AQA

.CG Maths.
Hints

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

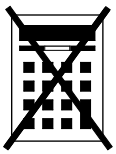
H

Higher Tier Paper 1 Non-Calculator

Tuesday 19 May 2020 Morning 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	
22–23	
24–25	
TOTAL	

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

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

Do not write outside the box

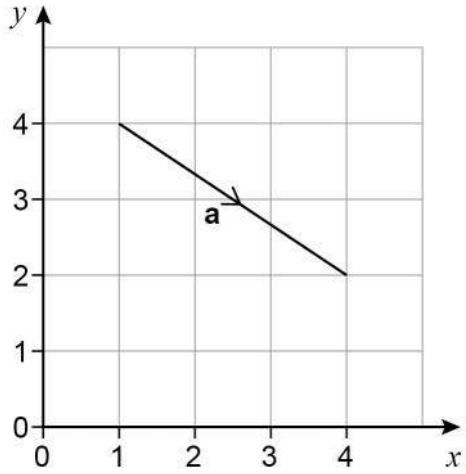
1 Circle the fraction that is equivalent to 4.75

[1 mark]

$\frac{15}{4}$ $\frac{19}{4}$ $\frac{21}{4}$ $\frac{23}{4}$

All the answers have 4 as the denominator. Convert 4 into a fraction with 4 as the denominator. Convert 0.75 into a fraction with 4 as the denominator. Add the two fractions together

2 Here is vector **a**.



Circle the column vector that represents **a**.

[1 mark]

$\begin{pmatrix}3\\2\end{pmatrix}$ $\begin{pmatrix}-3\\2\end{pmatrix}$ $\begin{pmatrix}3\\-2\end{pmatrix}$ $\begin{pmatrix}-3\\-2\end{pmatrix}$

Column vectors are in the form $\begin{pmatrix}x\\y\end{pmatrix}$ where x is the amount in the x direction and y is the amount in the y direction

3 Which one of these is a square number **and** a cube number?

Circle your answer.

[1 mark]

100 1000 10 000 1 000 000

Square numbers can be square rooted and cube numbers can be cube rooted. Think of each of these numbers as powers of 10. If the power can be divided by 2 and 3 it can be both square rooted and cube rooted

Do not write outside the box

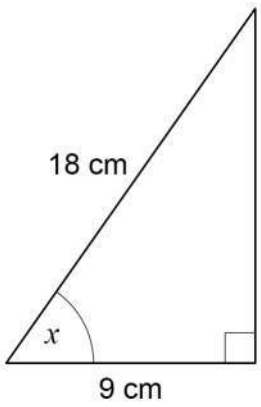
4 Circle the reciprocal of $\frac{5}{6}$

[1 mark]

$\frac{6}{5}$ $\frac{1}{6}$ $-\frac{1}{6}$ $-\frac{6}{5}$

Reciprocal means 1 divided by

5 Use trigonometry to work out the size of angle x.



Not drawn accurately

[2 marks]

SOH CAH TOA

List SOH CAH TOA as formula triangles. Tick what sides we have to decide which formula triangle to use. Cover over the term which involves the angle x to work out the formula involving the angle. We should get a trig function of x = a fraction. Simplify the fraction then work out what angle of x would give this fraction. S: sin of the angle. C: cos of the angle. T: tan of the angle. O: opposite. H: hypotenuse. A: adjacent

Answer _____ degrees

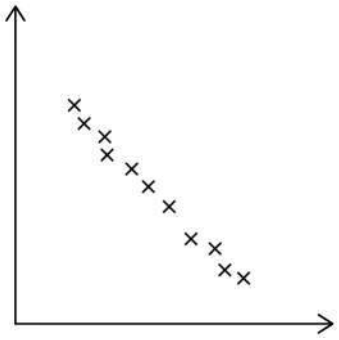
The angles we need to remember for the trig values are 0, 30, 45, 60 and 90. List these out in order. For the sin values list 0, 1, 2, 3, 4 under these. For the cos values list 4, 3, 2, 1, 0 under these. Then square root them all then put them over 2. For the tan values, divide the sin value by the cos value

6

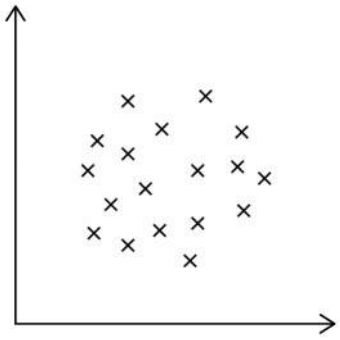
Do not write outside the box

6 A and B are scatter graphs.

Graph A



Graph B



What type of correlation is shown by each graph?

Choose from

Weak positive
Strong positive
Weak negative
Strong negative
No correlation

[2 marks]

Graph A _____

Graph B _____

Correlation is to do with how the two variables are linked. One variable is on the x axis and the other is on the y axis. There is positive correlation if both variables increase together. There is negative correlation if one increases while the other decreases. There is no correlation if there is no link between the two variables

Do not write outside the box

7 Here is some information about 80 people who play in bands.

12 are singers but not guitar players.

30% are neither a singer nor a guitar player.

$\frac{1}{4}$ of the guitar players are also singers.

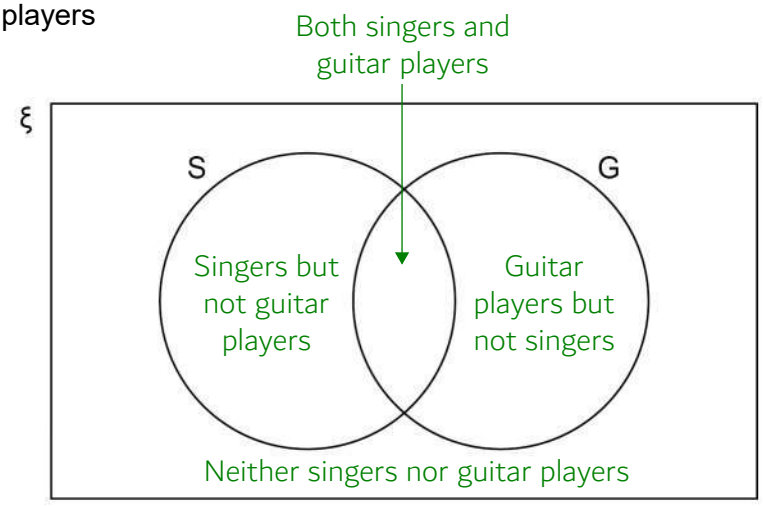
Complete this Venn diagram to represent the information.

[4 marks]

ξ = 80 people who play in bands

S = singers

G = guitar players



Work out 10% of 80 then multiply this to get 30% to find how many are neither singers nor guitar players. Subtracting the singers but not guitar players and neither singers nor guitar players from 80 works out how many are guitar players. A quarter of these are both singers and guitar players. The rest are guitar players but not singers

6

Do not write outside the box

8 The shorter side of a parallelogram has length 6.5 cm

Not drawn accurately

The length of the shorter side is $\frac{1}{9}$ of the perimeter.

Work out the length of the longer side.

[3 marks]

Opposite sides in a parallelogram are equal. Multiplying the shorter side by 9 works out the perimeter. Subtracting both of the shorter sides from the perimeter leaves the total of both of the longer sides. Dividing this will give one of the longer sides

Answer _____ cm

Do not write outside the box

9 (a) All the terms of a **geometric** progression are positive.

The second and fourth terms are shown.

……. 4 ……. 16

Work out the first and third terms.

[2 marks]

Geometric means that each term is multiplied by the same amount to get the next term. Let x be the amount it multiplies by each time. 4 multiplied by x twice gives 16. Write this as an equation then rearrange to find x. It cannot be negative. Once we have the amount it multiplies by each time, we can follow the sequence backward by doing the opposite of multiplying to get the third and first term

First term _____

Third term _____

9 (b) The first two terms of an **arithmetic** progression are shown.

p $5p$ …..

The sum of the first three terms is 90

Work out the value of p.

[3 marks]

The sequence is arithmetic so increases by the same amount between each term. Add up the first three terms in terms of p and set this equal to 90. Then rearrange to find p by doing opposite operations to both sides

Answer _____

8

Do not write outside the box

10 The cost of a holiday is £2400

Rana pays a deposit followed by monthly payments, in the ratio

deposit : total of the monthly payments = 3 : 5

She makes 6 equal monthly payments.

Work out her monthly payment.

[4 marks]

Work out how many parts there are in total in the ratio. This many parts represents the total of £2400. Work out what 1 part is worth. Then work out what 5 parts are as this gives the total of the monthly payments. Then work out what 1 of the monthly payments is worth

Answer £ _____

Do not write outside the box

11 As a decimal $\frac{11}{40} = 0.275$

Work out $\frac{33}{400}$ as a decimal.

[2 marks]

The numerator is 3 times as large and the denominator is 10 times as large. Increasing the numerator increases the decimal. Increasing the denominator decreases the decimal

Answer _____

Turn over for the next question

6

Do not write outside the box

12 Two wire shapes make an earring.

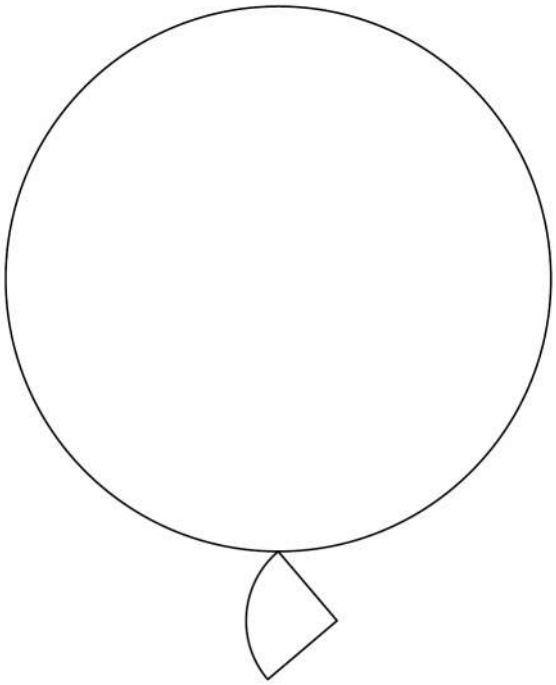
The shapes are

a circle with radius 21 mm

and

a quarter circle.

Not drawn accurately



radius of circle : radius of quarter circle = 7 : 2

12 (a) Show that the radius of the quarter circle is 6 mm

[1 mark]

7 parts of the ratio represent the radius of the circle which is 21mm. Work out 1 part of the ratio. Then work out the 2 parts which represents the radius of the quarter circle

Do not write outside the box

12 (b) Work out the **total** length of the wire in the earring.

Give your answer in the form $a\pi + b$ where a and b are integers.

[4 marks]

Adding the wire used for the circle and quarter circle give the total length of wire.
Arc length = 1/4 of the circumference
Circumference = π x diameter
Diameter = 2 x radius
Don't forget to add the two radii on the quarter circle

Answer _____ mm

Turn over for the next question

5

Do not write outside the box

13 (a) s and t are **positive** integers.

$(x + s)(x - t)$ is expanded and simplified.

The answer is $x^2 + kx - 40$ where k is a positive integer.

Work out the **smallest** possible value of k.

[2 marks]

Expand out the brackets and factorise the two middle x terms to express in the same form as the answer. By equating the coefficients of the expansion and the answer we can work out what k and 40 must be equal to in terms of s and t. Work out possible values of k by working out the possible values of s and t

Answer _____

13 (b) Faisal tries to solve $(x + 2)(x - 7) = 0$

Here is his working.

	$(x + 2) = 0$	or	$(x - 7) = 0$
Answer	$x = 2$	or	$x = 7$

Give a reason why his answer is wrong.

[1 mark]

When one of the brackets equals to 0 multiplying both brackets will give 0. x = 7 is correct as if you add 7 to both sides in the equation x - 7 = 0 we get x = 7

Do not write outside the box

14 (a) $c = 2^{10} \times 3 \times 5^6$ ← This is an example of a product of primes in index form

Work out $18c$.

Give your answer as a product of prime factors in index form.

[2 marks]

Find 18 as a product of primes by doing a factor tree. Then multiply the result by $2^{10} \times 3 \times 5^6$. Multiplication can be done in any order and $a^x \times a^y = a^{x+y}$

Answer _____

14 (b) Work out $\sqrt[3]{\frac{2^7 \times 11^3}{2}}$

Give your answer as an integer.

[2 marks]

$a^x / a^y = a^{x-y}$. Cube rooting divides all of the powers by 3 when there is a single term

Answer _____

7

Do not write outside the box

15 $3x = \frac{1}{2}y$

Circle the ratio $x : y$

[1 mark]

6 : 1 1 : 6 3 : 2 2 : 3

We could substitute in the x and y value for each ratio into the equation to see if they satisfy the equation

16 A sequence of numbers is formed by the iterative process

$$u_{n+1} = \frac{4}{u_n - 1} \qquad u_1 = 9$$

Work out the values of u_2 and u_3

[2 marks]

To find u_2, $u_{n+1} = u_2$ so n + 1 = 2, n = 1 therefore $u_n = u_1$. Substituting in u_1 for u_n gives u_2. To divide by a fraction, keep the first number, change the sign to multiplication and flip the second number. To multiply by a fraction, divide by the denominator then multiply by the numerator

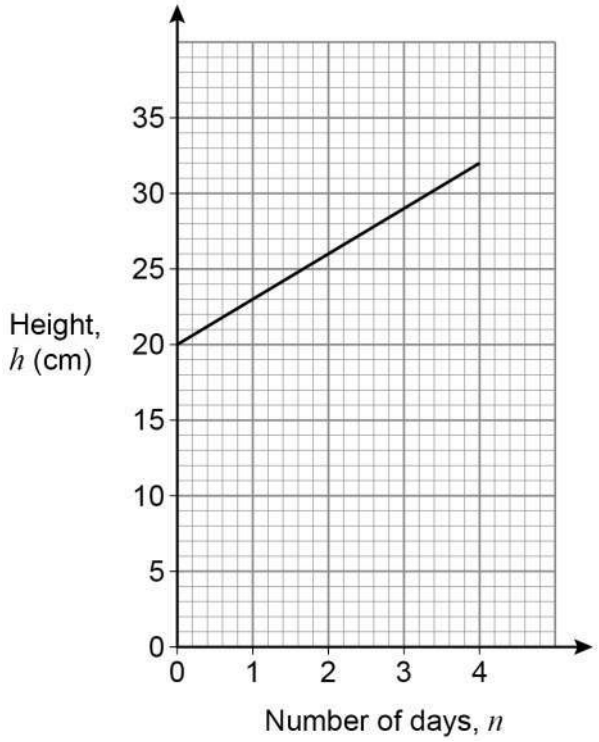
$u_2 =$ _____

$u_3 =$ _____

Do not write outside the box

17 Jim buys a plant of height 20 cm

The graph shows how the height of the plant changes during the next 4 days.



Work out a formula for h in terms of n.

[3 marks]

We need to find the equation of the line. The general equation of a straight line is y = mx + c, where m is the gradient and c is the y intercept, the y coordinate where it crosses the y axis. Gradient = (change in y)/(change in x). Write h instead of y as h is on the y axis and n instead of x as n is on the x axis

Answer $h =$

6

Turn over ►

Do not write outside the box

18 Solve the simultaneous equations

$$2x + 4y = -9$$

$$2y = 4x - 7$$

[4 marks]

Rearrange the second equation to make y the subject. Substitute y for the result in the first equation to get an equation only in terms of x. Solve for x. Substitute the value of x into the rearranged equation with y as the subject to find y

$x =$ _____ $y =$ _____

Do not write outside the box

19 Circle the expression that is equivalent to $\frac{x}{5} + \frac{x}{10}$

[1 mark]

$\frac{3x}{10}$ $\frac{2x}{15}$ $\frac{x}{25}$ $\frac{x^2}{50}$

The fractions can be added if the denominators are the same. Find a common multiple of 5 and 10. Multiply both the numerators and denominators of one or both fractions to get this common multiple as the denominator. Then add the numerators

20 (a) Write down the value of 7^0

[1 mark]

Answer _____

$7^1 = 7$. Subtracting 1 from the power divides by 7

20 (b) Work out the value of $32^{-\frac{3}{5}}$

[2 marks]

Answer _____

The denominator of 5 as a power means 5th root. To find the 5th root of 32 find which number to the power of 5 gives 32. The numerator of 3 as a power means to cube. The negative as a power means reciprocal

Turn over for the next question

8

Do not write outside the box

21 Write these numbers in order of size.

$15.6 \qquad 3\sqrt{23} \qquad 2.1^4 \qquad \frac{47}{3}$

Start with the smallest.

[2 marks]

$\sqrt{23} < \sqrt{25}$. $2.1^4 > 2^4$. Divide 47 by 3 to work out 47/3 as a decimal

Smallest _____

_____

_____

Largest _____

Do not write outside the box

22 (a) y is directly proportional to x^3

$y = 17$ when $x = 4$

Work out an equation connecting y and x.

[3 marks]

x^3 can be multiplied by anything and still be directly proportional to y. So use k to represent what x^3 is multiplied by and write an equation in terms of y, x and k. Rearrange to find k by substituting in the values of x and y given. Then substitute the value of k back into the original equation

Answer _____

22 (b) m is inversely proportional to $\sqrt{r}$

The value of r is multiplied by 4

Circle what happens to the value of m.

[1 mark]

× 2 × 16 ÷ 2 ÷ 16

Inversely proportional means that the opposite effect happens to m so if r is multiplied, m will be divided. As r is square rooted, the square root of 4 will be what m is divided by

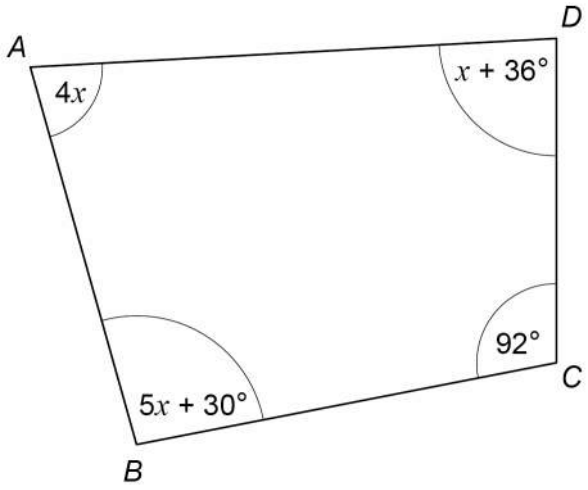
Turn over for the next question

6

Do not write outside the box

23 *ABCD* is a quadrilateral.

Not drawn accurately



Prove that *ABCD* is **not** a cyclic quadrilateral.

[4 marks]

Opposite angles in a cyclic quadrilateral add up to 180. Assume that it is a cyclic quadrilateral and use this fact to find what x is for one of the pairs of opposite angles by adding the opposite pair and setting it equal to 180 then rearranging and solving the equation. Then show that this does not give 180 when the value of x found is substituted into the other pair added together

Do not write outside the box

24 y is an obtuse angle.

Which statement is true?

Tick **one** box.

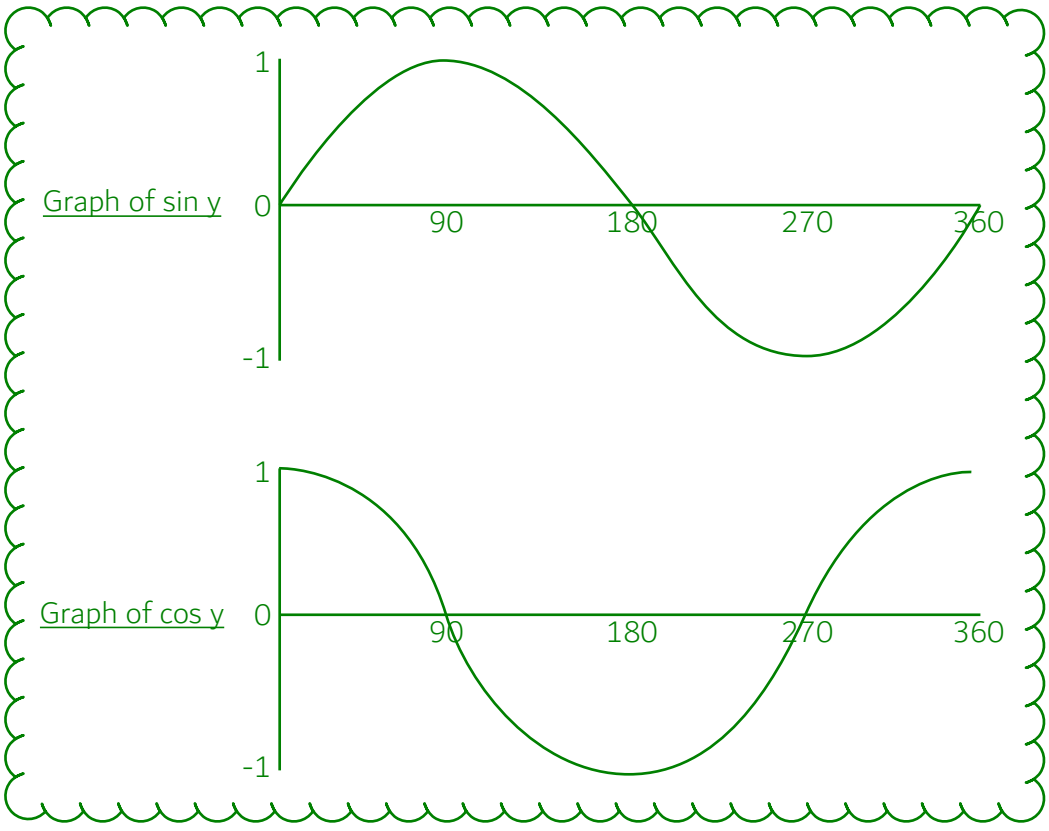
[1 mark]

☐ $\sin y > 0$ and $\cos y > 0$

☐ $\sin y > 0$ and $\cos y < 0$

☐ $\sin y < 0$ and $\cos y > 0$

☐ $\sin y < 0$ and $\cos y < 0$



Turn over for the next question

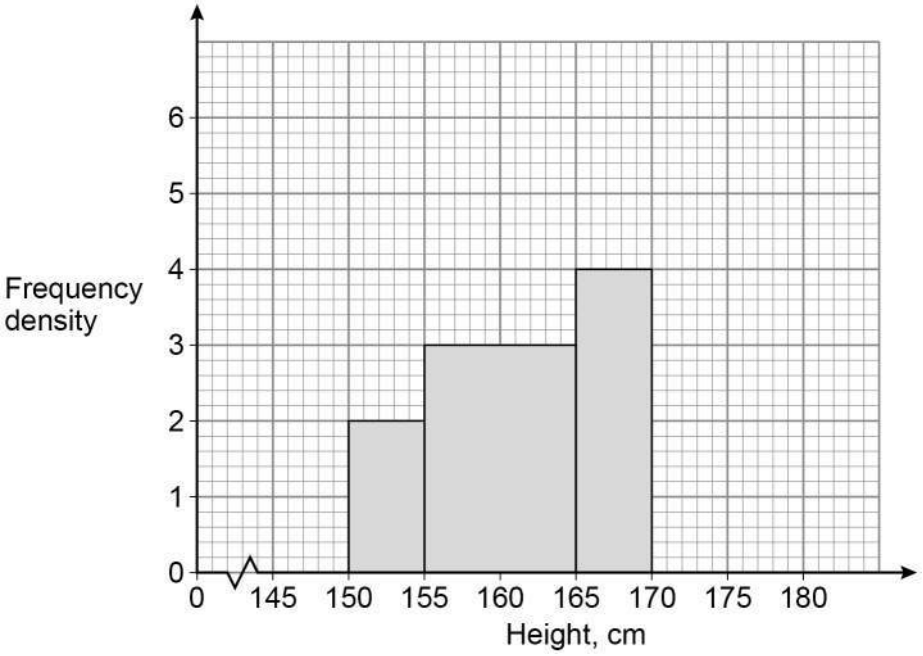
5

Do not write outside the box

25 A histogram is drawn to represent the heights of a sample of women.

Three of the four bars are shown.

The bar for $170 \text{ cm} \leqslant \text{height} < 180 \text{ cm}$ is missing.



There are 74 women in the sample.

Complete the histogram.

[4 marks]

Frequency = class width x frequency density.
Work out the frequencies of the first three bars. Subtracting these frequencies from 74 leaves the frequency for the fourth bar. Find the frequency density of the fourth bar using its frequency and class width

Do not write outside the box

26 (a) Show that $\frac{14}{\sqrt{7}}$ can be written in the form $a\sqrt{b}$ where a and b are integers.

[2 marks]

Rationalise the denominator: c/√d x √d/√d. Doing this should eliminate any surds from the denominator. √d x √d = d. Simplify the resulting fraction to eliminate the denominator

26 (b) Work out $2\sqrt{10} \times \sqrt{80} \times \sqrt{18}$

Give your answer as an integer.

[3 marks]

√ab = √a x √b
This can be used to simplify surds if one of a or b are a square number. It can also be used to multiply surds together. Do not attempt to multiply the surds without simplifying first as this will give a large number which will be difficult to square root. Simplify the surds as much as possible then multiply the whole numbers and remaining surds separately. The surds multiplied together should give a square number which can be rooted to get a whole number

Answer _____

Turn over for the next question

9

Do not write outside the box

27 A and B are similar solid cylinders.

base area of A : base area of B = 9 : 25

Complete these ratios.

[2 marks]

curved surface area of A : curved surface area of B = _____ : _____

height of A : height of B = _____ : _____

The ratio of the area is the same for all of the faces. Square rooting both sides of the ratio gives the ratio of the lengths and height is a length

28 Factorise fully $144 - 4x^2$

[2 marks]

It can be factorised using difference of two squares: $A^2 - B^2 = (A + B)(A - B)$. There should be common factors to both terms in both brackets and these can also be brought out as factors

Answer _____

Do not write outside the box

29 The graph of $y = x^3 + 6$ is translated 4 units to the right.

The translated graph has equation $y = f(x)$

Work out $f(x)$.

Give your answer in the form $x^3 + ax^2 + bx + c$ where a, b and c are integers.

[4 marks]

Subtracting 4 from all of the x translates it 4 to the right as the same values are got to 4 later. There should be a cubed bracket which needs expanding. Write it out as three brackets multiplied together, expand the first two brackets, collect like terms and simplify, then expand out with the third bracket. Collect like terms and simplify again. Don't forget about the +6 in the original equation

Answer _____

END OF QUESTIONS

8