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Worked Solutions

F

Tuesday 7 June 2022 – Morning

GCSE (9–1) Mathematics

J560/02 Paper 2 (Foundation Tier)

Time allowed: 1 hour 30 minutes

You must have:
- the Formulae Sheet for Foundation Tier (inside this document)

You can use:
- geometrical instruments
- tracing paper

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space, use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

Please note that these worked solutions have neither been provided nor approved by OCR 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** the questions.

1 **(a)** Work out.

(i) $4 - 5$

Counting back 5 from 4: 3, 2, 1, 0, -1

(a)(i) -1 **[1]**

(ii) 2×-3

2 x 3 = 6 so 2 x -3 = -6

(ii) -6 **[1]**

(iii) $\frac{1}{7} + \frac{2}{7}$

The denominators are the same so the numerators can be added. 1 + 2 = 3 and the denominator stays the same

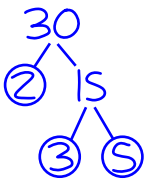
(iii) $\frac{3}{7}$ **[1]**

(iv) $\frac{1}{2}$ of $1\frac{1}{2}$

$\frac{1}{2} \times \frac{3}{2}$ ← Converting the mixed number into 3/2 by multiplying the 1 by the denominator and adding the result to the numerator. 'Of' means to multiply. To multiply fractions the numerators can be multiplied and the denominators can be multiplied

(iv) $\frac{3}{4}$ **[1]**

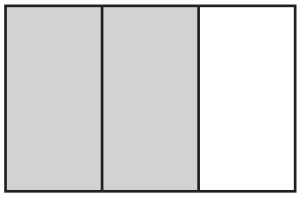
(b) Write down the largest prime factor of 30.



← Doing a factor tree for 30 works out that it is 2 x 3 x 5 as a product of prime factors. The largest prime factor is 5

(b) 5 **[2]**

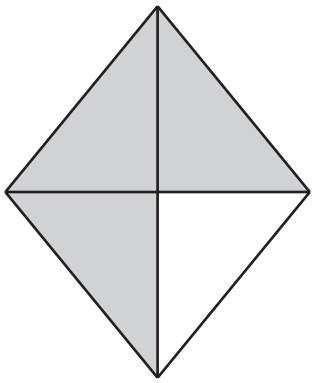
2 **(a)** What fraction of this shape is shaded?



2 out of the 3 equal sections are shaded

(a) $\frac{2}{3}$ **[1]**

(b) What percentage of this shape is shaded?



$4\overline{)100}$ = 025

$25 \times 3 = 75$

3 out of the 4 equal sections are shaded so 3/4 is shaded. This is 75% as a percentage. If the conversion to a percentage wasn't known, 3/4 of 100 could be worked out by dividing the 100 by 4 to works out 1/4 then multiplying the result by 3 to work out 3/4

(b) 75 % **[1]**

(c) Write 0.2 as a fraction.
Give your answer in its simplest form.

$\frac{2}{10}$

The 2 is worth 2 tenths so is 2/10. This simplifies to 1/5 by dividing both the numerator and denominator by 2. It cannot go any simpler as the numerator and denominator cannot be divided by the same whole number any further

(c) $\frac{1}{5}$ **[2]**

(d) Work out 80% of 30.

3×8

10% is 1/10 as a fraction. Dividing the 30 by 10 works out that 10% of 30 is 3. Multiplying the value of 10% of 30 by 8 works out the value of 80% of 30

(d) 24 **[2]**

3 Bananas cost 25p each.

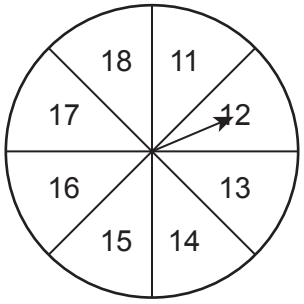
How many bananas can be bought for £2?

008
25|200
50
75
100
125
150
175
200

There is 100p in £1, so multiplying the £2 by 100 converts it into 200p. Dividing the 200p by the 25p works out how many lots of 25p it is and therefore how many bananas can be bought. Listing the 25 times table helps with the short division

..... 8 ..... **[2]**

4 A student makes a fair 8-sided spinner.
They write the numbers 11, 12, 13, 14, 15, 16, 17 and 18 on the spinner.



(a) Write down the probability of the student's spinner landing on a number which is less than 12.

Only the 11 is less than 12. This is 1 out of the 8 numbers

(a) ..... $\frac{1}{8}$ ..... **[1]**

(b) Find the probability of the student's spinner landing on a multiple of 3.

The multiples of 3 are 12, 15 and 18 as these are in the 3 times table. This is 3 out of the 8 numbers

(b) ..... $\frac{3}{8}$ ..... **[2]**

5 Write the ratio $5 : 7\frac{1}{2}$ in its simplest form.

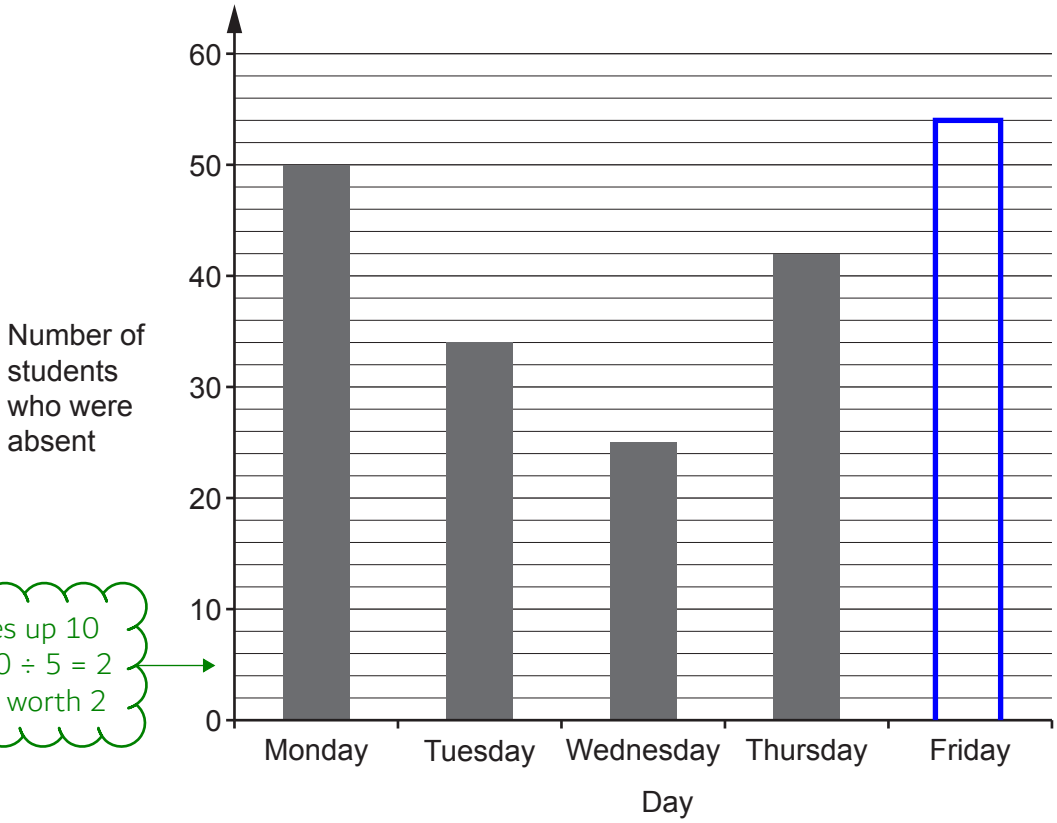
$5 : \frac{15}{2}$ ← Converting the mixed number into an improper fraction by multiplying the 7 by the denominator then adding the result to the numerator. 7 x 2 = 14. 1 + 14 = 15

$10 : 15$ ← Multiplying both sides of the ratio by 2 to eliminate the fractions

Dividing both sides of the ratio by 5 to simplify it. It cannot go any simpler as the 2 and 3 cannot be divided by the same whole number

.....2..... : .....3..... **[2]**

6 Taylor has collected data on the number of students who were absent from their school last week. The bar chart shows the results for the first four days.



The scale goes up 10 over 5 lines. 10 ÷ 5 = 2 so each line is worth 2

(a) On Friday there were 54 students who were absent from the school.

Show this information on the bar chart. **[1]**

(b) Taylor says

On Monday 150% of the students were absent from my school.

Could this be true?
Explain how you decide.

No as this is more than all of the students

100% is all of the students and 150% is more than this

[1]

(c) There are 600 students in Taylor's school.
Find the percentage of students who were absent from Taylor's school on Thursday.

$\frac{42}{600}$ ← 42 out of the 600 students were absent. Expressing this as a fraction

$\frac{7}{100}$ ← Simplifying the fraction so that the denominator is 100 by dividing both the numerator and denominator by 6

Percentage is out of 100 so 7/100 is equivalent to 7%

(c) ..... 7 ..... % **[3]**

7 **(a)** Multiply out.

$5(x+2)$

(a) ..... $5x+10$ ..... **[1]**

(b) Rearrange this formula to make r the subject.

$p = 3r - 5$

$p+5=3r$ ← Adding 5 to both sides eliminates the -5 on the right to get the r term on its own

Dividing both sides by 3 eliminates the 3 on the right to get r on its own

(b) ..... $\frac{p+5}{3}=r$ ..... **[2]**

8 **(a)** Work out.

(i) 3.08 + 0.82

3.08
+0.82
3.90

Making sure that all the decimal places are in the right column

(a)(i) 3.9 **[1]**

(ii) 7.7 ÷ 11

0.7
11|7.7

Using short division

(ii) 0.7 **[1]**

(b) Work out.

$(2.1 - \frac{3}{5}) \times 0.3$

Give your answer as a decimal.

0.6
5|3.0

Converting 3/5 into a decimal by dividing the numerator by the denominator

Following the order of operations (BIDMAS) so the brackets need to be done first. Subtracting the 0.6 from the 2.1

Next multiplying the result by the 0.3. Ignoring the decimal points when multiplying then as there are 2 decimal places in total in the 1.5 and 0.3, putting 2 decimal places in the answer

(b) 0.45 **[3]**

9 A local theatre is putting on a show.
50 child tickets are sold.
The ratio of the number of child tickets sold to the number of adult tickets sold is 5 : 2.

The cost of a child ticket is £2.50.
The cost of an adult ticket is £5.00.

Work out the **total** amount paid for the tickets.

2.50 × 50 = 125.00 ← Multiplying the £2.50 cost of a child ticket by the 50 child tickets works out that £125 was paid for the child tickets

50 ÷ 5 ← 5 parts of the ratio represent the 50 child tickets. Dividing the 50 by the 5 parts works out that 1 part of the ratio is worth 10

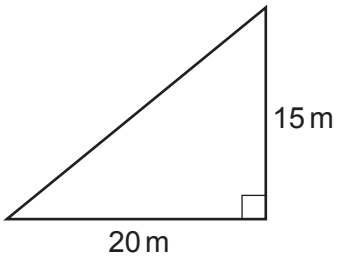
10 × 2 ← Multiplying the value of 1 part of the ratio by the 2 parts which represent the adult tickets works out that 20 adult tickets were sold

20 × 5 ← Multiplying the 20 adult tickets by the £5 cost of an adult ticket works out that £100 was paid for the adult tickets. 2 x 5 = 10 so 20 x 5 = 100

125 + 100 = 225 ← Adding the £125 paid for the child tickets and the £100 paid for the adult tickets works out the total amount paid for the tickets

£ ..... 225 ..... **[4]**

10 The diagram shows Kai's garden.
It is in the shape of a right-angled triangle.



Not to scale

Kai is going to spread grass seed on the garden.

- A bag of grass seed covers an area of 35 m^2.
- Each bag of grass seed costs £8.99.

Kai can only buy whole bags of grass seed.
Kai buys the least number of bags needed for the garden.

Calculate the cost of buying the bags of grass seed that Kai needs.
You must show your working.

20÷2 ← Area of triangle = 1/2 x base x height. The base is 20m and the height is 15m. First working out that half of the base is 10m

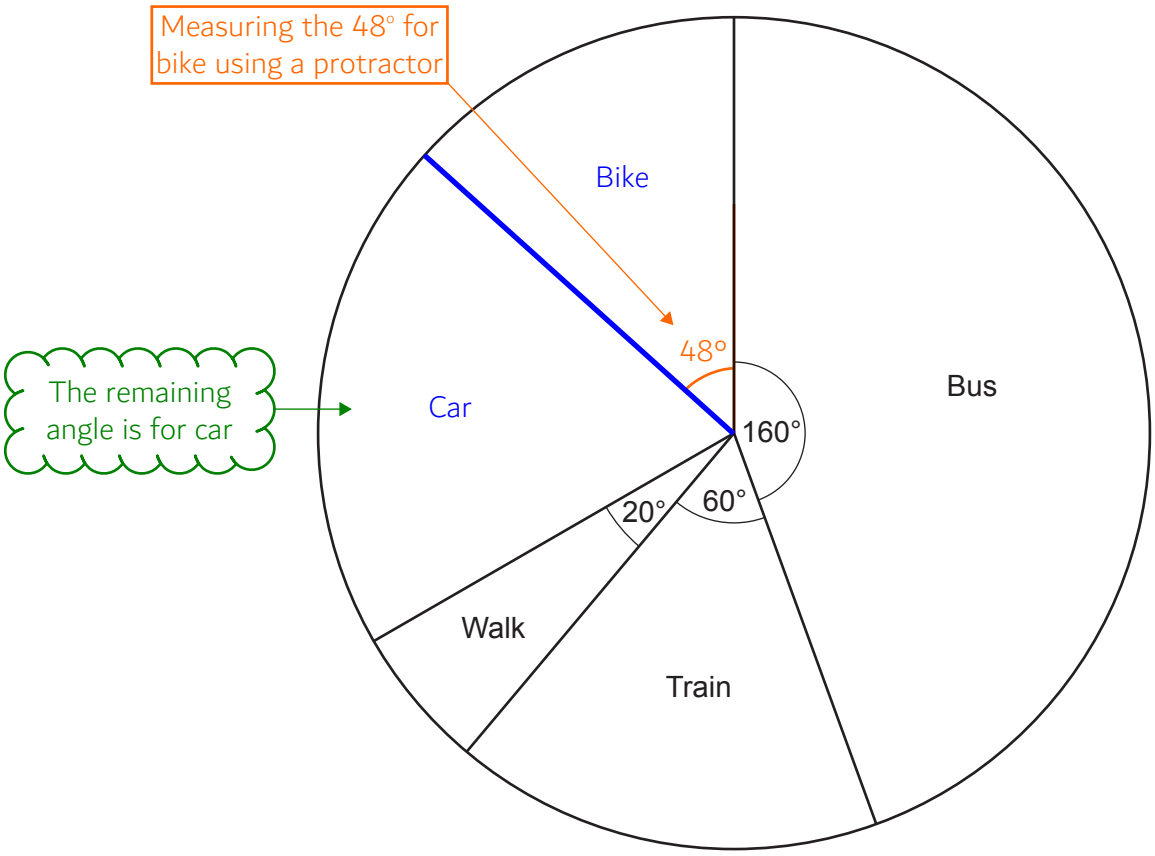
10×15 ← Multiplying the 10m (half of the base) by the height of 15m works out that the area of the garden is 150m^2

004 r10
35⟌150
35, 70, 105, 140, 175 ← Dividing the area of the garden by the 35m^2 covered by each bag of grass seed works out that more than 4 bags are needed

8.99
× 5
44.95 ← More than 4 are needed so the minimum number of bags is 5. Multiplying this by the price of each bag works out the cost of buying the bags of grass seed needed

£ 44.95 **[6]**

11 Some students were asked how they travel to school.
Each student gave one answer.
The pie chart shows the proportion who travel by bus, by train or walk.



(a) All of the remaining students travel to school either by bike or by car.
The ratio of the number who travel by bike to the number who travel by car is 2 : 3.

Complete the pie chart.
You must show your working. **[6]**

$^{2}\cancel{3}60 - 20 - 60 - 160 = 120$ ← There are 360° in total in a pie chart. Subtracting the 20° for walk, the 60° for train and the 160° for bus from 360° works out that there are 120° for bike and car

$5\overline{)120} = 024$ ← There are 5 parts in total in the ratio as 2 + 3 = 5. These represent the 120° which is for bike and car. Dividing the 120° by the 5 parts works out that 1 part of the ratio is worth 24°

$24 \times 2 = 48$ ← Multiplying the value of 1 part of the ratio by the 2 parts which represent bike works out that the angle for bike is 48°

(b) Which way of travelling to school is the mode?

Bus has the largest sector so has the highest frequency → Bus ..... **[1]**

12 Dinosaurs first appeared on Earth 2.4×10^8 years ago.
Dinosaurs became extinct on Earth 7×10^7 years ago.

(a) Explain why it is appropriate to use standard form for these numbers.

There would be a lot of zeros

Numbers with lots of zeros are harder to read and write. Using standard form is useful for very large and small numbers

[1]

(b) Use the given information to work out how long dinosaurs existed on Earth.
Give your answer in standard form.

$$\begin{array}{r} 2.4 \\ -0.7 \\ \hline 1.7 \end{array}$$

Subtracting the two numbers works out the difference between when dinosaurs first appeared and when they became extinct and therefore how long dinosaurs existed on Earth. Converting 7×10^7 to 0.7×10^8 by dividing the 7 by 10 and adding 1 to the power of 10 so that the two numbers can be subtracted easier and it will give an answer in standard form. $2.4 \times 10^8 - 0.7 \times 10^8$

(b) 1.7×10^8 **[3]**

13 **(a)** Complete this statement by writing the missing power in the box.

$$784 = 2^{\boxed{4}} \times 7^2$$

[1]

49
× 2
98
× 2
196
× 2
392
× 2
784

$7^2 = 7 \times 7 = 49$. This needs to be multiplied by 2 4 times to get 784 so needs to be multiplied by 2^4

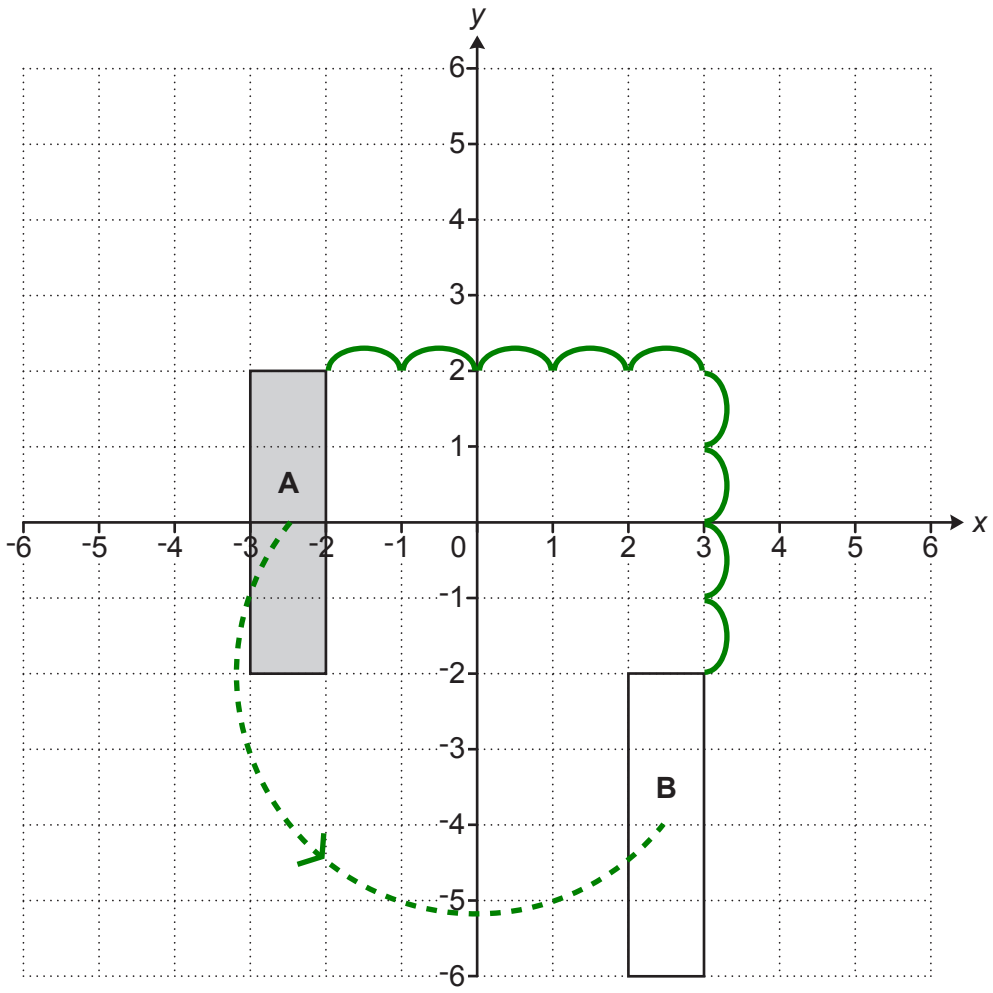
(b) Use your answer to part **(a)** to find the value of $\sqrt{784}$.

$2^2 \times 7$ ← Halving the powers of the 2^4 and 7^2 does the square root

$2^2 = 2 \times 2 = 4$. $4 \times 7 = 28$

(b) 28 ..... **[2]**

14 Rectangle **A** and rectangle **B** are drawn on the coordinate grid.



Describe fully **two** different **single** transformations that map rectangle **A** onto rectangle **B**.

1 Translation by $\begin{pmatrix}5\\-4\end{pmatrix}$

A can be moved 5 to the right and 4 down to B. This is 5 in the x-direction and -4 in the y-direction and can be written as a column vector

2 Rotation, 180°, centre (0 , -2)

To work out the centre of rotation, use tracing paper and try rotating A around different points until the point it rotates around is found

[6]

15 y is inversely proportional to x.
$y = 20$ when $x = 3$.

Find the value of y when $x = 12$.

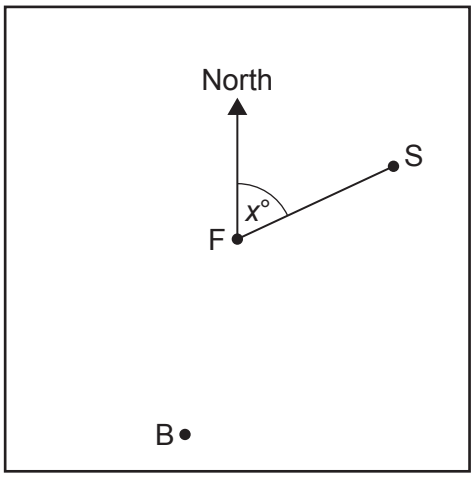
12 ÷ 3 ← This works out that the 12 is 4 times greater than the 3

20 ÷ 4 ← x has been multiplied by 4 so y needs to be divided by 4. As they are inversely proportional, whatever one of them is multiplied or divided by, the opposite needs to be done to the other

$y =$ ..... 5 ..... **[3]**

16 A town square has a fountain (F) at the centre.
There is also a bell tower (B) and a statue (S).

The bearing of the statue from the fountain is $x°$.



Not to scale

(a) The bearing of the bell tower from the fountain is 140° more than the bearing of the statue from the fountain.

Write down, in terms of x, the bearing of the bell tower from the fountain.

140° more than x°

(a) ..... $x + 140$ ..... ° **[1]**

(b) The bearing of the bell tower from the fountain is also three times the bearing of the statue from the fountain.

Work out the bearing of the bell tower from the fountain.

$3x = x + 140$ ← 3 times the bearing of the statue from the fountain is 3x. This must be equal to the x + 140 as they are describing the same bearing

$2x = 140$ ← Subtracting x from both sides gets all the x on the same side

$2\overline{)140} = 70$ ← Dividing both sides by 2 works out that x = 70

$70 + 140 = 210$ ← The bearing of the bell tower from the fountain is 140° more than x

(b) ..... 210 ..... ° **[4]**

17 Morgan is playing a computer game.
They can score 0, 1, 2 or 3 points on each turn.
They record their scores for 100 turns.
The table shows the relative frequencies of their scores.

Score	0	1	2	3
Relative frequency	0.08	0.42	0.38	0.12

(a) Complete the table. **[2]**

$1.00 - 0.08 - 0.42 - 0.38 = 0.12$

All the relative frequencies must add up to 1 as it was always 0, 1, 2 or 3.
Subtracting the other relative frequencies from 1 leaves the relative frequency for 3

(b) Morgan says

I scored more than 160 points **in total** in my 100 turns.

Is Morgan correct?
Show how you decide.

Multiplying the relative frequencies by 100 works out that there were 8 scores of 0, 42 scores of 1, 38 scores of 2 and 12 scores of 3

$0 \times 8 = 0$ — Multiplying the score of 0 by the 8 times it was scored works out that the total score for the 0s is 0

$1 \times 42 = 42$ — Multiplying the score of 1 by the 42 times it was scored works out that the total score for the 1s is 42

$38 \times 2 = 76$ — Multiplying the score of 2 by the 38 times it was scored works out that the total score for the 2s is 76

$12 \times 3 = 36$ — Multiplying the score of 3 by the 12 times it was scored works out that the total score for the 3s is 36

$42 + 76 + 36 = 154$ — Adding the total score for the 1s, the total score for the 2s and the total score for the 3s works out that Morgan scored 154 in total

No — 154 is not more than 160

..... **[4]**

18 A bag only contains red marbles, blue marbles and yellow marbles.

- The probability of picking a red marble is $\frac{2}{5}$.
- There are nine yellow marbles.
- The probability of picking a blue marble is three times as likely as picking a yellow marble.

Work out the **total** number of marbles in the bag.
You must show your working.

$\frac{5}{5} - \frac{2}{5} = \frac{3}{5}$ ← There is 1 lot of marbles, which can be expressed as 5/5. Subtracting the 2/5 of the marbles which are red leaves 3/5 which are blue or yellow

9×3 ← There must be 3 times as many blue marbles as yellow marbles. So multiplying the 9 yellow marbles by 3 works out that there are 27 blue marbles

$27 + 9$ ← Adding the 9 yellow marbles to the 27 blue marbles works out that there are 36 marbles which are blue or yellow

$36 \div 3$ ← 3/5 of the marbles must be 36 marbles. Dividing the 36 by 3 works out that 1/5 of the marbles is 12

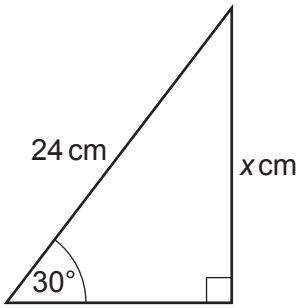
12×5 ← Multiplying 1/5 of the marbles by 5 works out 5/5, which is the total number of marbles

60 ..... **[5]**

19 **(a)** Circle the value of sin 30°.

See bottom of page → $\frac{1}{2}$ $\frac{\sqrt{3}}{2}$ $\frac{1}{3}$ $\frac{\sqrt{3}}{3}$ $\frac{1}{4}$ **[1]**

(b) Here is a right-angled triangle.



Not to scale

Work out the value of x.

SOH CAH TOA

Using right-angled trigonometry. Writing SOH CAH TOA as formula triangles then ticking O as we are looking for the opposite and H as we have the hypotenuse. There are two ticks on the SOH formula triangle so this one can be used

$\frac{1}{2} \times 24$

From the formula triangle: opposite = sin of the angle x hypotenuse. sin30 = 1/2 and the hypotenuse is 24cm

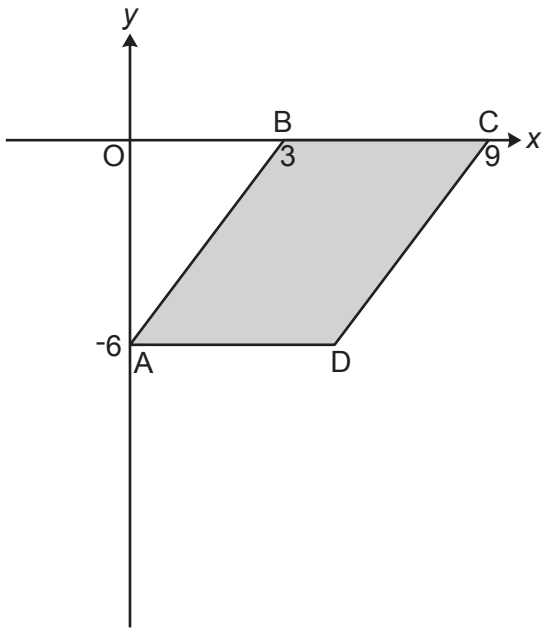
1/2 of 24 is 12

(b) $x =$ 12 **[2]**

0 30 45 60 90
0 1 2 3 4

Listing the angles of 0, 30, 45, 60, 90 then listing 0, 1, 2, 3, 4 under these. Square rooting them and putting them over 2 works out the sin values. The 1 is for 30. $\sqrt{1} = 1$ then putting it over 2 is 1/2

20 The graph shows a parallelogram ABCD.



Not to scale

A has coordinates (0, -6), B has coordinates (3, 0) and C has coordinates (9, 0).

Find the equation of the line that passes through the points C and D, giving your answer in the form $y = mx + c$.
You must show your working.

$\frac{0--6}{3-0} = \frac{6}{3} = 2$ ← CD is parallel to BA so they have the same gradient. Working out the gradient of BA. Gradient = (change in y) /(change in x). Change in y from (0 , -6) to (3 , 0) is 0 - -6 and change in x is 3 - 0. Subtracting a negative is double negative so 0 - -6 becomes 0 + 6

$y = 2x + c$ ← The general equation of a straight line is y = mx + c, where m is the gradient and c is the y-intercept. The gradient of CD must be 2 so substituting this for m

$c = 0 - 2 \times 9$ ← Rearranging to find c by subtracting 2x from both sides gives c = y - 2x. Substituting in the x and y-coordinates from (9 , 0) as it is on the line and must satisfy the equation

$= -18$ ← c is -18

Going back to the equation y = 2x + c and substituting in the value of c

$y = 2x - 18$ ..... **[5]**

21 (a)

$(x+4)(x+3) = x^2 + 7x + 12$

Darcy says that the statement in the box is an equation.
Ellis says that the statement in the box is an identity.
One of them is correct.

Explain which one of Darcy or Ellis is correct.

Ellis is correct because both sides are identical

In an identity, both sides are identical. It will be true for all values of x. They cannot be solved for a value of x. It can't be an equation as it cannot be solved for a value of x and it would only work for one value of x if it was

[2]

(b) Solve by factorising.

$x^2 + 4x - 12 = 0$

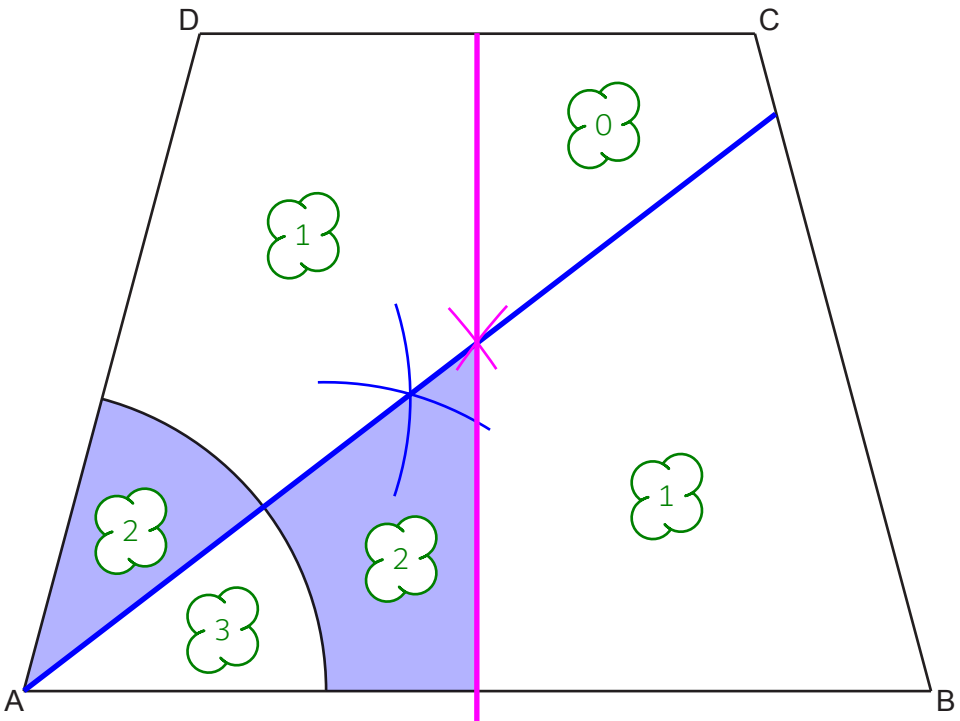
$(x+6)(x-2)=0$ ← 6 and -2 multiply to the -12 and add to the 4 (the coefficient of x). Putting these in brackets with x factorises it

One of the two brackets must equal to 0 in order to multiply to 0. If x + 6 = 0, x = -6. If x - 2 = 0, x = 2

(b) $x =$ -6 or $x =$ 2 **[3]**

22 The diagram shows the scale drawing of a sandpit, ABCD.
It also shows the arc of all points in the sandpit that are 80 cm from corner A.

Scale: 1 cm represents 20 cm



Constructing an angle bisector of angle DAC (shown in blue) finds all the points which are the same distance from side AB and side AD. Everything below the line is closer to side AB

Constructing a perpendicular bisector of side AB (shown in pink) finds all the points which are the same distance from corners A and B. Everything on the left of the line is closer to corner A

A game is played by throwing a ball into the sandpit.
Points may be scored when the ball lands in the sandpit.

- 1 point if the ball lands within 80 cm of corner A,
  and
- 1 point if the ball is closer to side AB than side AD,
  and
- 1 point if the ball is closer to corner A than corner B.

By completing the construction, find and shade the regions where 2 points can be scored.
Show all your construction lines. **[6]**

The number of points for each region is indicated

END OF QUESTION PAPER