Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

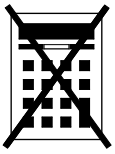
H

Higher Tier Paper 1 Non-Calculator

Wednesday 6 November 2024 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	

N 0 V 2 4 8 3 0 0 1 H 0 1

IB/M/Nov24/G4008/E9

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 should be written in the exam.

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

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

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

Do not write outside the box

1 Work out the value of 1.5^2

[2 marks]

15
× 15
75
150
225

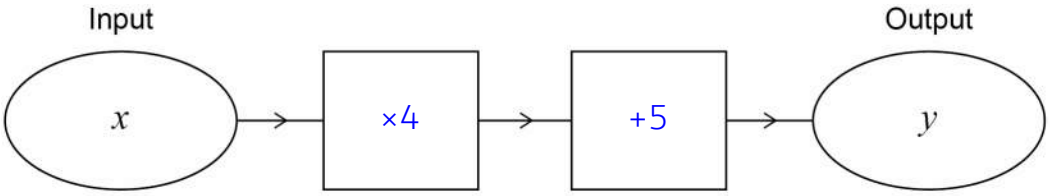
Ignoring the decimal point and doing $15^2 = 15 \times 15$

There were 2 decimal places in total in 1.5 and 1.5 so bringing the decimal point back 2 places

Answer 2.25

2 (a) Complete this number machine so that $y = 4x + 5$

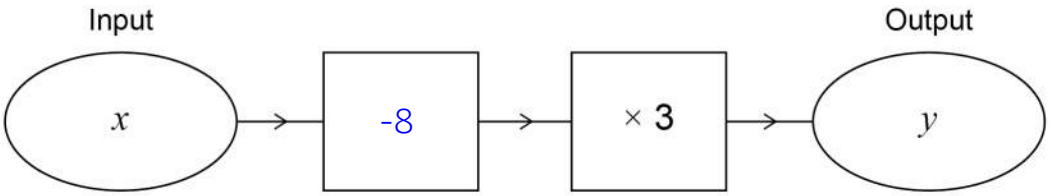
[1 mark]



x is multiplied by 4 then has 5 added to the result to get y

2 (b) Complete this number machine so that $y = 3x - 24$

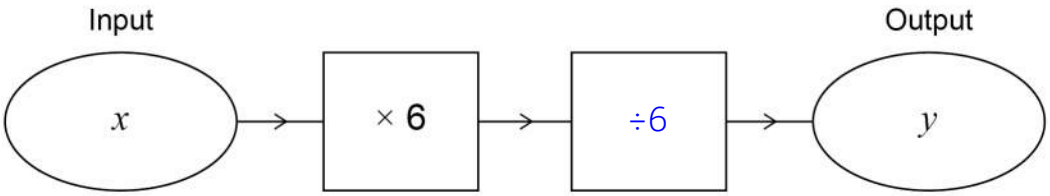
[1 mark]



Going back in the number machine by dividing the 3x - 24 by 3 gives x - 8

2 (c) Complete this number machine so that $y = x$

[1 mark]



Doing the opposite of multiplying by 6 by dividing by 6 cancels each other out so that there is no effect

Do not write outside the box

3 Each number in a list is increased by 10

Tick **one** box for each statement.

[3 marks]

	True	False	Cannot tell
The mode is increased by 10	✓		
The median is increased by 10	✓		
The range is increased by 10		✓	

The mode is the most frequent number. This will be increased by 10.
The median is the middle number when they are all put in order. This will be increased by 10.
Range is the difference between the largest and smallest. As both the largest and smallest increase by 10 there is no effect on the range

4 (a) Write the missing term in the geometric progression.

[1 mark]

16
× 4
64
2

1 4 16 64 256

It multiplies by 4 between each term

4 (b) A Fibonacci-type sequence begins

5 –9

The sequence is continued by adding the previous two terms.

Work out the next **two** terms.

[2 marks]

Answer -4 and -13

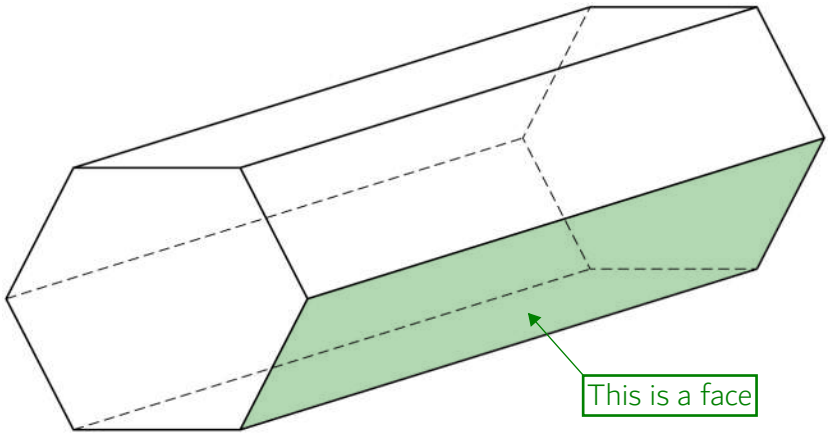
5 + -9 = 5 - 9 = -4

-9 + -4 = -9 - 4 = -13

11

Do not write outside the box

5 Here is a solid prism.



5 (a) How many faces does the prism have?

[1 mark]

Answer 8

5 (b) The prism has

volume = 3500 cm^3

and

length = 20 cm

Work out the area of the cross-section of the prism.

[2 marks]

$$20 \overline{)\, 3\,{}^{3}5^{15}0^{10}0} = 0\,1\,7\,5$$

Volume of prism = area of cross-section × length. So dividing the volume by the length gives the area of the cross-section

Answer 175 cm^2

Do not write outside the box

6 Work out $1\frac{1}{5} - \frac{3}{10}$

Give your answer as a fraction.

[2 marks]

$\frac{6}{5}$ ← Converting the mixed number into an improper fraction by multiplying the whole number by the denominator then adding the result to the numerator

$\frac{12}{10} - \frac{3}{10}$ ← Multiplying both the numerator and denominator of 6/5 by 2 to make it have the same denominator as 3/10

Answer $\frac{9}{10}$

↑ Subtracting the numerators. The denominator stays the same

Turn over for the next question

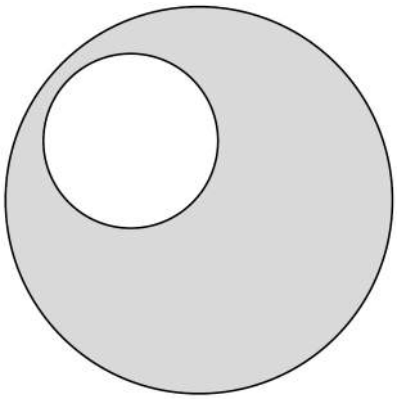
5

Do not write outside the box

7 A large circle and a small circle are shown.

The radius of the large circle is 12 cm

radius of large circle : radius of small circle = 4 : 1



Not drawn accurately

Work out the shaded area.

Give your answer in terms of π

[4 marks]

$\pi \times 12^2 = 144\pi$ ← Area of circle = π × radius^2. So the area of the large circle is 144π cm^2

$12 \div 4$ ← 4 parts of the ratio represent 12 cm. Dividing the 12 cm by 4 works out that 1 part of the ratio is worth 3 cm. This is the radius of the small circle

$\pi \times 3^2$ ← Area of circle = π × radius^2. So the area of the small circle is 9π cm^2

$144\pi - 9\pi$ ← Subtracting the area of the small circle from the area of the large circle works out that the shaded area is 135π cm^2

Answer 135π cm^2

Do not write outside the box

8 (a) In this part, assume that each person works at the same rate.

10 people can complete a job in 9 hours.

If 15 people work on the same job, how many hours will it take to complete the job?

[2 marks]

$10 \times 9 = 90$ ← Multiplying the 10 people by the 9 hours each person does works out that 90 hours worth of work is done

15, 30, 45, 60, 75, 90 ← Dividing the 90 hours worth of work by the 15 people works out that they each do 6 hours

Answer 6 hours

8 (b) In fact, of the 15 people

6 work at a slower rate

9 work at a faster rate.

What does this mean about the number of hours it will take to complete the job?

Tick **one** box.

[1 mark]

☐ It is greater than the answer to (a)

☐ It is the same as the answer to (a)

☐ It is less than the answer to (a)

☑ It is not possible to say — As it depends how much slower and how much faster the people work

7

9 $\begin{pmatrix} a \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ 3b \end{pmatrix} = \begin{pmatrix} 5 \\ 20 \end{pmatrix}$ ← 5: x-component; ← 20: y-component

Work out the values of a and b.

[3 marks]

$a + 1 = 5$ ← First dealing with the x-components. Then subtracting 1 from both sides finds that a = 4

$2 + 3b = 20$ ← Next dealing with the y-components

$3b = 18$ ← Subtracting 2 from both sides gets the b term on its own

$a =$ 4 $\quad b =$ 6

Dividing both sides by 3 gets b on its own

Do not write outside the box

10 Clive owns two coffee shops, A and B.

Out of 150 people

- 18 people use both shops
- 46% use shop A
- $\frac{2}{5}$ use shop B **only**.

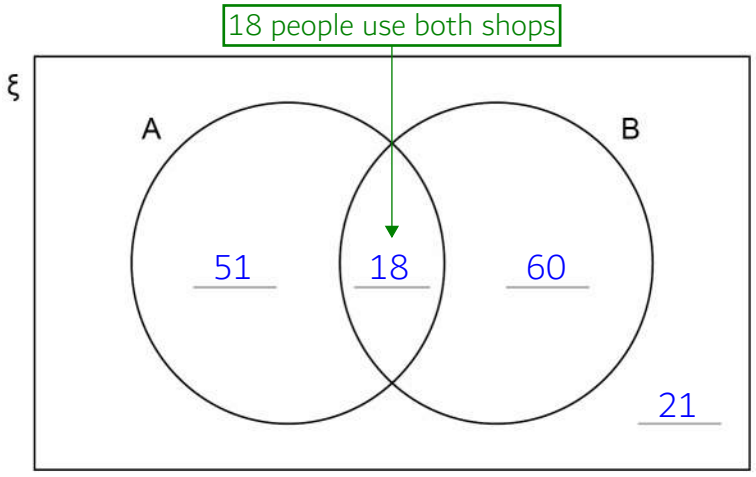
Complete the Venn diagram to represent the information.

[4 marks]

ξ = 150 people

A = people who use shop A

B = people who use shop B



$$\begin{array}{r} 46 \\ \times 15 \\ \hline 230 \\ 460 \\ \hline 690 \end{array}$$

1% of the 150 people is 150 ÷ 100 = 1.5. Multiplying this by 46 works out that 46% of the people is 69 who use shop A. The decimal point is ignored and then put back in at the end

$$\begin{array}{r} 69 \\ -\,18 \\ \hline 51 \end{array}$$

Subtracting the 18 people who use both shops from the 69 who use shop A works out that 51 people only use shop A

$$5\overline{)150} \times 2 = 030 \times 2$$

Dividing the 150 people by 5 then multiplying the result by 2 works out that 60 people use shop B only

$$\begin{array}{r} 51 \\ +18 \\ +60 \\ \hline 129 \end{array}$$

Adding all of the numbers in the rings works out that there are 129 people in the Venn diagram so far

$$\begin{array}{r} 1\,\overset{4}{5}\,\overset{1}{1}0 \\ -\,129 \\ \hline 21 \end{array}$$

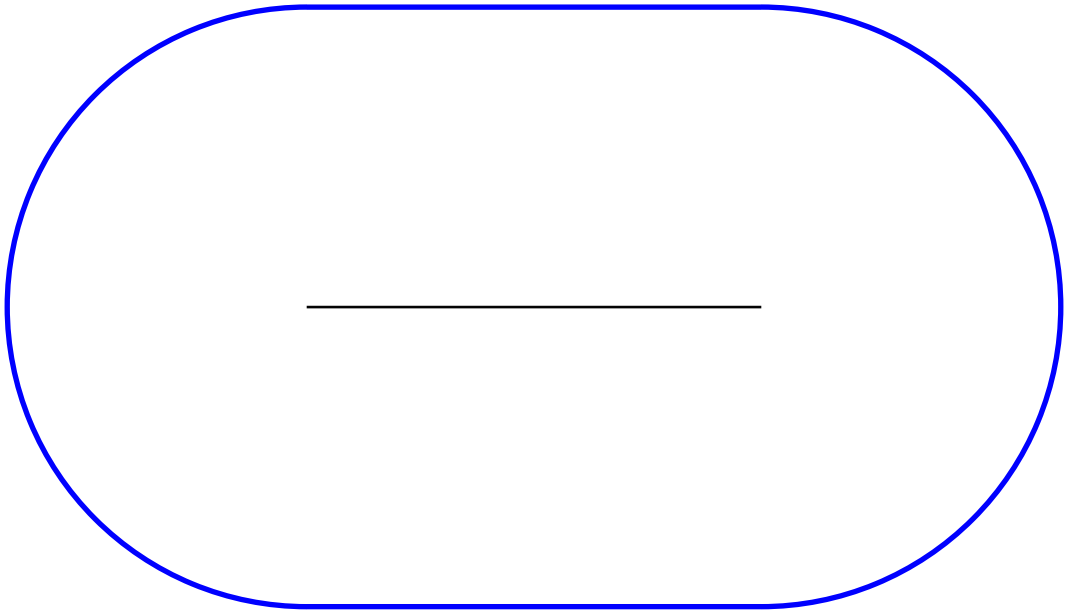
Subtracting the 129 people in the Venn diagram so far from the 150 people works out that there must be 21 on the outside

7

Do not write outside the box

11 Construct the region that lies within 4 cm of the line.

[3 marks]



Using a compass, set the radius to 4 cm and draw semicircular arcs from each end of the line. Then join up the arcs with a ruler

Do not write outside the box

12 (a) Convert $\frac{27}{11}$ to a recurring decimal.

[2 marks]

$$11\overline{)\,2\,{}^{2}7.{}^{5}0\,{}^{6}0}\;\;0\;2.\;4\;\;5$$

Using short division to divide the numerator by the denominator. The remainder of 5 repeats so it will be 2.45454545...

Answer $2.4\dot{5}$

12 (b) Convert $0.1\dot{5}$ to a fraction.

[3 marks]

$x = 0.1\dot{5}$ ← Let x be the recurring decimal

$10x = 1.5\dot{5}$ ← There is 1 recurring digit so multiplying x by 10 once rewrites the decimal with the recurring digit in the same decimal place

$9x = 1.4$ ← Subtracting x from 10x cancels out the recurring digit

$x = \frac{1.4}{9}$ ← Dividing both sides by 9 expresses x as a fraction, but it has a decimal in it

Answer $\frac{14}{90}$

Multiplying both the numerator and denominator by 10 eliminates the decimal within the fraction

8

Do not write outside the box

13 (a) By rounding each number to one significant figure,

estimate the value of $\dfrac{\sqrt{401} + 1.9^3}{\cos 58.7^\circ}$

You **must** show your working.

[3 marks]

$\dfrac{\sqrt{400} + 2^3}{\cos 60}$ ← Each number is rounded to 1 significant figure

$20 + 8 = 28$ ← $\sqrt{400} = \sqrt{4} \times \sqrt{100} = 2 \times 10 = 20$ and $2^3 = 2 \times 2 \times 2 = 4 \times 2 = 8$. So the numerator is 28

0 30 45 60 90
4 3 2 1 0 ← Writing the angles of 0, 30, 45, 60, 90 degrees. Listing 4, 3, 2, 1, 0 under these. The 1 is under the 60 degrees. Square rooting this 1 then putting it over 2 works out that cos60 = 1/2

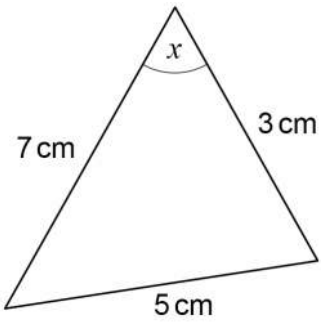
$28 \div \frac{1}{2}$ ← The fraction can be written as the numerator divided by the denominator

Answer 56

$28 \times 2 = 56$ ← To divide by a fraction: keep the first number, change the division to a multiplication, flip the fraction. 1/2 flips to 2/1, which is 2. So it becomes 28 × 2

Do not write outside the box

13 (b) Here is a triangle.



Not drawn accurately

Sam attempts to find the value of cos x using the cosine rule.

Here is his working.

$5^2 = 3^2 + 7^2 + 2 \times 3 \times 7 \times \cos x$

$5^2 = 10^2 + 42 \times \cos x$

$25 = 142 \cos x$

Therefore $\cos x = \frac{25}{142}$

Identify **two** errors Sam has made.

[2 marks]

Error 1 It should be - 2 × 3 × 7 × cos$x$

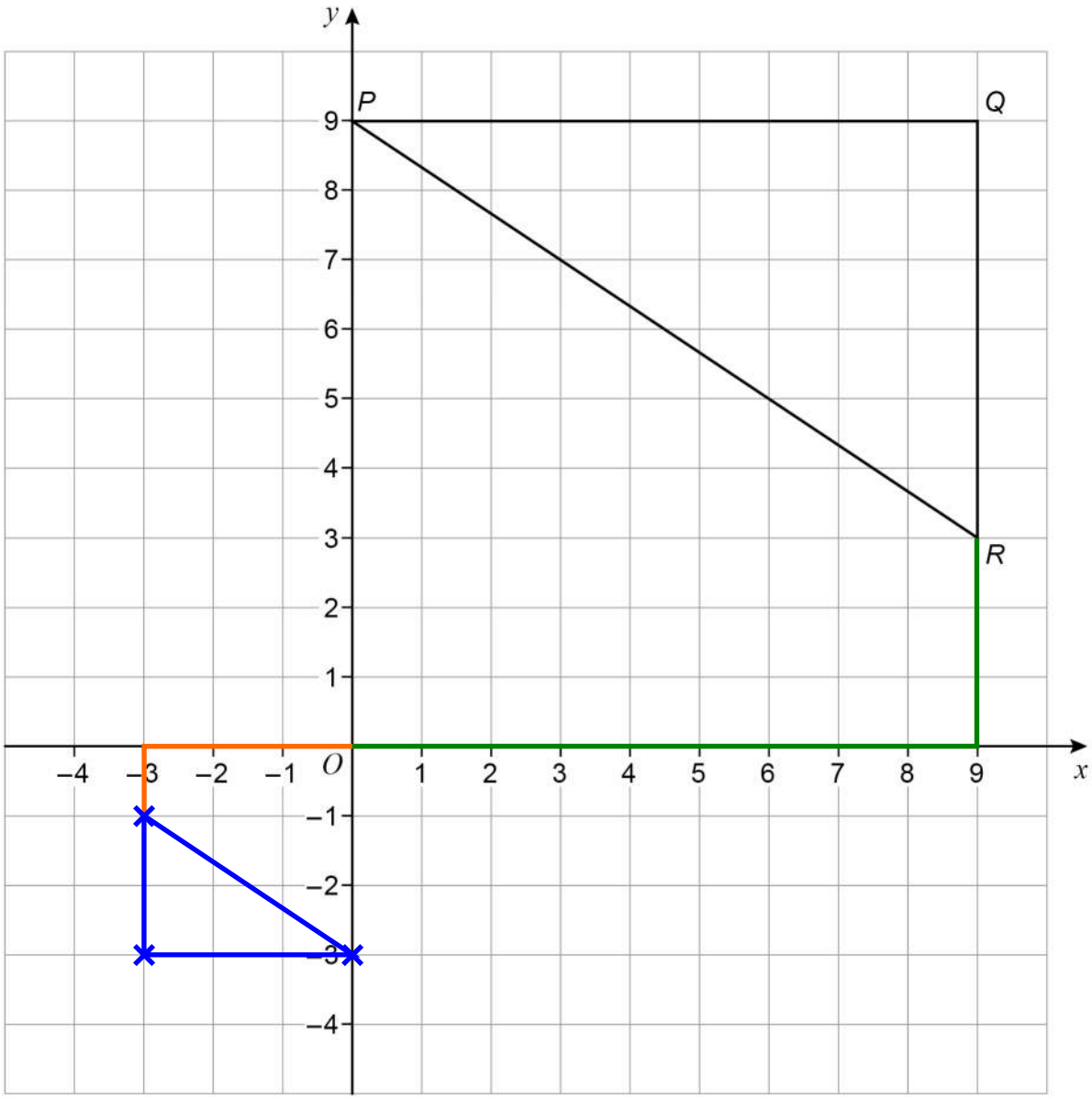
Error 2 $3^2 + 7^2$ is not 10^2

5

Do not write outside the box

14 Enlarge triangle *PQR* by scale factor $-\frac{1}{3}$ with centre (0, 0)

[3 marks]



$\begin{pmatrix} 0 \\ 9 \end{pmatrix} \times -\frac{1}{3} = \begin{pmatrix} 0 \\ -3 \end{pmatrix}$

$\begin{pmatrix} 9 \\ 3 \end{pmatrix} \times -\frac{1}{3} = \begin{pmatrix} -3 \\ -1 \end{pmatrix}$

$\begin{pmatrix} 9 \\ 9 \end{pmatrix} \times -\frac{1}{3} = \begin{pmatrix} -3 \\ -3 \end{pmatrix}$

Multiplying the vectors from (0, 0) to each corner of the triangle by -1/3 then doing the resulting vector from (0, 0) gives the corners of the new triangle. Then joining up the corners with a ruler

Do not write outside the box

15 (a) Solve the inequality $20 - 5x \leqslant 30$

[3 marks]

$20 \leq 5x + 30$ ← Adding 5x to both sides to make the x term positive

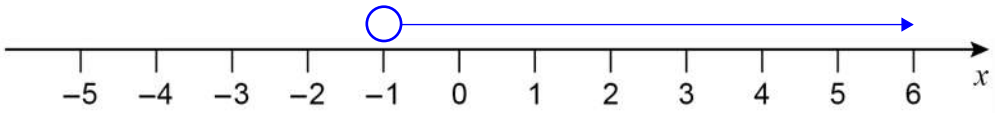
$-10 \leq 5x$ ← Subtracting 30 from both sides to get the x term on its own

Answer $-2 \leq x$

↑ Dividing both sides by 5 gets x on its own

15 (b) Represent $x > -1$ on the number line.

[1 mark]



The circle is not shaded in as it cannot be equal to -1

16 When w is **truncated** the answer is 8

Sacha writes the error interval due to truncation as $7.5 \leqslant w < 8.5$

Give a reason why Sacha is wrong and state the correct error interval for w.

[2 marks]

Reason 7.5 does not truncate to 8

7.5 truncates to 7 as the decimal places are ignored. It is not the same as rounding

Correct error interval 8 $\leqslant w <$ 9

↑ It must be at least 8 but less than 9 to truncate to 8

9

Do not write outside the box

17 (a) A circle has centre (0, 0) and circumference 36π

Work out the equation of the circle.

[2 marks]

$2\pi r = 36\pi$ ← Circumference = $2\pi r$, where r is the radius

$r = 18$ ← Dividing both sides by 2π finds that the radius is 18

Answer $x^2 + y^2 = 18^2$

The general equation of a circle with its centre at (0, 0) is $x^2 + y^2 = \text{radius}^2$

17 (b) Point *J* has coordinates (15, 0) and point *K* has coordinates (30, –5)

Work out the equation of the straight line through *J* and *K*.

[4 marks]

$\frac{-5 - 0}{30 - 15}$ ← Gradient = (change in y)/(change in x)

$\frac{-5}{15} = \frac{-1}{3}$ ← Simplifying the gradient to make it easier to work with

$0 = \frac{-1}{3} \times 15 + c$ ← The general equation of a straight line is y = mx + c, where m is the gradient and c is the y-intercept. Substituting the coordinates from (15, 0) for x and y

$0 = -5 + c$ ← $-1/3 \times 15 = -5$. Then adding 5 to both sides finds that c = 5

Answer $y = \frac{-1}{3}x + 5$

The general equation of a straight line is y = mx + c, where m is the gradient and c is the y-intercept. Substituting in the values of m and c

Do not write outside the box

18 (a) Express $x^2 + 8x - 5$ in the form $(x + a)^2 - b$ where a and b are integers.

[2 marks]

$(x + 4)^2 - 5 - 16$ ← Completed the square by halving the coefficient of x and putting this in a bracket with x and squaring the bracket. Subtracting 4^2 from the end

Answer $(x + 4)^2 - 21$

18 (b) A curve has the equation $y = (x - 7)^2 + 8$

Write down the coordinates of the turning point of the curve.

[2 marks]

Answer (7 , 8)

↑ The smallest a squared value can be is 0. x = 7 for the square bracket to be equal to 0. When the square bracket is 0, y = 8

Turn over for the next question

10

Do not write outside the box

19 (a) Expand and simplify fully $(x + 2)(2x + 3)(3x + 4)$

[3 marks]

$2x^2 + 3x + 4x + 6$ ← Expanding the first two brackets

$(2x^2 + 7x + 6)(3x + 4)$ ← Simplifying by collecting like terms and writing multiplied by the third bracket

$6x^3 + 8x^2 + 21x^2 + 28x + 18x + 24$ ← Expanding

Answer $6x^3 + 29x^2 + 46x + 24$

↑ Simplifying by collecting like terms

19 (b) Use your answer from part (a) to work out $102 \times 203 \times 304$

[2 marks]

$x + 2 = 102$ ← There are three numbers multiplied together. There were three brackets multiplied together in part (a). Setting the first bracket equal to the first number

$x = 100$ ← Subtracting 2 from both sides gets x on its own. This value of x works as substituting 100 for x in the three brackets gives 100 + 2 = 102, 2(100) + 3 = 203 and 3(100) + 4 = 304

$6(100)^3 + 29(100)^2 + 46(100) + 24$ ← Substituting 100 for x in the expanded and simplified expression found in part (a)

6000000
$+ 290000$
$+ 4600$
$+ 24$
6294624

Answer 6294624

↑ Working out the value of each term and adding them all together

Do not write outside the box

20 (a) Show that $\frac{\sqrt{363}}{\sqrt{3}}$ simplifies to an integer.

[2 marks]

$3\overline{)3\ 6\ 3}$ → $1\ 2\ 1$ ← $\sqrt{a}/\sqrt{b} = \sqrt{a/b}$

$\sqrt{121}$ ← It simplifies to this

11 ← $11^2 = 121$ so $\sqrt{121} = 11$, which is an integer

20 (b) Rationalise the denominator and simplify $\frac{20}{\sqrt{5}}$

[2 marks]

$\frac{20}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ ← $\sqrt{5}$ can be multiplied by $\sqrt{5}$ to make it rational. So the numerator also needs to be multiplied by $\sqrt{5}$

$\frac{20\sqrt{5}}{5}$ ← $20 \times \sqrt{5} = 20\sqrt{5}$ and $\sqrt{5} \times \sqrt{5} = 5$

Answer $4\sqrt{5}$

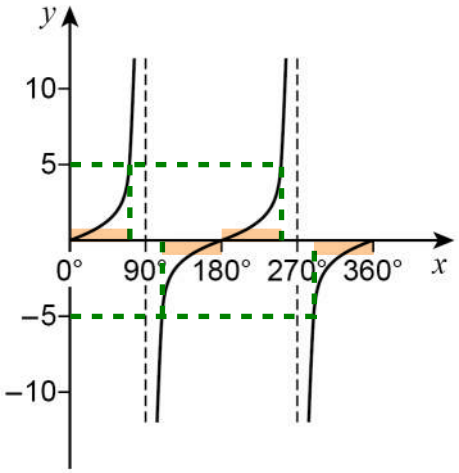
↑ Dividing the 20 on the numerator by the 5 on the denominator

Turn over for the next question

9

Do not write outside the box

21 Here is a sketch of the graph of $y = \tan x$ where $0° \leqslant x \leqslant 360°$



You are given that **tan 78.69° = 5**

21 (a) Work out the other value of x where $\tan x = 5$ and $0° \leqslant x \leqslant 360°$

[1 mark]

180.00
+ 78.69
258.69
1

From the graph it can be seen that it repeats every 180°. So adding 180° to 78.69° works out the other value of x

Answer 258.69 °

21 (b) Work out the **two** values of x where $\tan x = -5$ and $0° \leqslant x \leqslant 360°$

[2 marks]

1 8 0. 0 0
- 7 8. 6 9
1 0 1. 3 1
+ 1 8 0. 0 0
2 8 1. 3 1

All the distances highlighted in orange on the graph are the same. So subtracting the 78.69° from 180° works out one of the values of x. Then as it repeats every 180°, adding 180° to the first value of x works out the second value of x

Answer 101.31 ° and 281.31 °

Do not write outside the box

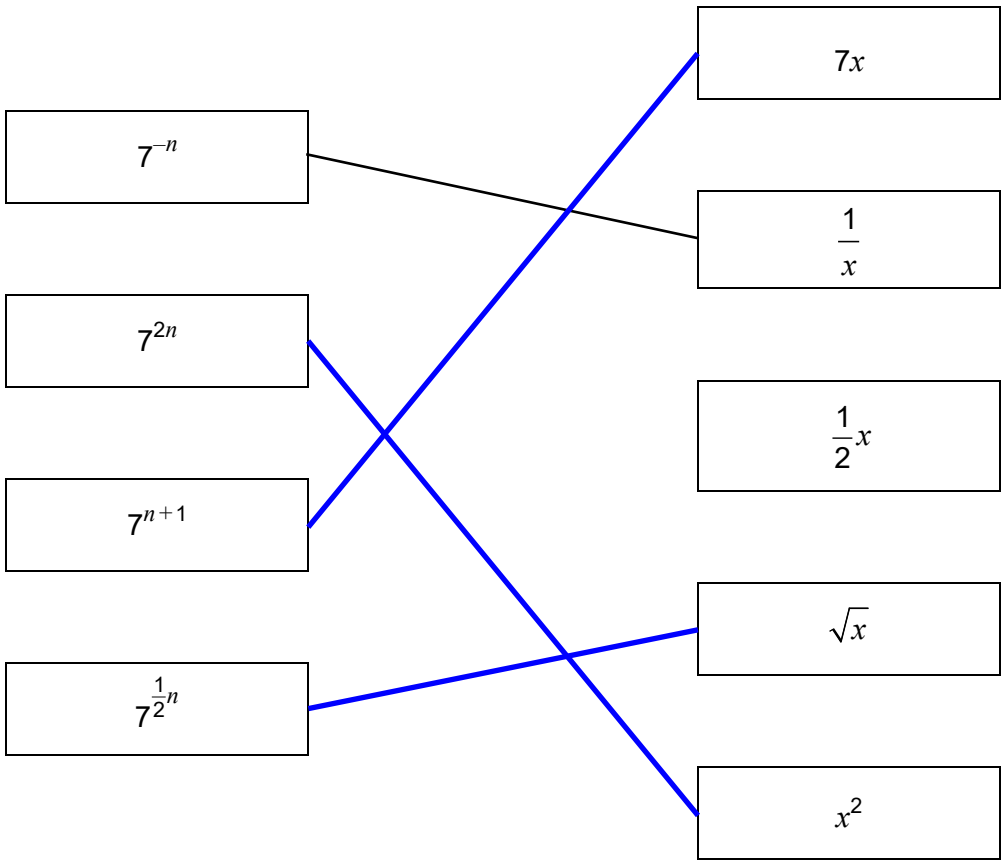
22

$7^n = x$

Match each expression on the left to the correct expression on the right.

One has been done for you.

[3 marks]



$7^{2n} = (7^n)^2 = x^2$.

$7^{n+1} = 7^n \times 7^1 = x \times 7 = 7x$.

$7^{1/2\,n} = (7^n)^{1/2} = \sqrt{7^n} = \sqrt{x}$

Turn over for the next question

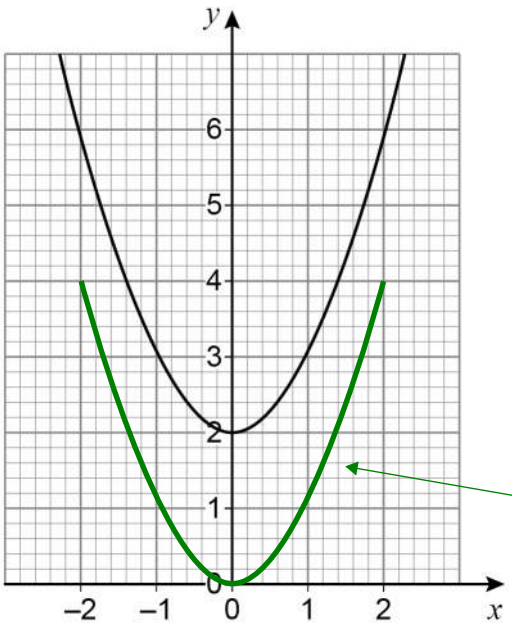
6

Do not write outside the box

23 In each part, the graph shown is a transformation of the graph $y = x^2$

23 (a) Write down the equation of the graph shown.

[1 mark]



The graph of $y = x^2$ is shown in green

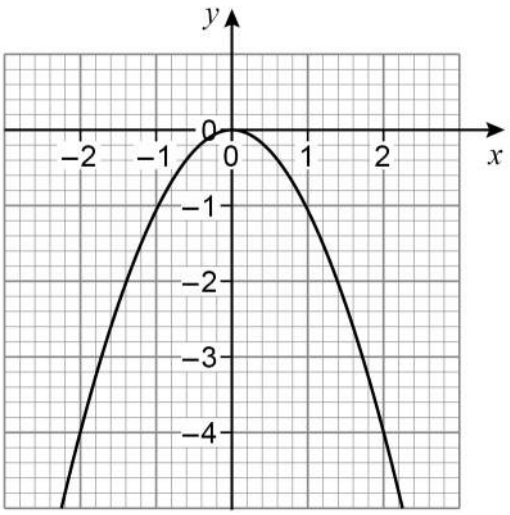
Answer $y = x^2 + 2$

The graph of $y = x^2$ is translated 2 upward

Do not write outside the box

23 (b) Write down the equation of the graph shown.

[1 mark]

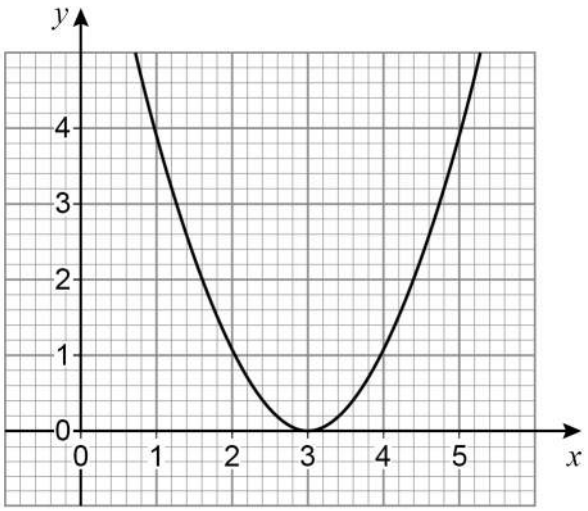


Answer $y = -x^2$

The graph of $y = x^2$ is reflected in the x-axis

23 (c) Write down the equation of the graph shown.

[1 mark]



Answer $y = (x - 3)^2$

The graph of $y = x^2$ is translated 3 to the right

END OF QUESTIONS

3