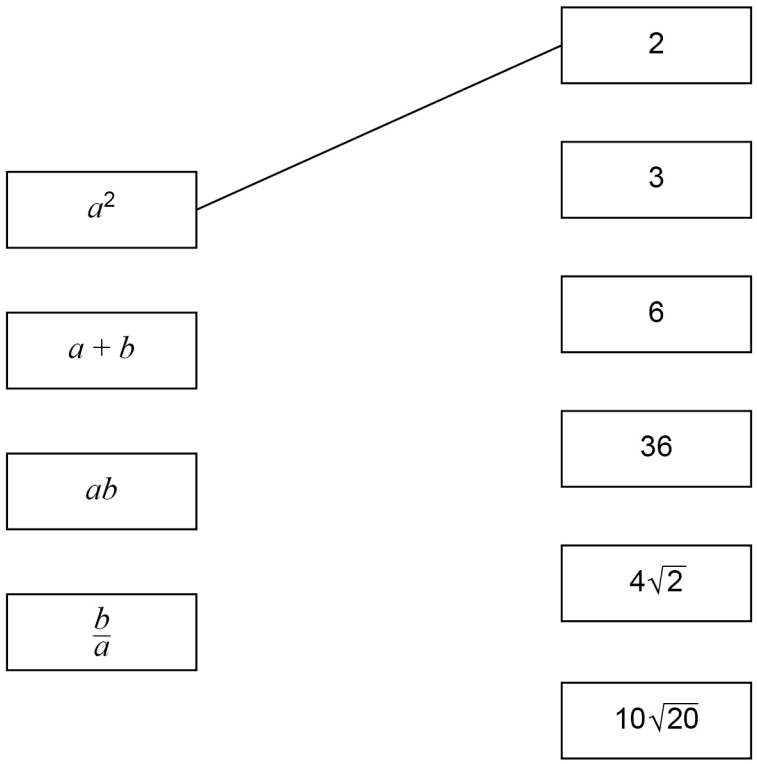
Answer _____

22 $a = \sqrt{2}$ and $b = \sqrt{18}$

Match each expression to its value.

One has been done for you.

[3 marks]



Do not write outside the box

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

[3 marks]

Answer _____

Do not write outside the box

23 Write $0.1\dot{3}$ as a fraction in its simplest form.

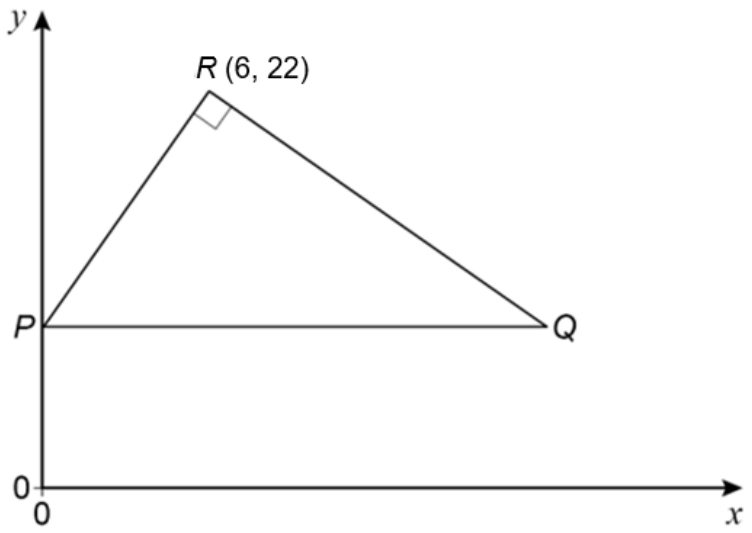
[3 marks]

Answer _____

8

Do not write outside the box

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



Not drawn accurately

PQ is a horizontal line, with P on the y-axis.

Angle PRQ is a right angle.

The gradient of PR is 3

Work out the coordinates of Q.

[5 marks]

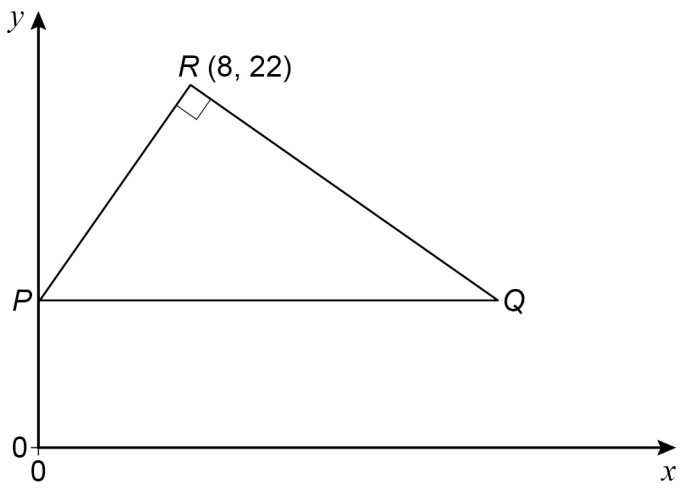
Answer (_____ , _____)

8

Turn over ►

Do not write outside the box

24 Points *P*, *Q* and *R* (8, 22) form a triangle.



Not drawn accurately

PQ is a horizontal line, with *P* on the y-axis.

Angle *PRQ* is a right angle.

The gradient of *PR* is 2

Work out the coordinates of *Q*.

[5 marks]

Answer (_____ , _____)

Do not write outside the box

25 Show that $\dfrac{5\sin 60° - \cos 30°}{2\tan 60°}$ can be written as $\tan x$, where x is an acute angle.

[4 marks]

Do not write outside the box

25 Show that $\dfrac{4\sin 30^\circ - \tan 45^\circ}{2\cos 30^\circ}$ can be written as $\tan x$, where x is an acute angle.

[4 marks]

Turn over for the next question

9

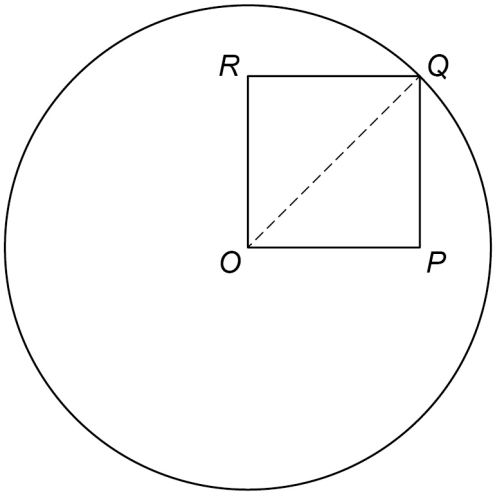
Do not write outside the box

26 A circle, centre O, has an area of 36π cm

Q is a point on the circle.

$OPQR$ is a **square**.

Not drawn accurately



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.

[4 marks]

$a =$ _____

8

Turn over ►

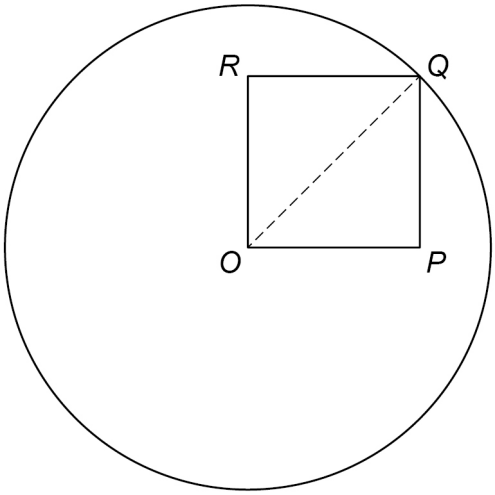
Do not write outside the box

26 A circle, centre *O*, has circumference 20π cm

Q is a point on the circle.

OPQR is a **square**.

Not drawn accurately



perimeter of the square : circumference of the circle = $\sqrt{a}$: π where a is an integer.

Work out the value of a.

You **must** show your working.

[4 marks]

$a =$ _____

Do not write outside the box

27 Liquid C is made by mixing liquid A and liquid B.

	Mass (g)	**Density (g/cm^3)**	**Volume (cm^3)**
Liquid A	200	a	$\frac{200}{a}$
Liquid B	300	b	$\frac{300}{b}$

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

[3 marks]

END OF QUESTIONS

3

Do not write outside the box

27 A journey has two stages.

	Distance (km)	Average speed (km/h)	Time (h)
Stage 1	30	a	$\frac{30}{a}$
Stage 2	30	b	$\frac{30}{b}$

Show that the average speed for the **whole** journey, in km/h, is $\frac{2ab}{a+b}$

[3 marks]

END OF QUESTIONS

7