AQA

.CG Maths.
Worked Solutions

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

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I declare this is my own work.

GCSE
MATHEMATICS

H

Higher Tier Paper 1 Non-Calculator

Friday 19 May 2023 Morning Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- mathematical instruments
- the Formulae Sheet (enclosed).

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	
22–23	
TOTAL	

J U N 2 3 8 3 0 0 1 H 0 1

IB/M/Jun23/E8

8300/1H

Please note that these worked solutions have neither been provided nor approved by AQA and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

Do not write outside the box

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

1 (a) Work out 0.7×0.5

[1 mark]

$7 \times 5 = 35$ ← Ignoring the decimals and the zeros as they are not signifiant figures

Answer 0.35

There are 2 decimal places in the 0.7 and 0.5 in total so there should be 2 decimal places in the answer

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

[1 mark]

Multiplying the denominator by 3 divides the fraction by 3 as the 5 is being divided by 3 times as much

Answer $\frac{5}{18}$

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

[1 mark]

$6 \overline{)2\,{}^{2}7\,{}^{3}0}$ = 0 4 5 ← Considering the division as the fraction 27/0.6. Multiplying both the numerator and denominator by 10 eliminates the decimals and gives 270/6

Answer 45

2 Solve $2x < 26$

[1 mark]

$2\overline{)26}$ → 13

Dividing both sides by 2 eliminates the 2 on the left and gets x on its own

Answer $x < 13$

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

Give your answer as a mixed number.

[1 mark]

$\frac{9}{4}$

Squaring both the numerator and denominator. $3^2 = 3 \times 3 = 9$ and $2^2 = 2 \times 2 = 4$

Answer $2\frac{1}{4}$

Dividing the 9 by the 4 gives the whole number of 2 with a remainder of 1 which is left in the fraction

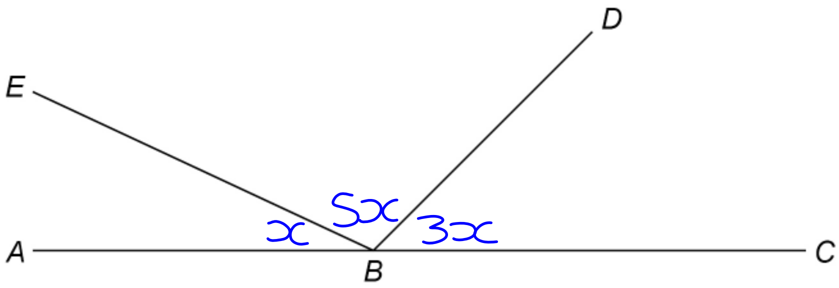
Turn over for the next question

Do not write outside the box

5

Do not write outside the box

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



Not drawn accurately

Let angle ABE be x as this is the smallest angle. The other angles are expressed in terms of x

angle *EBD* = 5 × angle *ABE*

angle *DBC* = 3 × angle *ABE*

Work out the size of angle *EBD*.

[3 marks]

Adding all three angles together works out that there is 9x in total around the point on a straight line, which must also add up to 180°

$9x = 180$

Dividing both sides by 9 finds that x = 20°

$180 \div 9 = 020$

Angle EBD = 5x

$20 \times 5 = 100$

Answer 100 °

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5 Two prime numbers are multiplied together.

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

Complete the calculation.

[3 marks]

2 × 29 = 58

$50 \div 2 = 25$
$60 \div 2 = 30$

At least one of the two numbers must be even in order to multiply to an even. The only even prime number is 2 so one of the numbers must be 2. Dividing both 60 and 50 by 2 works out that the other prime number must be between 25 and 30

$29 \times 2 = 58$

The only prime number between 25 and 30 is 29 so this must be the other prime number

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]

$96 \div 6 = 16$

6 parts of the ratio represent the £96 which Bruce gets. Dividing by 6 works out that 1 part of the ratio is worth £16

$16 \times 5 = 80$

Multiplying the value of 1 part of the ratio by 5 works out that the 5 parts representing Andrew is worth £80

The method continues on the next page

Answer £ 84

10

$$4 \overline{)80} = 20$$

This works out 1/4 of the £80 Andrew has and therefore finds that Andrew gives Carl £20

$$3 \overline{)96} = 32$$

This works out that 1/3 of the £96 Bruce has is £32

$$32 \times 2 = 64$$

Multiplying the 1/3 by 2 works out 2/3 of the £96 Bruce has and therefore finds that Bruce gives Carl £64

$$64 + 20 = 84$$

Adding the £20 Andrew gives to Carl and the £64 Bruce gives to Carl works out that Carl receives £84

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]

200
3|600

040
5|2²00

$40 \div 5 = 8$

Dividing both sides of the equation by the 3, then a 5 and another 5 finds that $2^a = 8$. This is 2^3 as $2 \times 2 \times 2 = 8$ so a must be 3

$a =$ 3

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

[2 marks]

$15x + 20 - 2x + 2$

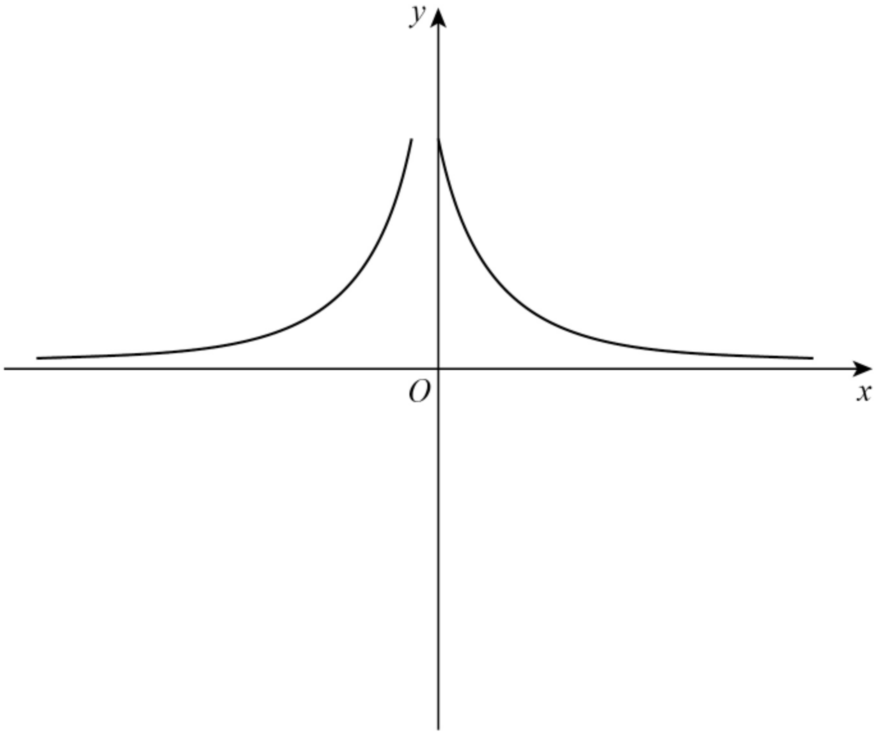
$5 \times 3x = 15x$
$5 \times 4 = 20$
$-2 \times x = -2x$
$-2 \times -1 = 2$

Answer $13x + 22$

Collecting like terms
$15x - 2x = 13x$
$20 + 2 = 22$

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

Should not have a value for x = 0

As x ≠ 0. Dividing by 0 would not give a value as it is undefined

Criticism 2

It is wrong for the negative values of x

As dividing by a negative x value should give a negative y value

7

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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]

$x+x-1+2x$ ← If Sunita is x years old, Beth must be x - 1 and Joel must be 2x. Adding all of these together gives the total age

$\frac{4x-1}{3}=5$ ← The total age is simplified by collecting like terms. To express the mean, the total age is divided by the 3 people. This expression must be equal to the mean of 5

$4x-1=15$ ← Multiplying both sides of the equation by 3 to eliminate the denominator on the left

$4x=16$ ← Adding 1 to both sides to eliminate the -1 and get the x term on its own

$x=4$ ← Dividing both sides by 4 eliminates the 4 on the left and gets x on its own

Answer 8

As x = 4, Sunita is 4 years old. Joel is double Sunita's age and 4 x 2 = 8

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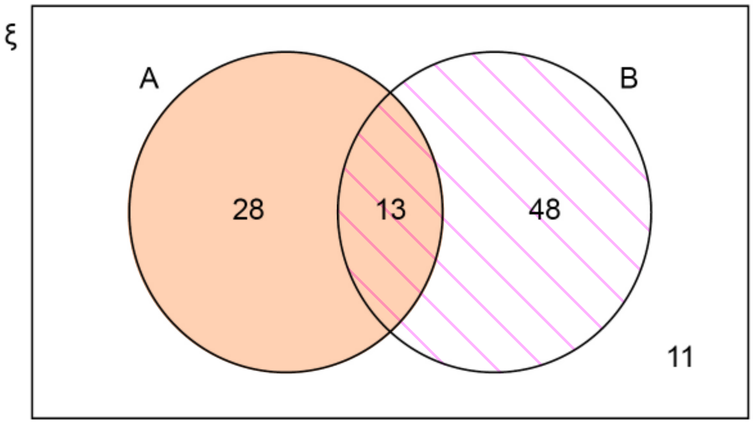
11 The Venn diagram represents 100 items.



11 (a) Write down P(A ∩ B)

The intersection of A and B is where it is both highlighted in orange and lined in pink, which is 13. The probability is 13 out of the 100 items

Answer $\frac{13}{100}$

11 (b) Work out P(A')

[1 mark]

48
+11
59

Everything not highlighted in orange is not A. Adding the 48 and 11 works out that 59 items were not A. So the probability is 59 out of the 100 items

Answer $\frac{59}{100}$

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

[1 mark]

100
− 11
89

Answer $\frac{89}{100}$

The union of A and B is where it is either highlighted orange, lined in pink, or both, which is everything apart from the 11. Subtracting the 11 from the 100 items works out that 89 items are in the union. The probability is 89 out of the 100 items

8

Turn over ▶

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

Complete the inequality for the value of a.

[1 mark]

a must be at least 1 but less than 10 for it to be in standard form

1 $\leqslant a <$ 10

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]

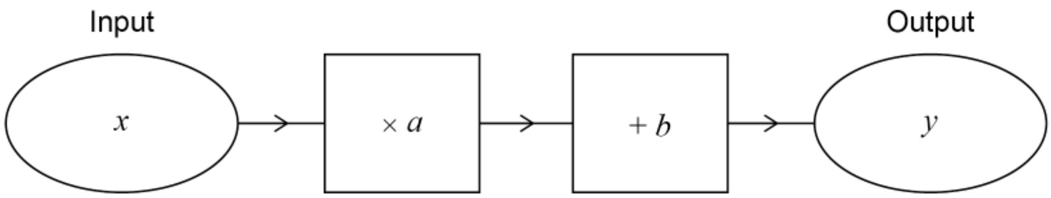
7.2

b must be 7.2 as this is the number which is as least 1 but less than 10 which can be multiplied by ten 3 times to get 7200. n must be 3. So 7.2 x 10^{-3} can be worked out by dividing 7.2 by ten 3 times

Answer 0.0072

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]

$y_1 = ax + b$ ← This expresses the output in terms of the input

$y_2 = a(x+2) + b$ ← This expresses the output in terms of the input when increased by 2

$= ax + b + 2a$ ← Expanding the bracket shows that the output when the input is increased by 2 is the same as the original output but is increased by 2a

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

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

Is he correct?

Show working to support your answer.

[2 marks]

$\dfrac{f(6)}{f(2)} = \dfrac{36k}{4k} = 9$ ← f(6) is found by substituting 6 for x in f(x). $f(6) = k(6)^2 = 36k$. $f(2) = k(2)^2 = 4k$. Simplifying the fraction by cancelling out the k and dividing the 36 by 4

$f(3) = 9k$ ← f(3) is found by substituting 3 for x in f(x). $f(3) = k(3)^2 = 9k$

No ← 9 does not equal to 9k

7

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

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

Lower quartile		Median		Upper quartile	Highest

5	8	12	13	19	24	25	28	30	34	41
		x			$2x$			$2.5x$		$5+3x$

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

Complete the list.

[2 marks]

Let x be the lower quartile as this is the smallest of the missing values. The median must be 2x as median = 2 x lower quartile. The upper quartile must be 2.5x as upper quartile = 2.5 x lower quartile. Interquartile range = upper quartile - lower quartile = 1.5x. So range = 3x as range = 2 x interquartile range. Adding the range to the lowest value gives the highest value so the highest value must be 5 + 3x

x must be even as multiplying an odd number by 2.5 would not give a whole number. It must be at least 8 as the numbers are in numerical order

$x=8$
$2x=16$

If the lower quartile was 8, the median would be 16 and this would be less than the 19 before it. Therefore the lower quartile cannot be 8

$x=10$
$2x=20$
$2.5x=25$

If the lower quartile was 10, the median would be 20 and the upper quartile would be 25, which is less than the 28 before it. Therefore the lower quartile cannot be 10

$x=12$
$2x=24$
$2.5x=30$
$5+3x=41$

If the lower quartile was 12, the median would be 24, the upper quartile would be 30 and the highest value would be 41. All of these values work

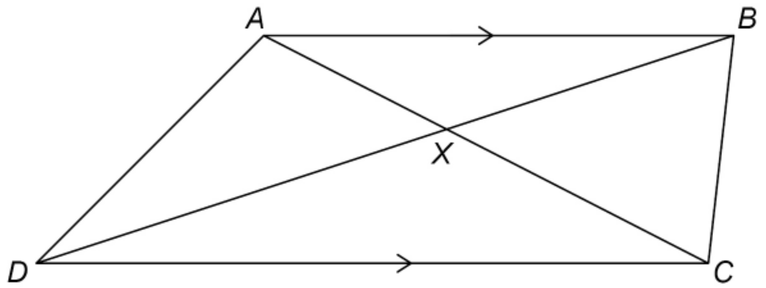
Do not write outside the box

15 *ABCD* is a trapezium.

All four sides are different lengths.

AB is parallel to *CD*.

The diagonals intersect at *X*.



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*	✓		

The first statement is true as all three angles in both triangles are the same. Angles AXB = DXC as they are vertically opposite. Angles BAX = DCX and ABX = CDX as they are alternate angles.

The second statement is not true as angles AXD = BXC as they are vertically opposite but none of the other angles can be equal. Angle DAX cannot equal to angle XCB as sides AD and BC are not parallel (there are only one pair of parallel sides in a trapezium) so the angles cannot be alternate. Angle DAX cannot equal to angle CBX as then the trapezium would be symmetrical, which cannot be the case as AD and BC must be different lengths.

The third statement is not true as angles XDC = XBA as they are alternate angles but angle XBA cannot equal to angle ADX as this would make triangle ADB isosceles and side AD cannot be equal to side AB.

The fourth statement is true as both triangles share the same base AB and have the same height as AB is parallel to DC so the lines are the same distance apart at all points.

Do not write outside the box

16 Solve the simultaneous equations

$2x - 5y = 13$ ← First equation

$3x + 4y = 8$ ← Second equation

[4 marks]

$6x - 15y = 39$
$6x + 8y = 16$
← Multiplying all terms on both sides of the first equation by 3 to get the third equation and all terms on both sides of the second equation by 2 to get the fourth equation. This is done to get the same number of x in both equations

$-23y = 23$ ← Subtracting the fourth equation from the third equation cancels out the x terms and gets an equation only in terms of y. 6x - 6x = 0. -15y - 8y = -23y. 39 - 16 = 23

$y = -1$ ← Dividing both sides by -23 gets y on its own

$3x - 4 = 8$ ← Substituting -1 for y in the second equation. 4 x -1 = -4

$3x = 12$ ← Adding 4 to both sides to eliminate the -4 on the left and get the x term on its own

Dividing both sides by 3 eliminates the 3 on the left and gets x on its own

$x =$ 4 $y =$ -1

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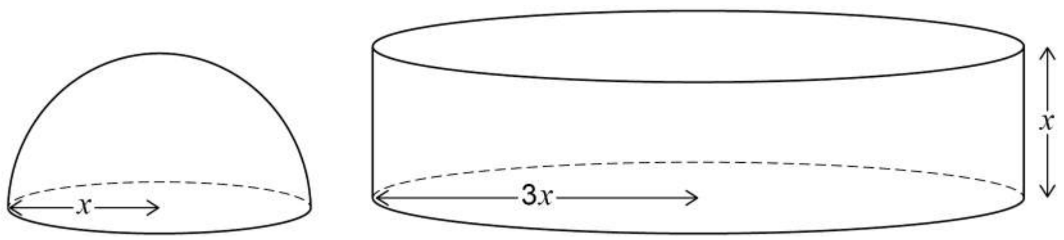
17 A solid hemisphere has radius x.

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]

$2\pi x^2 + \pi x^2$ ← Surface area of the hemisphere. Using the formula for the surface area of a sphere and halving it (so the 4 becomes 2) to get the curved surface area of the hemisphere. Substituting x for r as this is the radius. Adding the area of the circle. Area of circle = πr^2, where r is the radius. Substituting x for r as this is the radius

$3\pi x^2$ ← Collecting the like terms to give the surface area of the hemisphere in the simplest form

$\pi(3x)^2 \times 2 + \pi \times 6x \times x$ ← Surface area of the cylinder. First expressing the area of the 2 circles. Area of circle = πr^2, where r is the radius. Substituting 3x for r as this is the radius. Multiplying by 2 as there are 2 circles. Adding the area of the curved surface of the cylinder. Curved surface area of cylinder = circumference x height. Circumference = πd, where d is the diameter. The diameter is 6x (as the diameter is double the radius) and the height is x

$18\pi x^2 + 6\pi x^2$

$24\pi x^2$ ← Simplifying both terms then collecting like terms to give the surface area of the cylinder in the simplest form

Answer 1 : 8

The ratio is $3\pi x^2 : 24\pi x^2$. This can be given in its simplest form by dividing both sides by 3, π and x^2

7

Turn over ►

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)

Cubing all sides of the inequality gives $6^3 < x < 7^3$. $6^3 = 6 \times 6 \times 6 = 36 \times 6$, which must be more than 45 so the answer must be 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]

$5 \times 4 \times 3 \times 2 \times 1 \times \frac{2}{5}$

Answer 48

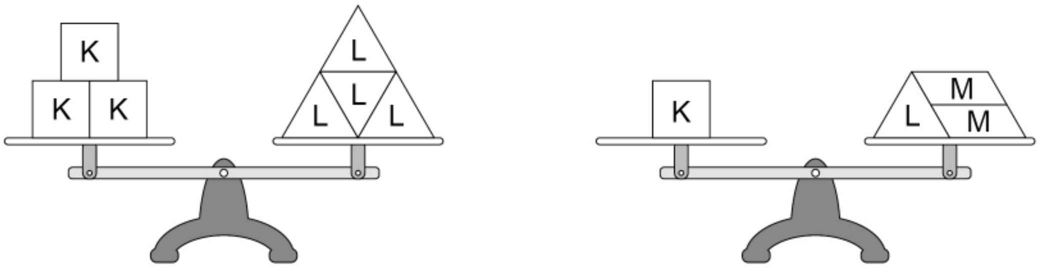
Using the product rule for counting to work out how many 5-digit numbers can be made then doing 2/5 of this as the 5-digit number must end in an odd digit and 2 out of the 5 digits are odd. There are 5 possibilities for the first digit. Given that 1 has already been chosen, there are 4 possibilities for the second digit. Given than 2 have already been chosen, there are 3 possibilities for the third digit. Given that 3 have already been chosen, there are 2 possibilities for the fourth digit. Given that 4 have already been chosen, there is 1 possibility for the fifth digit.

First doing 2/5 of the 5, which is 2. Then 2 x 4 = 8. 8 x 3 = 24. 24 x 2 = 48. 48 x 1 = 48

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]

$3K = 4L$ ← 3 K weights balance with 4 L weights so they must be equal

$K = \frac{4}{3}L$ ← Dividing both sides of the equation by 3 eliminates the 3 on the left to get K on its own

$\frac{4}{3}L = L + 2M$ ← Using the second set of scales, K = L + 2M. Substituting 4/3 L for K

$\frac{1}{3}L = 2M$ ← Subtracting L from both sides to get the L on the same side

$L = 6M$ ← Multiplying both sides by 3 eliminates the 1/3 on the left to get L on its own

Answer 6

1 L weight would balance with 6 M weights

Turn over for the next question

6

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]

This is completed the square form

$(x-3)^2 - 15 - 9$

Completing the square by halving the coefficient of x (which is -6) to get -3. Putting this in a bracket with x and squaring it. The -15 stays the same but $(-3)^2$ needs to be subtracted in order for the expression to have the same value

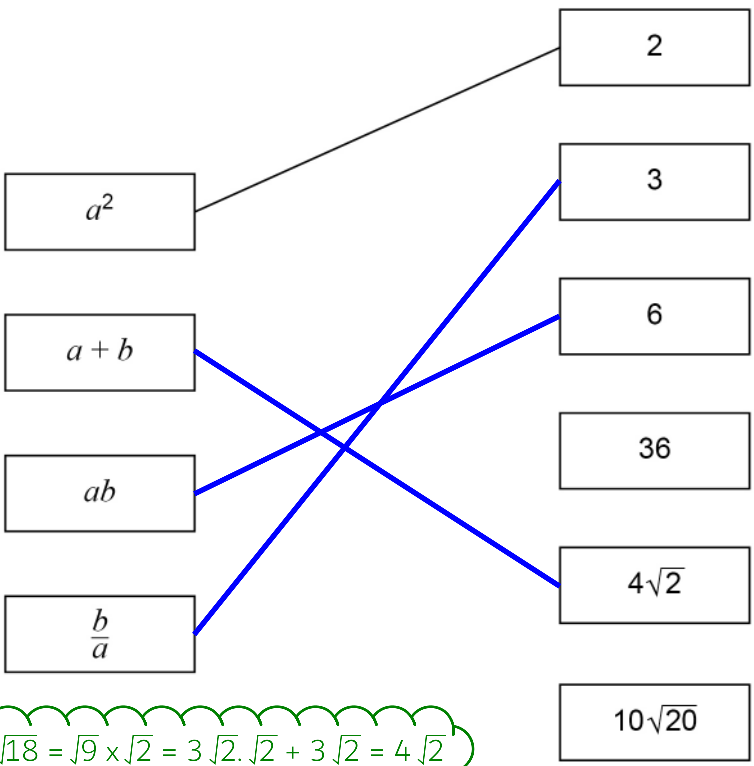
Answer $(x-3)^2 - 24$

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

Match each expression to its value.

One has been done for you.

[3 marks]



$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$ so $\sqrt{18} = \sqrt{9} \times \sqrt{2} = 3\sqrt{2}$. $\sqrt{2} + 3\sqrt{2} = 4\sqrt{2}$

$\sqrt{2} \times \sqrt{18} = \sqrt{36} = 6$

$\sqrt{18}/\sqrt{2} = \sqrt{9} = 3$

Do not write outside the box

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

[3 marks]

$x = 0.1\dot{3}$ ← Let x be the recurring decimal

$10x = 1.3\dot{3}$ ← There is one recurring digit so multiplying by 10 once allows it to be written with the recurring digit in the same decimal place

$9x = 1.2$ ← Subtracting x from 10x cancels out the recurring digit

$x = \frac{1.2}{9}$ ← Dividing both sides by 9 expresses x as a fraction

$= \frac{12}{90}$ ← Multiplying both the numerator and denominator by 10 to get rid of the decimals in the fraction

$= \frac{6}{45}$ ← Both the numerator and denominator are even so they can be both divided by 2 to simplify the fraction

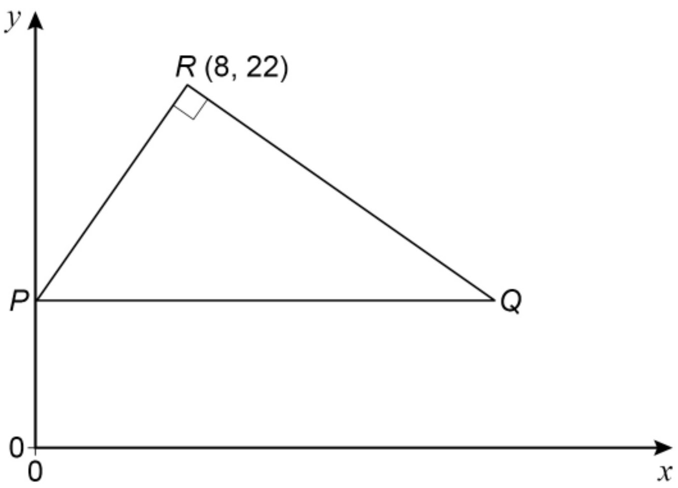
Both the numerator and denominator are multiples of 3 so they can both be divided by 3 to simplify the fraction. 2 and 15 cannot be divided by the same amount to get smaller whole numbers

Answer $\frac{2}{15}$

8

Do not write outside the box

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



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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]

$\frac{22-y}{8-0}=2$ ← Gradient = (change in y)/(change in x). Change in y from P to R is 22 - y (where y is the y-coordinate of P) and change in x from P to R is 8 - 0. The gradient of PR is 2

$22-y=16$ ← 8 - 0 = 8. Multiplying both sides by 8 eliminates the 8 as the denominator on the left

$y=6$ ← 6 must be subtracted from 22 to get 16 so y = 6. This is the y-coordinate of P and also Q as both points are on a horizontal line

$\frac{6-22}{x-8}=-\frac{1}{2}$ ← Gradient = (change in y)/(change in x). Change in y from R to Q is 6 - 22 and change in x from R to Q is x - 8 (where x is the x-coordinate of Q). The gradient of RQ is -1/2 as it is perpendicular to PR so its gradient must be the negative reciprocal of 2

$\frac{x-8}{-16}=-2$ ← Doing the reciprocal of both sides to make x the numerator

$x-8=32$ ← Multiplying both sides by -16 eliminates the denominator on the left

$x=40$ ← Adding 8 to both sides gets x on its own and finds that the x-coordinate of Q is 40

Answer (40 , 6)

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]

0	30	45	60	90
0	1	2	3	4
4	3	2	1	0

Listing out the angles for the trig values which need to be memorised. 0, 30, 45, 60, 90. Under these, listing 0, 1, 2, 3, 4 for the sin values and 4, 3, 2, 1, 0 for the cos values

$\sin 30 = \frac{\sqrt{1}}{2} = \frac{1}{2}$

Square rooting the 1 under the 30 then putting it over 2 expresses the value of sin30. $\sqrt{1} = 1$

$\tan 45 = \frac{\sqrt{2}}{2} \div \frac{\sqrt{2}}{2} = 1$

Square rooting the 2 under the 45 then putting it over 2 expresses the value of sin45. Doing the same for cos45. Dividing sin45 by cos45 expresses tan45. Anything divided by itself is 1

$\cos 30 = \frac{\sqrt{3}}{2}$

Square rooting the 3 under the 30 then putting it over 2 expresses the value of cos30

$\dfrac{4 \times \frac{1}{2} - 1}{2 \times \frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}}$

Substituting in the values of sin30, tan45 and cos30 into the expression and simplifying

$\tan 0 = \frac{\sqrt{0}}{2} \div \frac{\sqrt{4}}{2} \neq \frac{1}{\sqrt{3}}$

Working out that it is not tan0 by dividing sin0 by cos0

$\tan 30 = \frac{\sqrt{1}}{2} \div \frac{\sqrt{3}}{2} = \frac{1}{2} \times \frac{2}{\sqrt{3}} = \frac{1}{\sqrt{3}}$

Working out that tan30 gives the same value by dividing sin30 by cos30

$\dfrac{4\sin 30 - \tan 45}{2\cos 30} = \tan 30$

Showing that the original expression can be written as tan30

Turn over for the next question

9

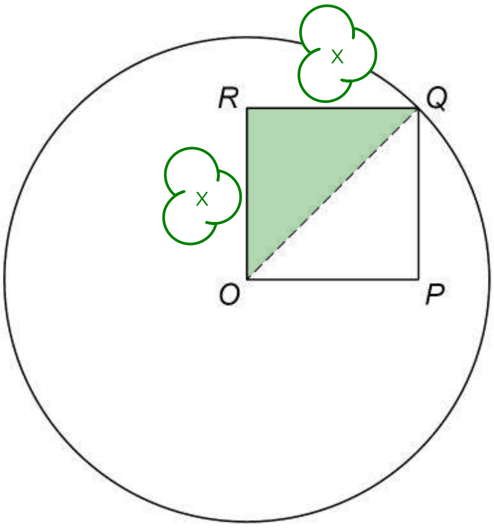
Do not write outside the box

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]

$\pi d = 20\pi$ ← Circumference = πd, where d is the diameter

$d = 20$ ← Dividing both sides by π finds that the diameter is 20 cm

$r = 10$ ← The radius is half of the diameter

$x^2 + x^2 = 10^2$ ← ORQ forms a right-angled triangle. Pythagoras' Theorem can be used to work out the length of the square (which is labelled as x). $a^2 + b^2 = c^2$, where c is the longest side and a and b are the two shorter sides. Substituting x for a and b and the radius for c

$2x^2 = 100$

$x^2 = 50$

$x = \sqrt{50}$ ← Solving the equation

$= 5\sqrt{2}$ ← Simplifying the surd by using $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$. $\sqrt{50} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$

$20\sqrt{2} : 20\pi$

$\sqrt{2} : \pi$ ← Writing the ratio of the perimeter of the square to the circumference of the circle. The perimeter of the square is 4 times the side length. Then simplifying the ratio by dividing both sides by 20

$a =$ 2

.CG Maths.

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 $\dfrac{2ab}{a+b}$

[3 marks]

$30+30=60$ ← Adding the distance for stages 1 and 2 gives the total distance of 60 km for the whole journey

$\frac{30}{a}+\frac{30}{b}$ ← Adding the time for stages 1 and 2 gives the total time for the whole journey

$\frac{30b}{ab}+\frac{30a}{ab}$ ← To add fractions the denominators need to be the same. Multiplying both the numerator and denominator of the first fraction by b and both the numerator and denominator of the second fraction by a does this

$60\div\frac{30b+30a}{ab}$ ← Once the denominators are the same the numerators can be added. Dividing the distance in kilometres by the time in hours works out the speed in km/h

$60\times\frac{ab}{30b+30a}$ ← To divide by a fraction, keep the first part, change the division to a multiply and flip the second fraction

$\frac{60ab}{30a+30b}$ ← Multiplying the 60 by the numerator

$\frac{2ab}{a+b}$ ← Simplifying the fraction by dividing both the numerator and denominator by 30

END OF QUESTIONS

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