

Please write clearly in block capitals.

Centre number

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Candidate number

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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

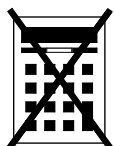
Time allowed: 1 hour 30 minutes

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.

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	

Advice

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



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

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 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.

- 1 Circle the fraction that is equivalent to 4.75

[1 mark]

$$\frac{15}{4}$$

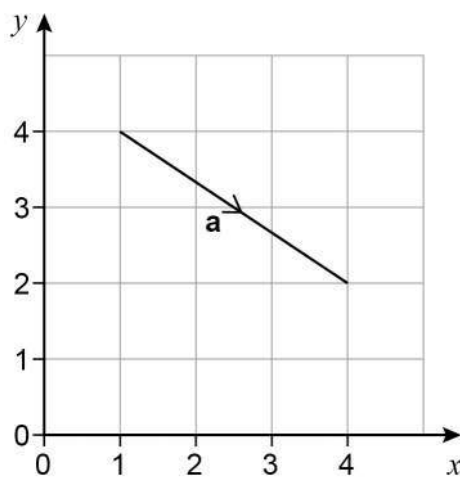
$$\frac{19}{4}$$

$$\frac{21}{4}$$

$$\frac{23}{4}$$

- 2 Here is vector **a**.

$$\begin{aligned} 4 &= 4/1 = 16/4. \\ 0.75 &= 3/4. \\ 16/4 + 3/4 &= 19/4 \end{aligned}$$

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

[1 mark]

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

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

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

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

3 to the right, which is 3 in the x direction. 2 down, which is -2 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

1000000 = 10^6 . The power of 6 can be divided by 2 and by 3 so therefore can be square rooted and cube rooted



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

[1 mark]

$$\frac{6}{5}$$

$$\frac{1}{6}$$

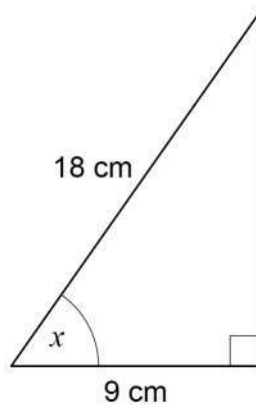
$$-\frac{1}{6}$$

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

Flipping the fraction does the reciprocal

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

Not drawn
accurately



[2 marks]

S O H C A H T O A

Using right-angled trigonometry. Ticking A as the 9 cm is the adjacent and ticking H as the 18 cm is the hypotenuse. There are two ticks on the CAH formula triangle so this one can be used

$$\frac{9}{18} = \frac{1}{2}$$

Covering C in the CAH formula triangle finds that $\cos$ of the angle = adjacent/hypotenuse. Putting the 9 over the 18 and simplifying by dividing both the numerator and denominator by 9 to get $\frac{1}{2}$

0 30 45 60 90
4 3 2 1 0

Listing the angles of 0, 30, 45, 60, 90 degrees. Listing 4, 3, 2, 1, 0 under these for the $\cos$ values. Square rooting the 1 then putting the result over 2 gives $\frac{1}{2}$ so $\cos 60 = \frac{1}{2}$

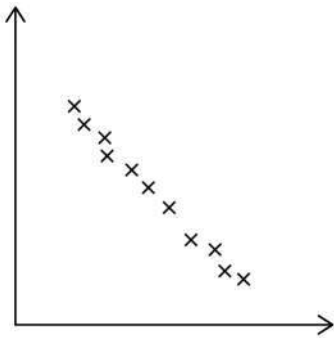
Answer 60 degrees



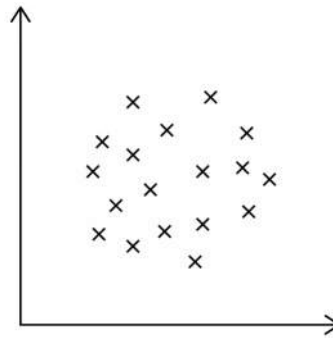
6

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 Strong negativeGraph B No correlation

If drawing a line of best fit, A would have a negative gradient and all the points would be quite close to it for Graph A so it has strong negative correlation. Graph B has no correlation as a suitable line of best fit cannot be drawn



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.

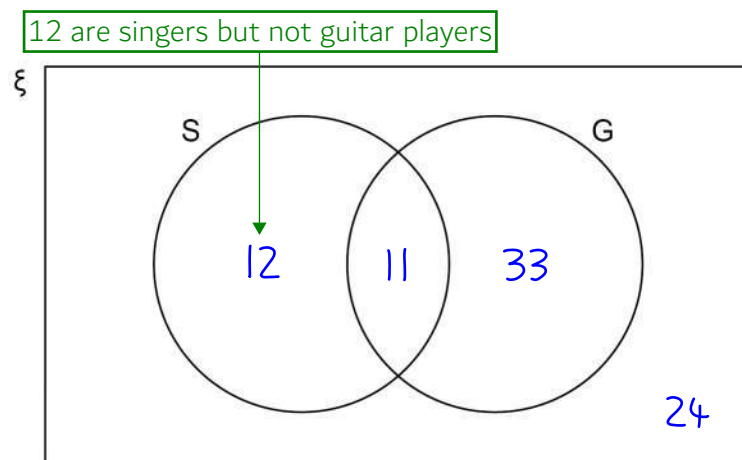
Complete this Venn diagram to represent the information.

[4 marks]

ξ = 80 people who play in bands

S = singers

G = guitar players



$$80 \div 10$$

10% as a fraction is $\frac{10}{100}$, which simplifies to $\frac{1}{10}$.
So dividing the 80 by 10 works out that 10% of 80 is 8

$$8 \times 3$$

Multiplying the value of 10% of 80 by 3 works out that 30% of 80 is 24. This many are neither a singer nor a guitar player

$$\begin{array}{r} 24 \\ + 12 \\ \hline 36 \end{array}$$

Adding the 12 and 24 so far on the Venn diagram works out that 36 have been accounted for so far

$$\begin{array}{r} 80 \\ - 36 \\ \hline 44 \end{array}$$

Subtracting this 36 from the 80 people works out that 44 are guitar players

$$44 \div 4$$

Dividing the 44 guitar players by 4 works out that $\frac{1}{4}$ of them is 11 who are also singers

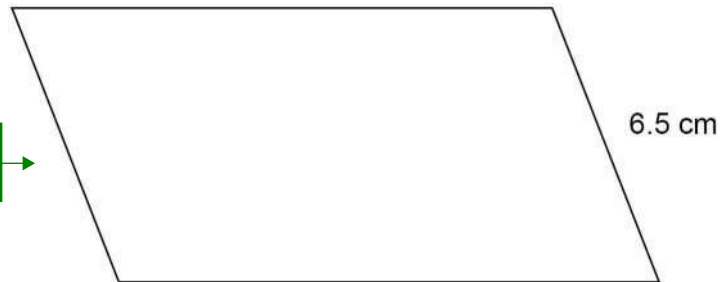
$$\begin{array}{r} 44 \\ - 11 \\ \hline 33 \end{array}$$

Subtracting the 11 who are both singers and guitar players from the 44 guitar players works out that 33 are guitar players but not singers



8

The shorter side of a parallelogram has length 6.5 cm

Not drawn
accuratelyOpposite sides on a
parallelogram are equalThe length of the shorter side is $\frac{1}{9}$ of the perimeter.

Work out the length of the longer side.

[3 marks]

$$\begin{array}{r} 6.5 \\ \times 9 \\ \hline 58.5 \end{array}$$

Multiplying the shorter side by 9 works out that the perimeter is 58.5 cm

$$\begin{array}{r} 6.5 \\ \times 2 \\ \hline 13.0 \end{array}$$

Multiplying the shorter side by 2 works out that both of the shorter sides combined are 13.0 cm

$$\begin{array}{r} 58.5 \\ -13.0 \\ \hline 45.5 \end{array}$$

Subtracting both of the shorter sides from the perimeter works out that the two longer sides combined are 45.5 cm

Answer $\frac{455}{20}$ cmDividing the length of the two longer sides combined by 2 works out one of the longer sides. This could be given as a fraction however $45.5/2$ has a decimal in it. Multiplying both the numerator and denominator by 10 gets rid of the decimals in the fraction

- 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]

$$4x^2 = 16$$

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. Writing this as an equation

$$x^2 = 4$$

Dividing both sides by 4 to get x^2 on its own

$$x = 2$$

Square rooting both sides finds that x is 2. There is no need to do the negative square root as x must be positive if all the terms are positive. So each term is multiplied by 2 to get to the next term

First term 2

To go from the second term to the first term, the 4 must be divided by 2 as this is the opposite of multiplying by 2

Third term 8

To go from the second term to the third term, the 4 must be multiplied by 2

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

p $5p$ $9p$

The sequence is arithmetic so increases by the same amount between each term. It increases by $4p$ from p to $5p$ so must increase by $4p$ again to $9p$ for the third term

The sum of the first three terms is 90

Work out the value of p .

[3 marks]

$$15p = 90$$

The sum of p , $5p$ and $9p$ is $15p$. This must be equal to the 90

$$15, 30, 45, 60, 75, 90$$

Dividing both sides by 15 gives p . Counting up in 15s until it reaches 90

Answer 6

6 lots of 15 go into 90



10

The cost of a holiday is £2400

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

$$\text{deposit : total of the monthly payments} = 3 : 5$$

She makes 6 equal monthly payments.

Work out her monthly payment.

[4 marks]

$$3+5$$

Adding the 3 and 5 parts in the ratio works out that there are 8 parts in total in the ratio which represent the £2400

$$2400 \div 8$$

Dividing the £2400 by the 8 parts which represent it works out that 1 part of the ratio is worth £300

$$5 \times 300$$

5 parts represent the total of the monthly payments so multiplying the value of 1 part by 5 works out that the total of the monthly payments is £1500

$$\begin{array}{r} 250 \\ 6 \overline{) 1500} \end{array}$$

Dividing the total of the monthly payments by the 6 months gives the monthly payment

Answer £ 250



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

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

[2 marks]

$$\begin{array}{r} 0.275 \\ \times 3 \\ \hline 0.825 \end{array}$$

← The 11 has been multiplied by 3 to get 33 so first multiplying the decimal by 3

Answer 0.0825

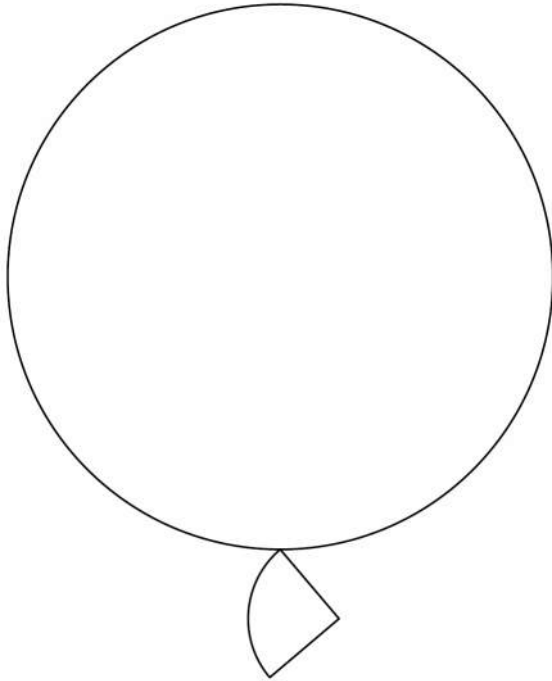
Dividing the 0.825 by 10 as the 40 has been multiplied by 10 to get 400.
Having a denominator 10 times the size is equivalent to dividing by 10

Turn over for the next question

Turn over ►



- 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]

$$21 \div 7$$

7 parts of the ratio represent the radius of the circle which is 21 mm. So dividing the radius of the circle by 7 works out that 1 part of the ratio is worth 3 mm

$$3 \times 2 = 6$$

Multiplying the value of 1 part of the ratio by 2 shows that the 2 parts which represents the radius of the quarter circle is 6 mm



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]

$$\begin{array}{r} 21 \\ \times 2 \\ \hline 42 \end{array}$$

Circumference = $\pi \times$ diameter. Multiplying the radius of the circle by 2 works out that the diameter of the circle is 42 mm. Then multiplying this by π works out that the circumference of the circle is 42π mm

$$6 \times 2$$

Circumference = $\pi \times$ diameter. Multiplying the radius of the quarter circle by 2 works out that the diameter of the quarter circle is 12 mm. Then multiplying this by π works out that the circumference of the quarter circle, if it was a whole circle, is 12π mm

$$12\pi \div 4$$

Dividing this 12π mm by 4 as it is a quarter circle works out that the arc length of the quarter circle is 3π mm

$$42\pi + 3\pi = 45\pi$$

Adding the circumference of the circle and the arc length of the quarter circle works out that the wire used in the circle and the wire used for the curve of the quarter circle is 45π mm

$$6 + 6$$

Adding 2 lots of the radius works out that the straight pieces of wire are 12 mm

Answer $45\pi + 12$ mm

Adding the length of the curved lengths of the wire and the straight lengths of the wire. Leaving the 12 separate to the 45π as this is the form it asked for

Turn over for the next question



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]

$x^2 - tx + sx - st$ ← Expanding the brackets

$x^2 + (s-t)x - st$ ← Factorising the two middle x terms to express in the same form as the answer

1, 40

2, 20

4, 10

5, 8

By equating the coefficients of the expansion and the answer, $st = 40$ and $s - t = k$.
Listing out the possible factor pairs of 40 to work out what s and t could be

Answer

3

As k is positive, s must be larger than t . The smallest positive value of $s - t$ is $8 - 5 = 3$

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

Here is his working.

$$\begin{array}{l} (x + 2) = 0 \quad \text{or} \quad (x - 7) = 0 \\ \text{Answer} \quad x = 2 \quad \text{or} \quad x = 7 \end{array}$$

Give a reason why his answer is wrong.

[1 mark]

$x = -2$ ← Subtracting 2 from both sides in the equation $x + 2 = 0$ gives $x = -2$, not $x = 2$

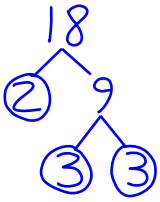


14 (a) $c = 2^{10} \times 3 \times 5^6$

Work out $18c$.

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

[2 marks]



Finding 18 as a product of primes by doing a factor tree. So $18 = 2 \times 3^2$

Answer $2^{11} \times 3^3 \times 5^6$

$18c = 2 \times 3^2 \times 2^{10} \times 3 \times 5^6$. Multiplication can be done in any order and $a^x \times a^y = a^{x+y}$. $2 \times 2^{10} = 2^{11}$ and $3^2 \times 3 = 3^3$

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

Give your answer as an integer.

[2 marks]

$\sqrt[3]{2^6 \times 11^3}$ ← $a^x/a^y = a^{x-y}$ so $2^7/2 = 2^6$

$2^2 \times 11$ ← Cube rooting divides the powers by 3

Answer 44

$2^2 = 4$ then $4 \times 11 = 44$



15

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

Circle the ratio $x : y$

[1 mark]

6 : 1

1 : 6

3 : 2

2 : 3

Multiplying both sides by 2 eliminates the fraction and gives $6x = y$. So x could be 1 and y could be 6

16

A sequence of numbers is formed by the iterative process

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

Work out the values of u_2 and u_3

[2 marks]

$$\frac{4}{9-1} = \frac{4}{8}$$

Substituting the value of u_1 for u_n finds u_2 . $4/8$ can be simplified to $1/2$ by dividing both the numerator and denominator by 4

$$\frac{1}{2} - \frac{2}{2}$$

Substituting the value of u_2 for u_n finds u_3 . Dealing with the denominator. $1/2 - 1$. The 1 is changed to $2/2$ so they can be subtracted. So the denominator is $-1/2$

$$4 \div \frac{-1}{2}$$

Doing the 4 divided by the denominator of $-1/2$

$$4 \times -2$$

To divide by a fraction: keep the first part, change the division to a multiply, flip the fraction. $-1/2$ becomes $2/-1$, which is equal to -2

$$u_2 = \frac{1}{2}$$

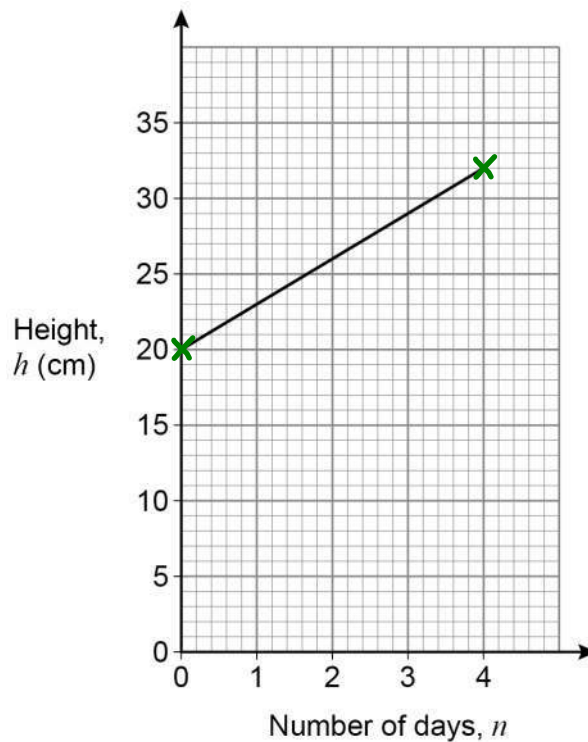
$$u_3 = -8$$



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]

$$\frac{12}{4}$$

Gradient = (change in y)/(change in x). From the point on the left to the point on the right, y has changed by 12 and x has changed by 4. So the gradient is 3

Answer

$$h = 3n + 20$$

The general equation of a straight line is $y = mx + c$, where m is the gradient and c is the y -intercept. The gradient is 3 and the y -intercept (the y -coordinate where it crosses the y -axis) is 20. Writing h instead of y as h is on the y -axis and n instead of x as n is on the x -axis



18 Solve the simultaneous equations

$$2x + 4y = -9 \quad \leftarrow \text{First equation}$$

$$2y = 4x - 7 \quad \leftarrow \text{Second equation}$$

[4 marks]

$$4y = 8x - 14 \quad \leftarrow \text{Multiplying both sides of the second equation by 2 to get the same number of } y \text{ as the first equation}$$

$$2x + 8x - 14 = -9 \quad \leftarrow \text{Substituting } 8x - 14 \text{ for } 4y \text{ in the first equation}$$

$$10x = 5 \quad \leftarrow 2x + 8x = 10x. \text{ Adding 14 to both sides to get the } x \text{ term on its own}$$

$$x = \frac{5}{10} \quad \leftarrow \text{Dividing both sides by 10 to get } x \text{ on its own. Dividing both the numerator and denominator of } 5/10 \text{ by 5 simplifies it to } 1/2$$

$$2y = 2 - 7 \quad \leftarrow \text{Substituting } 1/2 \text{ for } x \text{ in the second equation. } 4 \times 1/2 = 2$$

$$x = \frac{1}{2} \quad y = -\frac{5}{2}$$

$$2 - 7 = -5. \text{ Then dividing both sides by 2 gets } y \text{ on its own}$$



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

[1 mark]

$$\frac{3x}{10}$$

$$\frac{2x}{15}$$

$$\frac{x}{25}$$

$$\frac{x^2}{50}$$

$$\frac{2x}{10} + \frac{x}{10}$$

Multiplying both the numerator and denominator of $x/5$ by 2 gives $2x/10$. The denominators are now the same so the fractions can be added. $2x + x = 3x$. The denominator stays as 10

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

[1 mark]

Answer

1

Anything to the power of 0 is 1

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

[2 marks]

Answer

 $\frac{1}{8}$

The denominator of 5 as a power means 5th root. $2^5 = 32$ so the 5th root of 32 is 2. The numerator of 3 as a power means to cube. $2^3 = 8$. The negative as a power means reciprocal. The reciprocal of 8 is $1/8$

Turn over for the next question



21 Write these numbers in order of size.

15.6

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

Start with the smallest.

[2 marks]

$$3 \overline{) 47.0} \begin{array}{r} 15.6 \\ 3 \times 15 = 45 \\ \hline 20 \\ 3 \times 6 = 18 \\ \hline 20 \\ 3 \times 6 = 18 \\ \hline 20 \end{array}$$

Dividing the numerator by the denominator converts $47/3$ to a decimal

Smallest

 $3\sqrt{23}$

$\sqrt{25} = 5$ so $\sqrt{23} < 5$ so $3\sqrt{23} < 15$

15.6

 $\frac{47}{3}$

Largest

 2.1^4

$2^4 = 16$ so $2.1^4 > 16$



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

$$y = 17 \quad \text{when} \quad x = 4$$

Work out an equation connecting y and x .

[3 marks]

$$y = kx^3$$

Writing the proportion as an equation. x^3 can be multiplied by anything and still be directly proportional to y . So using k to represent what x^3 is multiplied by

$$k = \frac{17}{4^3}$$

Rearranged to get k on its own by dividing both sides by x^3 and substituted in the values of y and x given

$$\frac{16}{64}$$

$$4^3 = 4 \times 4 \times 4 = 16 \times 4 = 64$$

Answer $y = \frac{17}{64}x^3$

$k = 17/64$. Substituting $17/64$ for k in the original equation

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]

$\times 2$

$\times 16$

$\div 2$

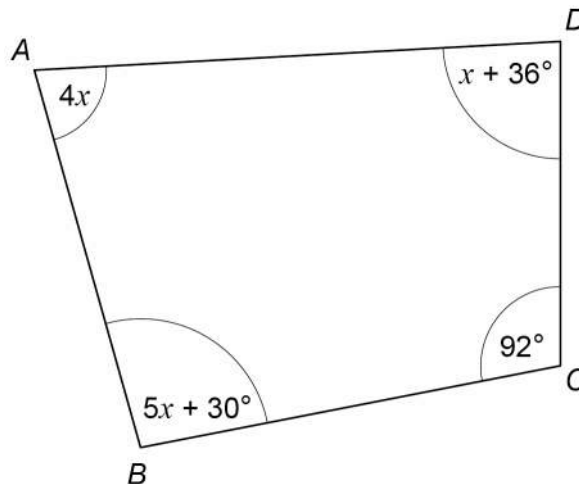
$\div 16$

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. $\sqrt{4} = 2$

Turn over for the next question



23

 $ABCD$ is a quadrilateral.Not drawn
accuratelyProve that $ABCD$ is **not** a cyclic quadrilateral.

[4 marks]

$$4x + 92 = 180$$

Assuming that it is a cyclic quadrilateral, opposite angles will add to 180 degrees. Adding angles BAD and BCD and setting it equal to 180 degrees

$$\begin{array}{r} 180 \\ - 92 \\ \hline 88 \end{array}$$

Subtracting 92 from both sides would give $4x = 88$

$$\begin{array}{r} 22 \\ 4 \overline{) 88} \end{array}$$

Dividing both side of $4x = 88$ by 4 gives $x = 22$

$$\begin{array}{r} 22 \\ \times 5 \\ \hline 110 \end{array}$$

$$5x = 110$$

$$\begin{array}{r} + 30 \\ + 22 \\ + 36 \\ \hline 198 \end{array}$$

Adding angles ABC and ADC while substituting x for 22 works out that the sum of angles ABC and ADC would be 198 degrees

Should be 180

The sum of angles ABC and ADC should be 180 degrees if they are opposite angles in a cyclic quadrilateral

Both pairs of opposite angles cannot add up to 180 degrees at the same time so it cannot be a cyclic quadrilateral



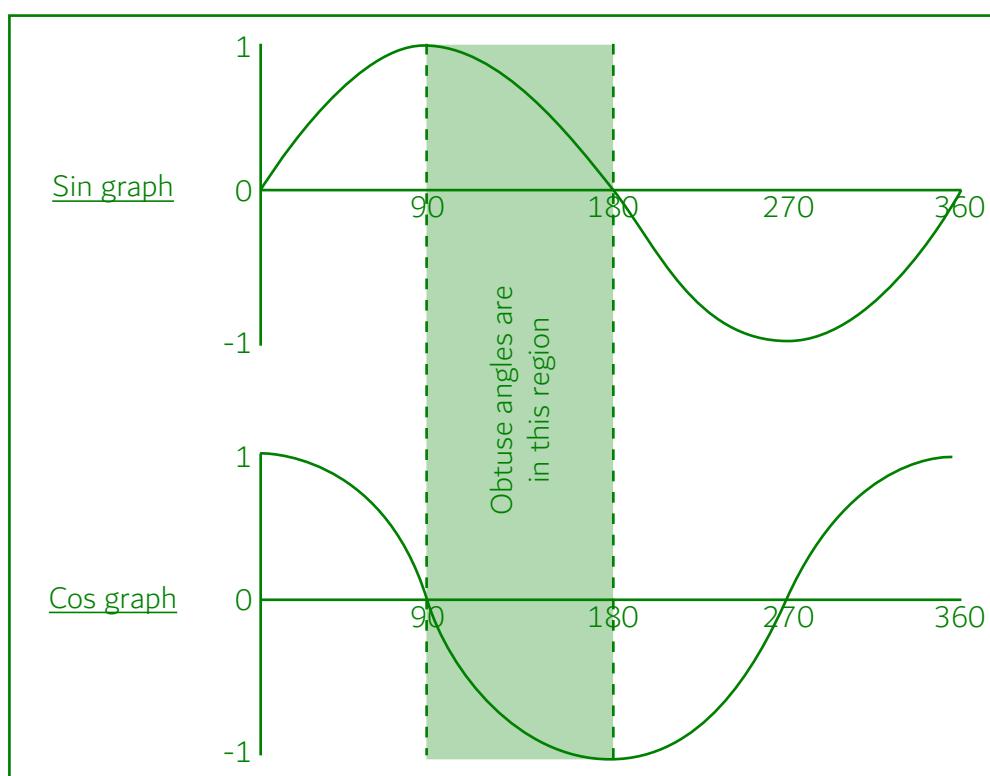
24

 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

Turn over ►

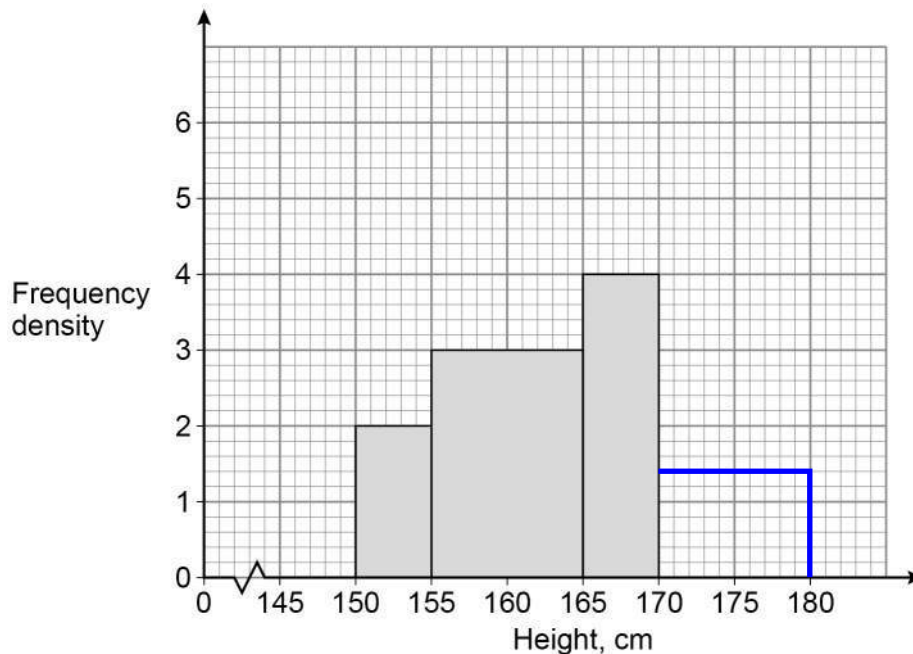


25

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

Three of the four bars are shown.

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



There are 74 women in the sample.

Complete the histogram.

[4 marks]

Frequency is the area of each bar on the histogram. Area of rectangle = base x height

$$5 \times 2 = 10$$

The base of the first bar is 5. The height of the first bar is 2. Multiplying these together gives an area of 10, which is the frequency represented by the first bar

$$10 \times 3 = 30$$

The base of the first bar is 10. The height of the first bar is 3. Multiplying these together gives an area of 30, which is the frequency represented by the second bar

$$5 \times 4 = 20$$

The base of the third bar is 5. The height of the third bar is 4. Multiplying these together gives an area of 20, which is the frequency represented by the third bar

$$10 + 30 + 20$$

Adding the frequency of the first, second and third bar works out that a frequency of 60 women has been represented on the histogram so far

$$74 - 60$$

Subtracting the 60 women represented so far from the total 74 women works out that the fourth bar must represent 14 women

$$14 \div 10$$

Height = area of rectangle $\div$ base. The area of the fourth bar must be 14 and the base is 10. So the height of the fourth bar is 1.4



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]

$$\frac{14}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$$

Rationalising the denominator

$$\frac{14\sqrt{7}}{7}$$

Multiplying the fractions by multiplying the numerators and denominators. $\sqrt{7} \times \sqrt{7} = 7$

$$2\sqrt{7}$$

Dividing the 14 on the numerator by the 7 on the denominator simplifies the fraction and gets the desired form

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

Give your answer as an integer.

[3 marks]

$$\sqrt{80} = \sqrt{4} \times \sqrt{20}$$

Simplifying $\sqrt{80}$ by using $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ to split it into two different square roots, one of which is the square root of a square number

$$= \sqrt{4} \times \sqrt{4} \times \sqrt{5}$$

Simplifying $\sqrt{20}$ by using $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ to split it into two different square roots, one of which is the square root of a square number

$$= 4\sqrt{5}$$

 $\sqrt{4} \times \sqrt{4} = 4$

$$\sqrt{18} = \sqrt{9} \times \sqrt{2}$$

Simplifying $\sqrt{18}$ by using $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ to split it into two different square roots, one of which is the square root of a square number

$$= 3\sqrt{2}$$

 $\sqrt{9} = 3$

$$2\sqrt{10} \times 4\sqrt{5} \times 3\sqrt{2}$$

Replacing $\sqrt{80}$ and $\sqrt{18}$ with fully simplified surds in the original expression

$$24\sqrt{100}$$

 $2 \times 4 \times 3 = 24$ and $\sqrt{10} \times \sqrt{5} \times \sqrt{2} = \sqrt{100}$ Answer 240 $\sqrt{100} = 10$ then $24 \times 10 = 240$

Turn over for the next question

Turn over ►



27

A and B are similar solid cylinders.

$$\text{base area of A : base area of B} = 9 : 25$$

Complete these ratios.

[2 marks]

$$\text{curved surface area of A : curved surface area of B} = \underline{9} : \underline{25}$$

$$\text{height of A : height of B} = \underline{3} : \underline{5}$$

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]

$$(12 + 2x)(12 - 2x) \leftarrow \text{It can be factorised using difference of two squares: } A^2 - B^2 = (A + B)(A - B)$$

$$\text{Answer } \underline{4(6+x)(6-x)}$$

It can be factorised further as 2 is a common factor to both terms in both brackets. Bringing out two 2s as factors gives 4 outside the brackets



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]

$$(x-4)(x-4)(x-4)$$

Subtracting 4 from all of the x translates it 4 to the right. Ignoring the $+6$ for now and writing out $(x-4)^3$

$$x^2 - 4x - 4x + 16$$

Expanding out the first two brackets

$$(x^2 - 8x + 16)(x-4)$$

Simplifying the expansion and writing it multiplied by the third bracket

$$x^3 - 4x^2 - 8x^2 + 32x + 16x - 64 + 6$$

Expanding out these two brackets and now dealing with the $+6$ which was ignored earlier

Answer

$$x^3 - 12x^2 + 48x - 58$$

Collecting the like terms

END OF QUESTIONS