MathsMadeEasy

GCSE Mathematics

Non Calculator

Higher Tier

Free Practice Set 6

1 hour 45 minutes

ANSWERS

Marks shown in brackets for each question (2)

A*	A	B	C	D	E
88	75	60	45	25	15

Legend used in answers

Green Box - Working out

5b means five times b
b = – 3 so 5 × – 3 = –15

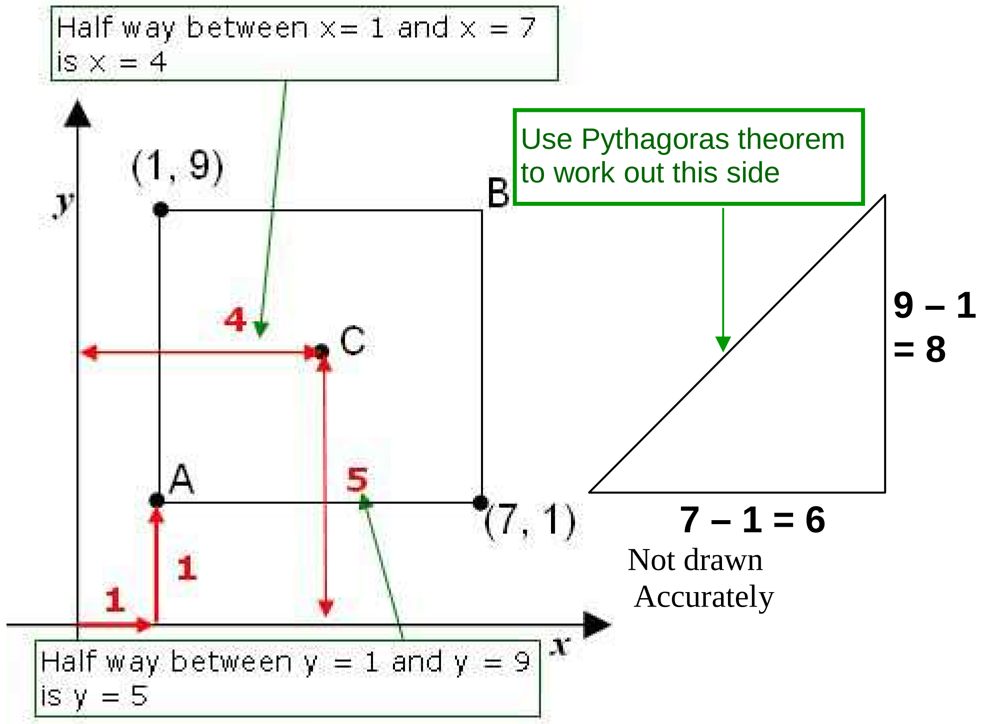
Red Box and ✓ - Answer

48 % ✓

Authors Note

Every possible effort has been made to ensure that everything in this paper is accurate and the author cannot accept responsibility for any errors.

1. A rectangle is drawn on an x-y axis below with co-ordinates for opposite corners.



a) What are the coordinates of point A?

A co-ordinate is two numbers which tell you firstly how far to move horizontally and then how far to move vertically.
Work out the co-ordinates of A using the other given co-ordinates in the rectangle.

A is (. **1 , 1** .)

(1)

b) Point C is halfway between the sides of the rectangle

What are the coordinates of point C?

Work out the width and height of the rectangle = 6 wide, 8 high
Divide these by two to find the distance of C from the sides = 3 , 4
Add these to the co-ordinates of point A = 1 + 3 , 1 + 4 = 4 , 5

C is (. **4 , 5** .)

(1)

c) What is the length of the diagonal AB of the rectangle?

To work out the length of the diagonal we can use Pythagoras's theorem because we have a right angled triangle.

First, work out the length of the sides from the co-ordinates

(Length diagonal)^2 = (length Side 1)^2 + (length side 2)^2
D^2 = 8^2 + 6^2 = 64 + 36 = 100
D = $\sqrt{100}$ = 10

AB = **10**

(2)

2.

Simplify means collect all the things that are the same together.
The sign before each term is for that term only

a) Simplify $10x + q - 6x - 3q$

$10x - 6x = 4x$

$q - 3q = -2q$

$4x - 2q$ ✓

(1)

b) Simplify $5s + 7y - 6s - 6y$

$5s - 6s + 7y - 6y = -s + y$

The sign only goes with the term in front of it

$-s + y$ ✓

(1)

c) Simplify $6x^2 - 5x^2$

You have 6 lots of x^2 and take five away so we have one lot

x^2 ✓

(1)

d) Expand and simplify:

$3(x + y) + 4(3x - 2y)$

Expand means multiply out the brackets:

$3(x + y) = 3x + 3y$

$4(3x - 2y) = 12x - 8y$

Simplify by putting same types together

$3x + 12x + 3y - 8y = 15x - 5y$

$15x - 5y$ ✓

(2)

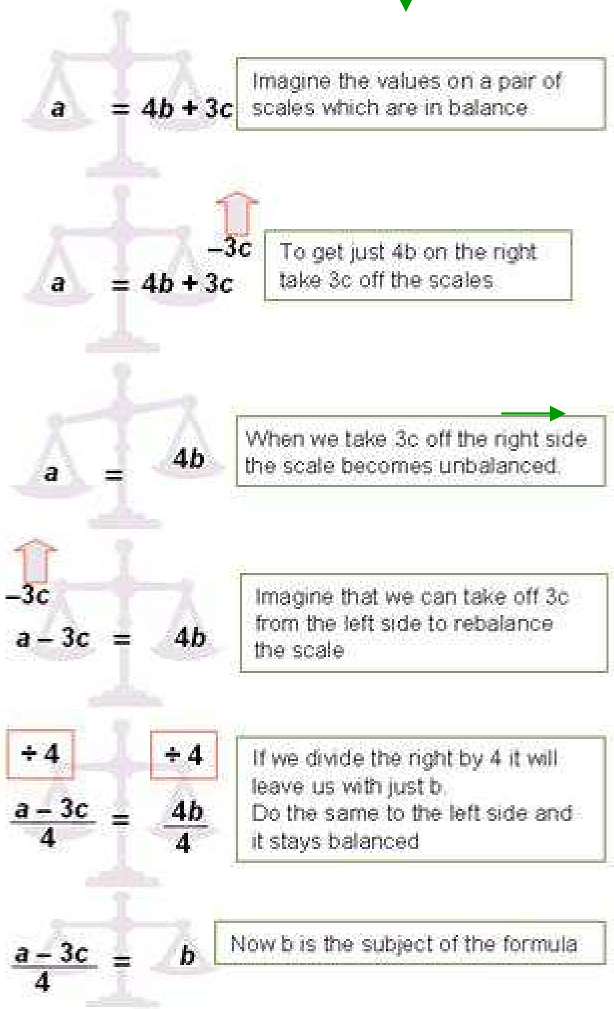
e) Make b the subject of the formula

$a = 4b + 3c$

We have to get b on one side of the equation and everything else on the other side.

Imagine that each side is different sides of a balance separated by the = sign.

To keep it balanced if we change one side we have to change the other side in exact in the same way.



Subtract 3*c* from both sides

$a - 3c = 4b + 3c - 3c$

$a - 3c = 4b$

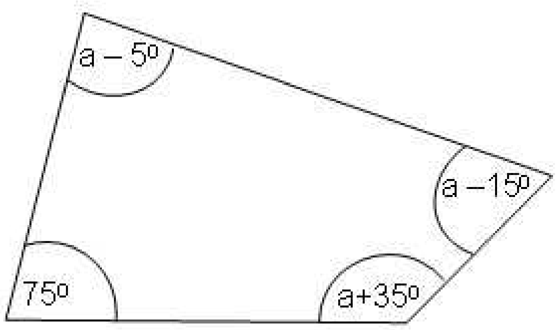
Divide both sides by 4

$$\frac{a - 3c}{4}$$

$$\frac{a - 3c}{4}$$

(2)

f) Four angles are shown in the quadrilateral below.



Write an equation for the total angles in the quadrilateral in terms of a.

All the angles in a quadrilateral add up to 360 degrees.

a –5 +75 +a –15 +a + 35 = 360

Add up the a's and the numbers

3a + 70 + 20 = 3a + 90 = 360

3*a* + 90 = 360 ✓

....

(2)

g) Factorise $9y^2 - 25$

This is a Difference Of Two Squares: $(a + b)(a - b) = a^2 - b^2$ (DOTS)
Common ones:
$y^2 - 4 = (y - 2)(y + 2)$
$y^2 - 9 = (y - 3)(y + 3)$

The + and – signs make sure that the x terms disappear.

Rewrite $9y^2 - 25 = (3y - 5)(3y + 5)$

(3y – 5)(3y + 5) ✓

(1)

h) Simplify $\dfrac{3x^2 - 16x - 12}{x^2 - 2x - 24}$

Factorise the top and bottom quadratics and look for terms to cancel

First Factorise the top term $3x^2 - 16x - 12$

Multiply 1st and last numbers, a × c = **3 x –12 = – 36**

1. Find two numbers which multiply to make – 36 → and also makes the *middle x value* –16 by adding or subtracting → – 36 = – 18 × +2 and – 16 = – 18 + 2

$3x^2 - 16x - 12$

2. Rewrite – 16*x* as (– 18*x* + 2*x*) in the equation

$3x^2 - 16x - 12 = 3x^2 - 18x + 2x - 12$

Notice : we put +2*x* next to the 12 and –18*x* next to the $3x^2$. We use it for factorisation in the next step

3. Factorise each pair of terms:

$3x^2 - 18x + 2x - 12$

→ $3x(x - 6) + 2(x - 6)$

4. Simplify: we have (x – 6) in both terms so we can take out as a factor

$3x(x - 6) + 2(x - 6) = (3x + 2)(x - 6)$ so $3x^2 - 16x - 12 = (3x + 2)(x - 6)$

Now Factorise the bottom term

$x^2 \; -2x \; -24$

1. Start with: $(x \quad A)(x \quad B)$
2. To find A and B look at the quadratic
3. A and B are two numbers which → make – 2 by adding or subtracting → and multiply to make –24

The two values are – 6 and + 4 because: –24 = –6 × + 4 and – 2 = –6 + 4

Rewriting the quadratic using –6 and 4 we get:

$x^2 - 2x - 24 = (x - 6)(x + 4)$

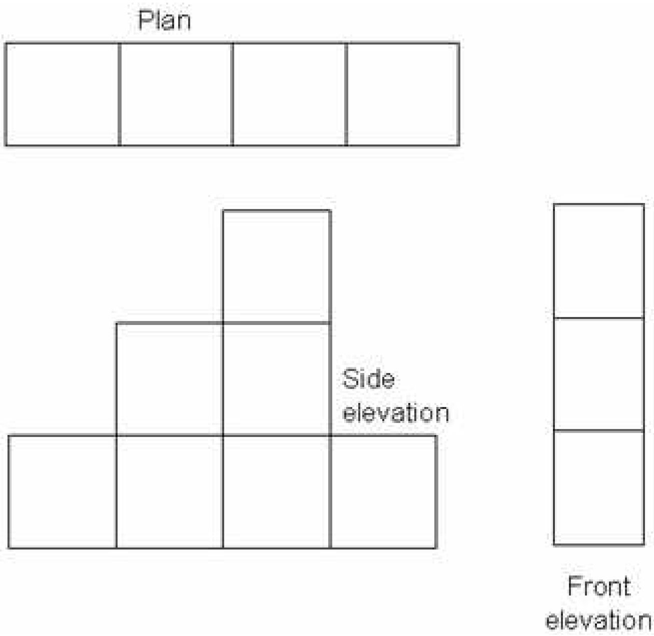
Rewriting $\dfrac{3x^2 - 16x - 12}{x^2 - 2x - 24} = \dfrac{(3x + 2)\cancel{(x - 6)}}{\cancel{(x - 6)}(x + 4)} = \dfrac{2x - 1}{x + 4}$

Cancel

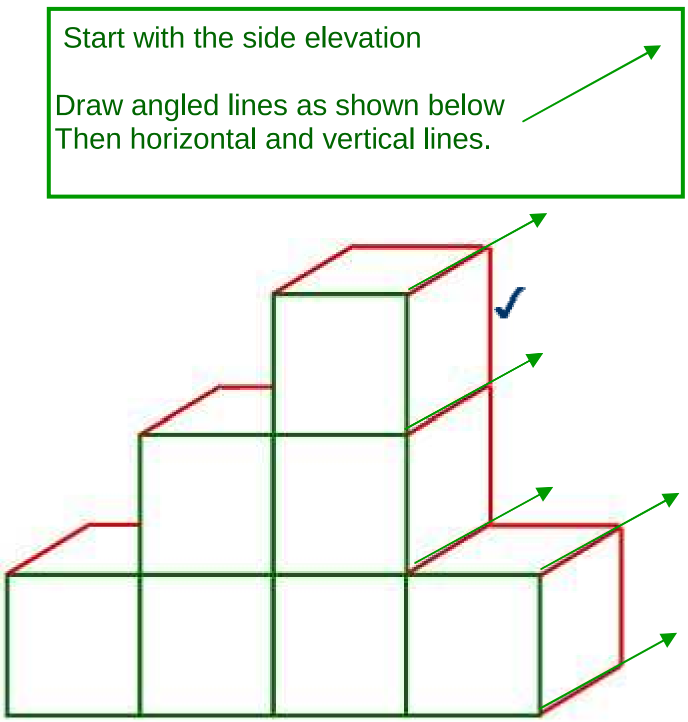
$\dfrac{3x + 2}{x + 4}$ ✓ .....

(4)

3. The plan, front elevation and side elevation of a 3-D shape are shown below.

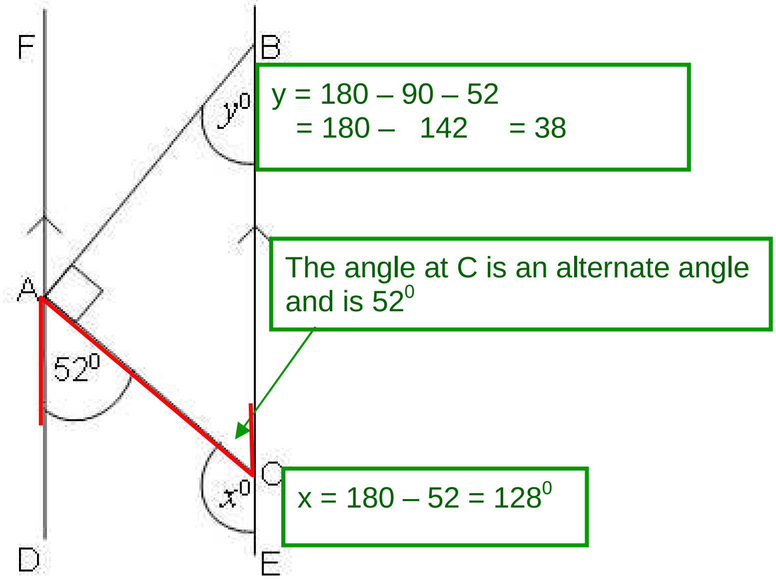


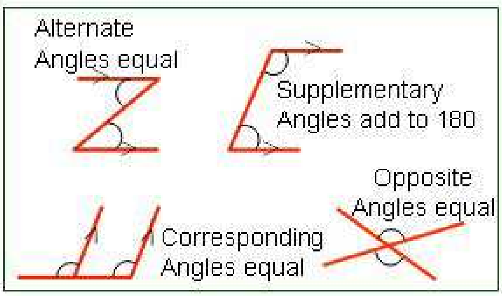
Draw a picture of the 3-D shape



(2)

4. The diagram shows two parallel lines DF and EB and a triangle ABC.





a) Work out the sizes of angles *x* and y

Find x by finding the angle at C. Then subtract this from 180

x = **128**° *y* = **38**°

(1)

b) Explain how you got your answer

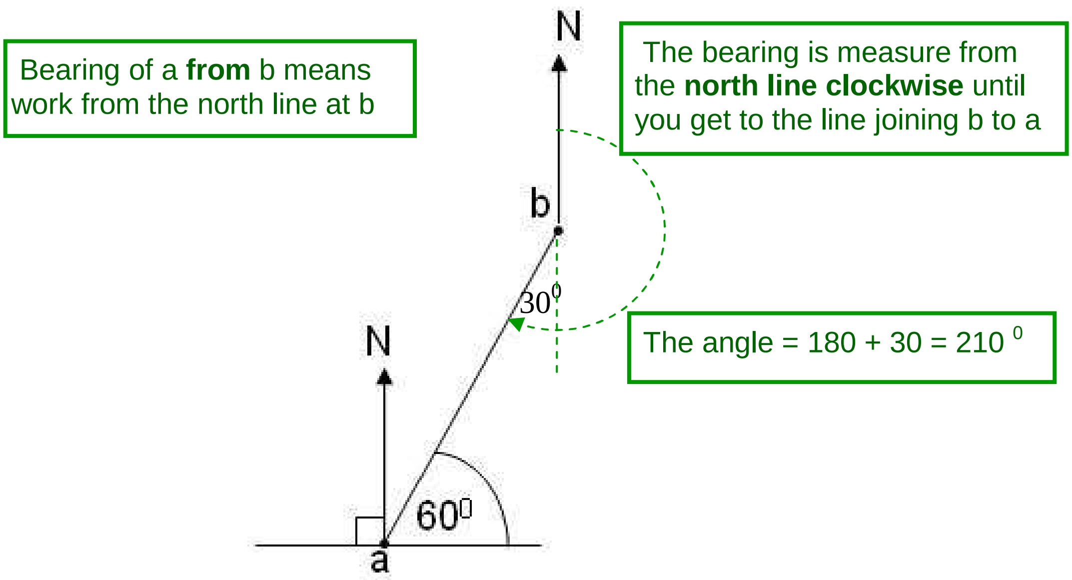
The angle at ACB is alternate = 52
x is on a straight line of 180 so x = 180 – 52 = 128

Find y by subtracting a right angle (90) and the angle at ACB (52) from 180

………

(1)

c) What is the bearing of ‘a’ from ‘b’ in the diagram below.



Bearing a from b = .**210**….°

(1)

5. A mobile phone cost £120 *excluding* VAT.
VAT on the mobile phone is 15 %

a) How much does the mobile phone cost *including* VAT?

15% = 10% + 5%.
10% of £120 = £12 (120÷ 10 = 12)
5% of £120 = £6 (half of above)

∴ 15% of £120 = £12 + £6 = £18

Add it to the £120 → £120 + £18 = £138

£ **138** ✓

(2)

b) Text messages cost 8p each.
In one month Sunita sent 150 text messages**.**
Sunita gets 100 free text messages per month.
How much did Sunita spend on text messages?

150 text – 100 free = 50 texts to pay for

50 x 8 pence is the same as 100 x 8 ÷ 2 = 800 ÷ 2 = 400pence

400pence = £4.00 (divide by 100 to convert pence to pounds)

£ **4** ✓

(2)

c) Sunita sent 150 text messages to her friends Bill, Jack and Ram in the ratio 1 : 4 : 5

How much did she send to each person?

Add up the ratios 1 + 4 + 5 = 10. we have 10 parts

Divide 150 by 10 = 15. One part = 15

Bill gets 1 x 15 = 15
Jack gets 4 x 15 = 60
Ram gets 5 x 15 = 75

Bill **15** ✓ Jack **60** ✓ Ram **75** ✓

(2)

6. Kathleen is *x* years old.

Her daughter Jane is half Kathleen's age.

The total age of both Kathleen and Jane is 63 years.

a) Write an equation for their total age in terms of x.

Kathleen is x years old.
Jane is $\frac{x}{2}$ years old.
Since we know that these add up to 63, we can make an *equation:*

$x + \frac{x}{2} = 63$ so $\frac{3x}{2} = 63$

$x + \frac{x}{2} = 63$ ✓

(1)

b) Solve the equation you wrote above (b) to find x (Kathleen's age)

$x + \frac{x}{2} = 63$ so $\frac{3x}{2} = 63$

Multiply both sides by 2 gives $3x = 63 \times 2$ so $3x = 126$

Divide both sides by 3 gives $\frac{3x}{3} = \frac{126}{3}$ so $x = 42$

Kathleen is 42 her daughter Jane is 21

42 ✓ years

(2)

7. What is

Follow the rules of BODMAS or BIDMAS
This tell you the order which you do calculate

Brackets Order Divide Multiply Add Subtract
Brackets Indices Divide Multiply Add Subtract

a) $\frac{8 \times 6 + 2}{0.5}$

Do the **M**ultiplication first

1st	8 x 6	= 48
2nd	48 + 2	= 50
3rd	50 ÷ 0.5	= 100

50 ÷ 0.5 **is NOT** 25, that is 50 ÷ 2
How many halves in 50 → there are 100

100 ✓

.... **(1)**

b) $\frac{\cancel{45}^{5} \times 7 \times \cancel{16}^{4}}{\cancel{9}^{1} \times \cancel{4}^{1}}$

Do some **C**ancelling to simplify first
Find a value that goes into the top and bottom

This leaves 5 x 7 x 4 = 20 x 7 = 140

140 ✓

.... **(1)**

(1)

c) Estimate $\frac{149.8 \times 9.9}{0.26}$

Change 149.8 → 150, 9.9 → 10 and 0.26 → 0.25

$\frac{150 \times 10}{0.25} = \frac{1500}{0.25} = 6000$ (1500 ÷ 0.25 is NOT 375)

6000 ✓

.... **(2)**

If you had 1500 cakes and cut them all into quarters, how many quarters would you have?

8. The formula $s = ut + \frac{1}{2}at^2$ gives the distance s an object moves

a) Find the value of s when $u = 7$, $a = 10$ and $t = 3$

Replace the letters with the values given..

So

$s = u \times t + \frac{1}{2} \times a \times t^2$

$s = 7 \times 3 + \frac{1}{2} \times 10 \times 3^2$

$s = 21 + \frac{1}{2} \times 90$

$s = 21 + 45$

$s = 66$

66

(2)

b) If $s = 145$, $u = 4$ and $t = 5$ find a

Rearrange the equation to make a the subject.

$s = ut + \frac{1}{2}at^2$

(–ut both sides) $s - ut = \frac{1}{2}at^2$

Double both sides $2(s - ut) = at^2$

$\div\ t^2$ $\frac{2(s - ut)}{t^2} = a$

Replace letters $\frac{2(145 - 20)}{25} = 2 \times 125 = 10$

10

(2)

9. What is:

a) $3\frac{1}{3} \div 2\frac{4}{5}$

Convert to fractions

$2\frac{4}{5} \rightarrow 5 \times 2 + 4 = \frac{14}{5}$

Convert to fractions

$3\frac{1}{3} \rightarrow 3 \times 3 + 1 = \frac{10}{3}$

If two fractions are divided make it easier by flipping over the last fraction and changing the operator from divide to multiply

$\frac{10}{3} \div \frac{14}{5} \rightarrow \frac{10}{3} \times \frac{5}{14} = \frac{50}{42}$

$\frac{25}{21}$ ✓ $1\frac{4}{21}$ ✓

.... **(2)**

b) $3\frac{2}{3} + 2\frac{3}{5}$

denominators

Put aside the 3 + 2 = 5 for now. Add the fractions

REMEMBER when we add fractions the **denominators** have to be the **same**

Find a denominator by multiplying 3 x 5 = 15

$\frac{2}{3} + \frac{3}{5} = \frac{?}{15} + \frac{?}{15}$

To get the ? we ask what we multiplied the bottom of the fraction by to get 15

The bottom 3 was multiplied by 5 so we have to multiply the top 2 by 5 = 10
The bottom 5 was multiplied by 3 so we have to multiply the top 3 by 3 = 9

$\frac{2}{3} + \frac{3}{5} = \frac{10}{15} + \frac{9}{15} = \frac{19}{15}$ or $1\frac{4}{15}$

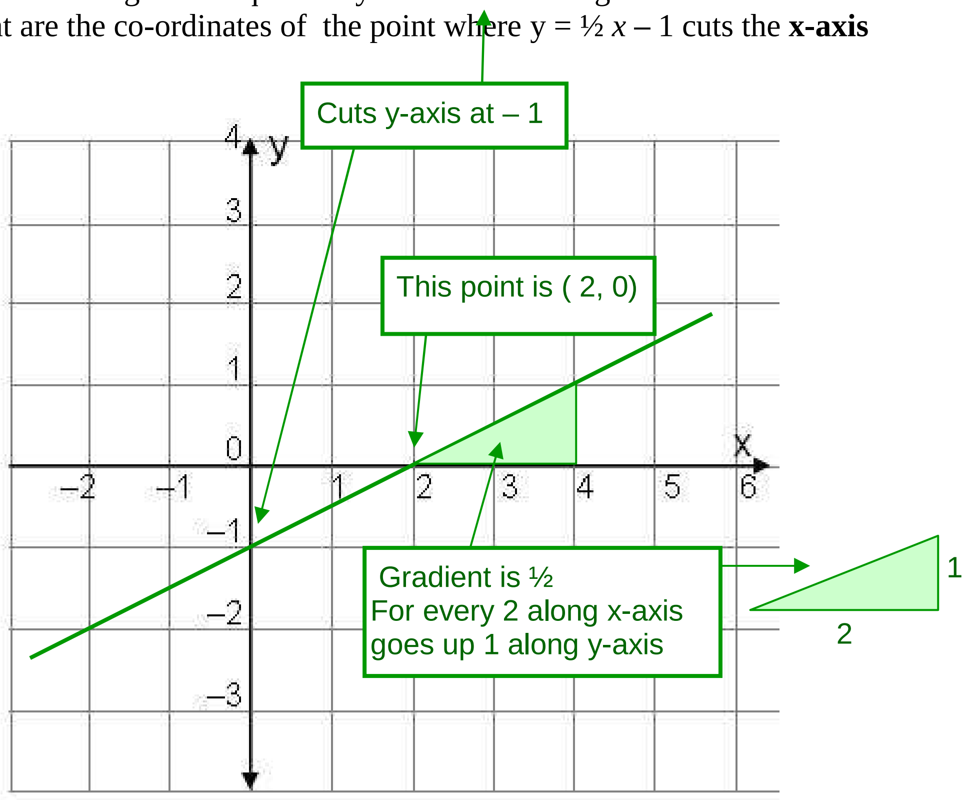
Now we can add the fractions

Now add 5 back in

$6\frac{4}{15}$ ✓

.... **(2)**

10. **a)** Draw the straight line equation y = ½ x – 1 on the grid below.
What are the co-ordinates of the point where y = ½ x – 1 cuts the **x-axis**



(1)

Point where cuts x-axis (........ , ...) **2 , 0** ✓

(1)

b) What is the gradient of the *perpendicular* line to y = ½ x – 1

If a line has a gradient of m
then the line perpendicular to this has gradient $\frac{-1}{m}$

Flip the gradient over and change the sign

.... **– 2** ✓

(1)

11. 120 batteries were tested to see how long they lasted.

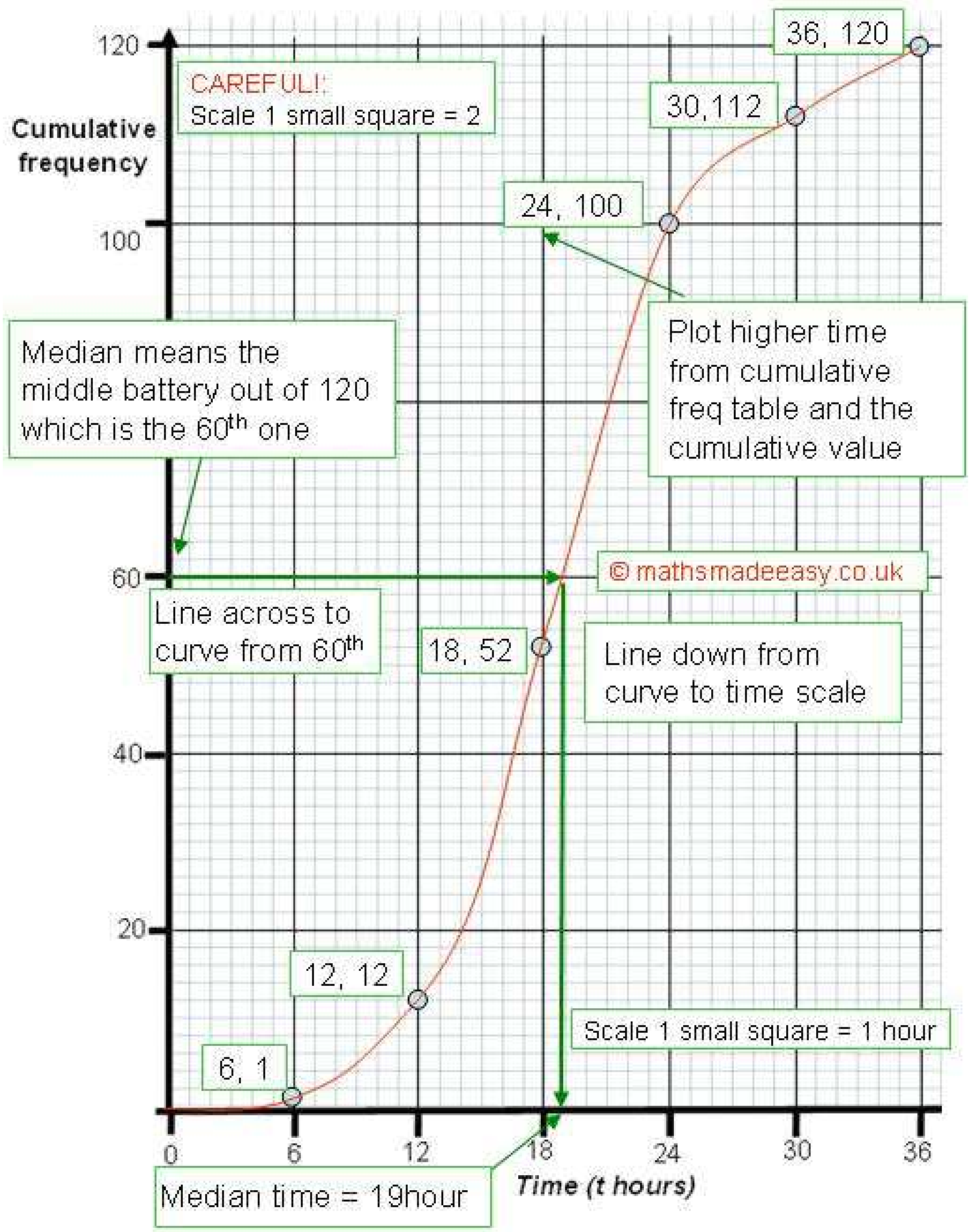
The table below shows how long in hours the batteries lasted.

Time (t hours)	Frequency
$0 \le t < 6$	1
$6 \le t < 12$	11
$12 \le t < 18$	40
$18 \le t < 24$	48
$24 \le t < 30$	12
$30 \le t < 36$	8

a) Complete the cumulative frequency table **(1)**

Time (t hours)	Cumulative Frequency
$0 \le t < 6$	1
$0 \le t < 12$	12
$0 \le t < 18$	52
$0 \le t < 24$	100
$0 \le t < 30$	112
$0 \le t < 36$	120

b) Using your completed table draw a cumulative frequency graph on the grid **(2)**



c) Using the completed graph estimate the median time

…………… **19**

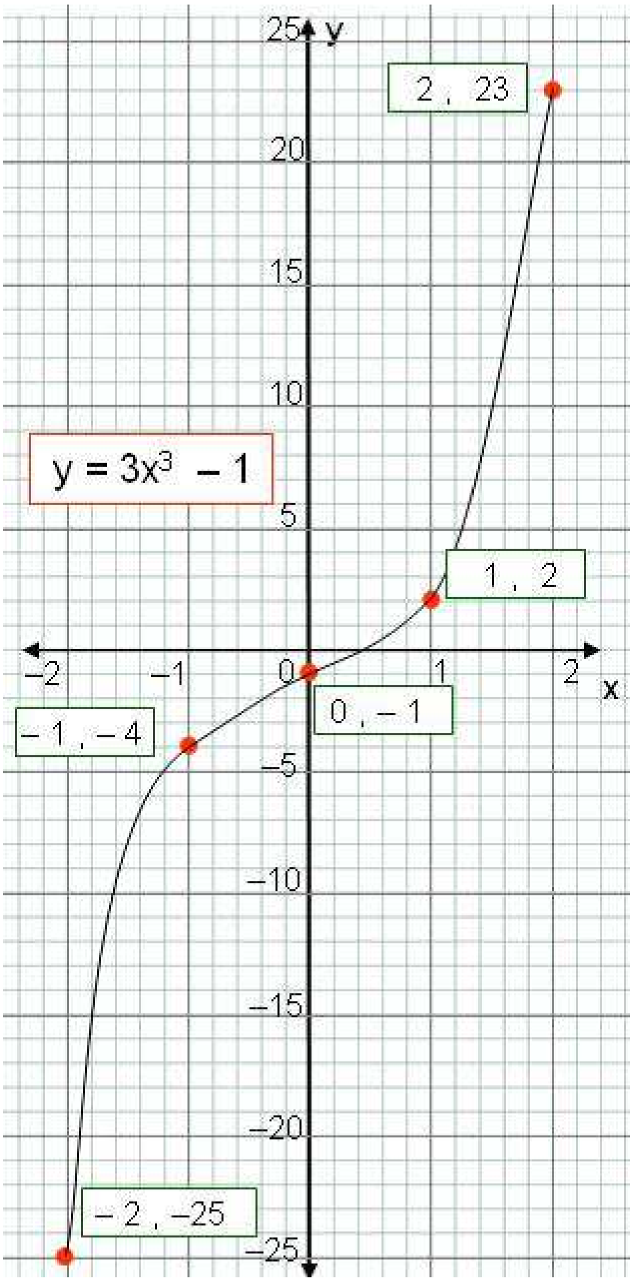
(1)

12. **a)** Complete the table of values for $y = 3x^3 - 1$ below.
Some of the working out has been done for you

x	–2	–1	0	1	2
$3x^3$	3×-2^3 $= -24$	3×-1^3 $= -3$	3×0^3 $= 0$	3	3×2^3 $= 24$
– 1	–1	–1	–1	–1	–1
= y	– 25 ✓	– 4 ✓	– 1 ✓	2	23 ✓

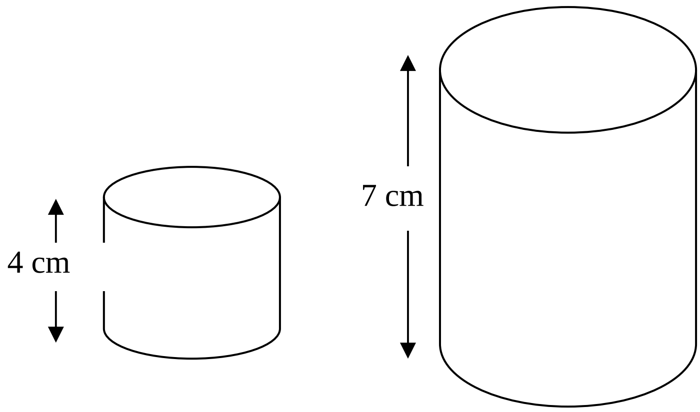
(2)

b) Plot the graph for $y = 3x^3 - 1$



(2)

13. Two mathematically similar cylinders are shown



Diagrams NOT drawn accurately

The volume of the smaller cylinder is 64 cm^3
Calculate the volume of the larger cylinder.

Since they are mathematically similar we can work out the scale factor for length

Scale factor (for length) = $\frac{\text{big side}}{\text{small side}} = \frac{7}{4}$

The scale factor for volume = (scale factor for length) $^3 = \left(\frac{7}{4}\right)^3$

The volume of the large cylinder can be found using the volume of the small cylinder × scale factor for volume

$V = 64^1 \times \frac{7}{4} \times \frac{7}{4} \times \frac{7}{4}$ = 49 x 7 = 343

343 ....cm^3
(3)

14. The mass of a solid sphere (M gm) is proportional to its radius (R cm) cubed.

When R = 4, M = 280 gms

Cubed means the value times itself three times

a) Find a formula for M in terms of R

Since M is proportional to R cubed we write this as: $M \propto R^3$
We can replace the $\propto$ sign with $= k$ where k is a constant. So $M = k R^3$

We know that when R = 4 , *M* = 1280 and can use this to find *k:*

$$M = k R^3$$
$$1280 = k \times 4 \times 4 \times 4$$
$$\text{so } k = \frac{1280}{4 \times 4 \times 4} = 20$$

We can rewrite the formula as: $M = 20 R^3$

Cancel $\frac{1280}{4 \times 4 \times 4}$ down with 4 → $\frac{320}{4 \times 4}$ → $\frac{80}{4}$ = 20

.....**$20R^3$**.

(3)

b) Find the value of M when R = 5

We have $M = 20 R^3$ with R=5
$M = 20 \times 5 \times 5 \times 5 = 2500$

20 x 5 x 5 x 5
100 x 25 = 2500

2500
....

(2)

15. Cyril played a game of tennis and then a game of squash.

The probability that he will win the game of tennis is 40%

The probability that he will win the game of squash is $\frac{3}{11}$

$40\% = \frac{4}{10}$

Assume that he only won or lost

a) Draw a probability tree to show this information

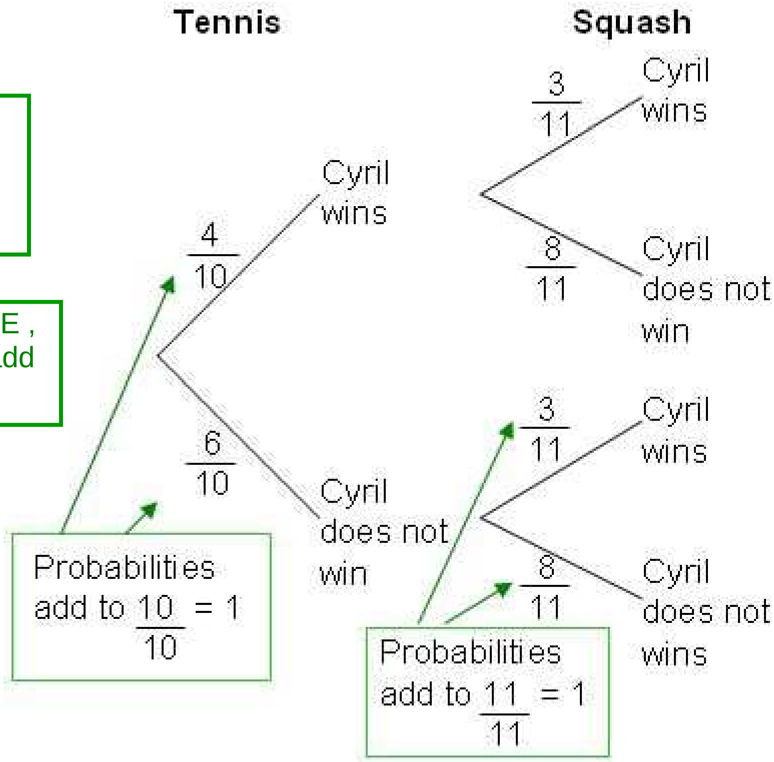
A probability TREE shows the probabilities at each stage.

As it forks both must add up to 1

Cyril is CERTAIN to WIN or LOSE , so these two probabilities must add up to 1

Probability Win tennis $= \frac{4}{10}$

Probability Lose tennis $= 1 - \frac{4}{10} = \frac{6}{10}$



(2)

b) What is the probability that Cyril will win one game

Cyril wins one game which means he loses then wins or wins then loses

There are two paths on the probability tree. We work out each path and add them.

So we ADD probability (win-lose) and probability (lose-win)

probability (win-lose) $= \frac{4}{10} \times \frac{8}{11} = \frac{32}{110}$

probability (lose-win) $= \frac{6}{10} \times \frac{3}{11} = \frac{18}{110}$

Now add these together

probability (win-lose) + probability (lose-win) $= \frac{32}{110} + \frac{18}{110} = \frac{50}{110}$

.... $\frac{5}{11}$ ....

(2)

16. Make x the subject of the formula $\dfrac{1}{y} = \dfrac{y - 6x}{xy - 7}$

Multiply both sides by $xy - 7$ To remove the $xy - 7$ from the right side	$\dfrac{xy - 7}{y} = y - 6x$
Multiply both sides by y To remove the y from the left side	$xy - 7 = y^2 - 6xy$
Get x's on left by adding $6xy$ to both sides	$xy - 7 + 6xy = y^2 - 6xy + 6xy$ $7xy - 7 = y^2$
add 7 to both sides	$7xy - 7 + 7 = y^2 + 7$ $7xy = y^2 + 7$
Divide by $7y$ to get x	$x = \dfrac{y^2 + 7}{7y}$

$$\frac{y^2 + 7}{7y}$$

(3)

17. What is $0.\dot{2}\dot{3}\dot{4}$ as a fraction in its simplest form

Recurring decimals have a pattern of digits which repeat forever
e.g. $0.\dot{2}\dot{3}\dot{4}$ means 0. 234234234 …

Count the number of digits in the pattern that are repeating. The dot above a digit tells you that it is repeating. So $0.\dot{2}\dot{3}\dot{4}$ is 0.234234234and has 3 repeating digits

Multiplying your recurring decimal by either 10, 100, 1000 etc.
Select the one which has the same number of zeros as the repeating pattern
So multiply $0.\dot{2}\dot{3}\dot{4}$ with three repeating digits, by 1000 which has 3 zeros

$0.\dot{2}\dot{3}\dot{4} \times 1000 = 234.234234$ etc

If we subtract the original we get an exact integer:

234.234234 – 0.224234 = 234

This is like multiplying our original by 999 (1000 – 1)

$0.\dot{2}\dot{3}\dot{4} \times 999 = 234$

Rearranging $0.\dot{2}\dot{3}\dot{4} \times 999 = 234$

we get $0.\dot{2}\dot{3}\dot{4} = \frac{234}{999}$

$$0.\dot{2}\dot{3}\dot{4} \times 1000 - 0.\dot{2}\dot{3}\dot{4} \times 1 = 234$$

$$0.\dot{2}\dot{3}\dot{4} \times 999 = 234$$

$$0.\dot{2}\dot{3}\dot{4} = \frac{234}{999} = \frac{26}{111}$$

Cancel with 9

……………….. **(2)**

18 In the table below are some expressions

The letters a, b and c represent lengths
The numbers have no dimensions

Tick the table to show whether each expression is a Length, Area, Volume, or None of these.

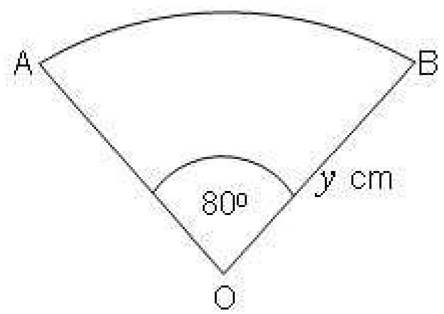
Remember: ignore any numbers

Expression	Length	Area	Volume	None of these
$5b^2c$			✓	
$2a + 4b + 3c$	✓			
$6a^2 + 6a$				✓
$3b(a + 2c)$		✓		

$5b^2c$ → ignore the 5 so we have length^3 → volume
$2a + 4b + 3c$ → 2,4 and 3 so we have length + length + length → length
$6a^2 + 6a$ → ignore 6 so we have length^2 + length → mixed
$3b(a + 2c)$ → ignore 3 and 2 and expand to give ba + bc or length^2 → area

(2)

19.



Work out the circumference and the area of a circle and then take the fraction of a circle that you have.

In this case we have 80 degrees out of 360 degrees

A sector of a circle is shown below with a radius of y cm and centre O.

a) Write an expression for the arc length AB in terms of y and π

Arc length is part of the circumference . Circumference = $2\pi r = 2\pi y$
The fraction of the circumference that we have = $\frac{80}{360} = \frac{2}{9}$

So AB = $\frac{2}{9} \times 2\pi y = \frac{4\pi y}{9}$

$\frac{4\pi y}{9}$ ✓

(1)

b) Write an expression for the sector area in terms of y and π

Sector area is part of the circle area . Area $= \pi r^2 = \pi y^2$
The fraction of the area that we have = $\frac{80}{360} = \frac{2}{9}$

So area sector $= \frac{2}{9} \times \pi y^2 = \frac{2\pi y^2}{9}$

$\frac{2\pi y^2}{9}$ ✓

(1)

20. **a)** Factorise $y^2 + 6y + 7$ by completing the square.

"Complete the square" means writing the equation in this form $(y + a)^2 - b$
This helps us solve the equation and is useful when looking at graphs of equations

$y^2 + 6y \rightarrow (y + 3)^2$

Work on the first two terms first. Look at the number for the y term and halve it. Put this inside the squared bracket as shown.

$y^2 + 6y = (y + 3)^2 - 9$

There will be an extra value created by squaring the number in the bracket. To make both sides of the equation equal we have to subtract it.

$$y^2 + 6y + 7 = (y + 3)^2 - 9 + 7$$
$$= (y + 3)^2 - 2$$

Finally we have to put the third term back and then simplify the equation

$(y + 3)^2 - 2$ ✓

.... **(3)**

b) Hence solve $y^2 + 6y + 7 = 0$. Give your answer in the form $a \pm \sqrt{2}$.

	$y^2 + 6y + 7$	$= 0$
so	$(y + 3)^2 - 2$	$= 0$
Rearrange	$(y + 3)^2$	$= 2$
Square root	$(y + 3)$	$= \pm\sqrt{2}$
Subtract 3	y	$= -3 \pm\sqrt{2}$

Don't forget ±

y = **$-3 \pm \sqrt{2}$** ✓ ....

(2)

21. **a)** Write 4.3×10^5 as an **ordinary number**

10^5 means 10 times itself 5 times or 100,000
$4.3 \times 10^5 = 4.3 \times 100{,}000 = 430{,}000$

430,000 ✓
…….

(1)

b) Write 0.00043 in **standard form**

To convert a number to standard form count the jumps needed to get the decimal point between the first two numbers.

Start at the decimal point

1 2 3 4

0 . 0 0 0 4 . 3

Jump over digits going right until you are just before last digit

We needed 4 jumps so we get 10^{-4}

4.3×10^{-4} ✓
……………………………

(1)

c) Work out :

$$(4 \times 10^3)^2 + 3.5 \times 10^7$$

Give your answer in **standard form.**

ADD powers

Put it to 10^7

$(4 \times 10^3)^2 = (4 \times 10^3) \times (4 \times 10^3) = 16 \times 10^6 = 1.6 \times 10^7$

$1.6 \times 10^7 + 3.5 \times 10^7 = 5.1 \times 10^7$

Once both numbers are to the **same power** of 10 we can **ADD** 1.6 and 3.5

5.1×10^7 ✓
……………………………

(3)

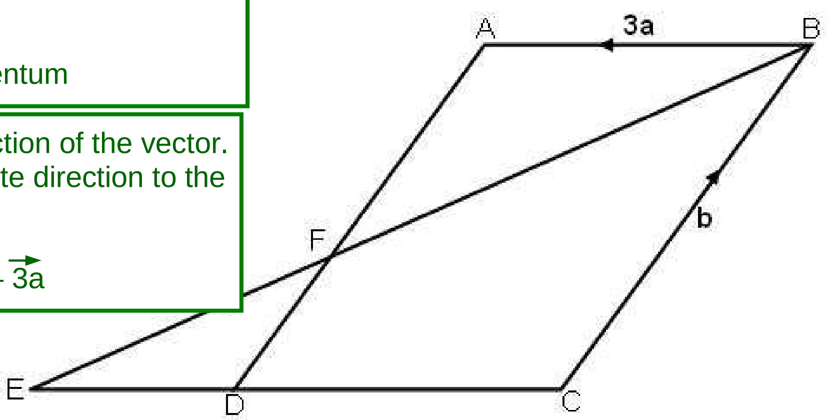
22.

A **vector** is a quantity with both magnitude (size) and direction.

e.g. force, velocity, momentum

The **arrow** shows the direction of the vector. When you go in the opposite direction to the arrow, reverse the sign.

So if $\overrightarrow{BA} = 3a$ then $\overrightarrow{AB} = -3a$



Since this is a parallelogram DC = AB and AD = BC

ABCD is a parallelogram
AF: FD is in the ration 3:2
CD:DE is in the ratio 3:2

$\overrightarrow{BA} = \mathbf{3a}$ $\qquad \overrightarrow{CB} = \mathbf{b}$

Work out a **vector** by finding a different route to go between the same points.

The vector AC means how to get from A to C. Do this by going from A to B then B to C

a) Find the following vector in terms of **a** and **b**

i) $\overrightarrow{AC}$

To go from A to C we use the route A to B and then B to C

We say $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$
$= -3a + -b$

–3a – b ✓

(1)

ii) $\overrightarrow{BF}$

To go from B to F we use the route B to A and then A to F

We say $\overrightarrow{BF} = \overrightarrow{BA} + \overrightarrow{AF}$
$= 3a + ?$

We can find AF from AD which we can work out.
AD = BC since we have a parallelogram = – b
AD is split in the ratio 3:2 so AF = 3/5 of – b

$\mathbf{3a - \frac{3b}{5}}$ ✓ **(1)**

iii) $\overrightarrow{FE}$

To go from F to E we use the route F to D and then D to E

We say FE $= \overrightarrow{FD} + \overrightarrow{DE}$

We can find FD since it is 2/5th of AD = 2/5 of – b
We can find DE from CD (3a). It is 2:3 so DE = 2a

$\mathbf{2a - \frac{2b}{5}}$ ✓

(1)

b) Hence prove that BFE is a straight line

For BFE to be a straight line the vectors of BF and FE must be the same.

$$BF = 3a - \frac{3b}{5} \quad \text{and} \quad FE = 2a - \frac{2b}{5}$$

Factorise both $$BF = 3\left(a - \frac{b}{5}\right) \quad \text{and} \quad FE = 2\left(a - \frac{b}{5}\right)$$

This means that BF is a multiple of FE but has the same direction.
Since they both go through the point F they must be in a straight line.

……….................

(2)

BF = 6 cm

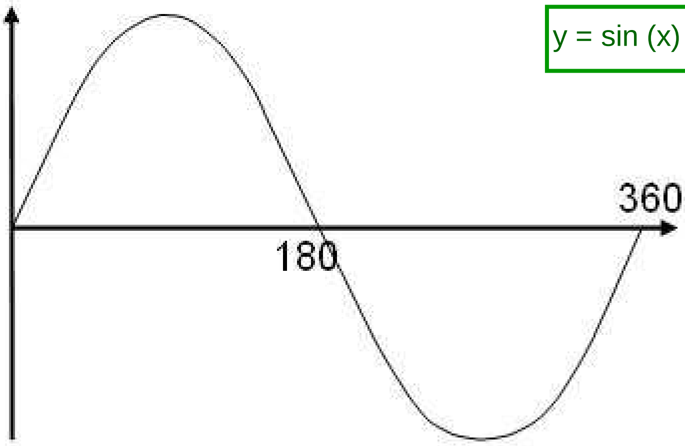
c) Find the length of BE

If BF = 6 cm, FE = 4 cm so BE = 6 + 4 = 10 cm

……….................. **10** **cm**

(1)

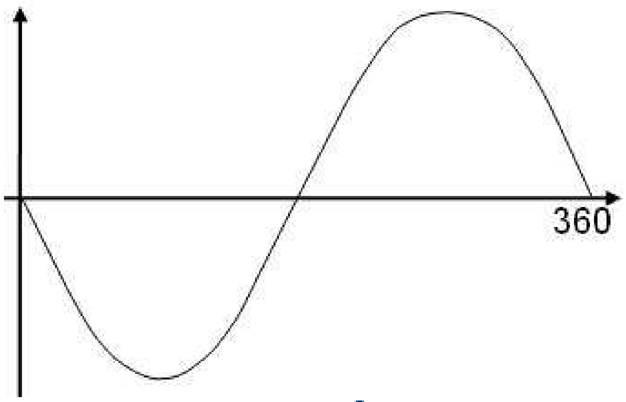
23. The graph of $y = \sin x^0$ is shown for values from $x = 0^0$ to 360^0



y = sin (x) looks like this

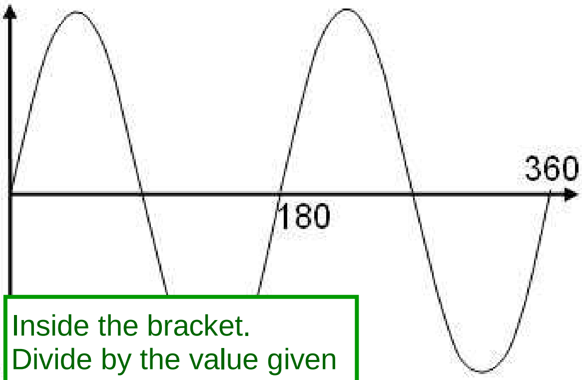
Each of the curves below has been transformed from y = sin x. Write down the equation for each.

This is a reflection of sin x. Every value we had for y has had its sign changed



y = …… **– Sin (x)** ✓ ………..

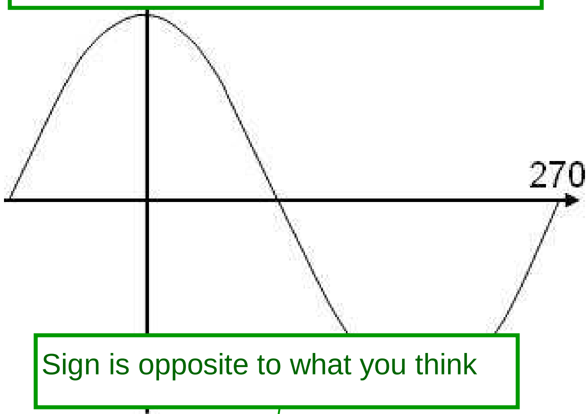
This is sin x crunched up by a half in the x direction



Inside the bracket.
Divide by the value given

y = ……. **Sin (2x)** ✓ ……..

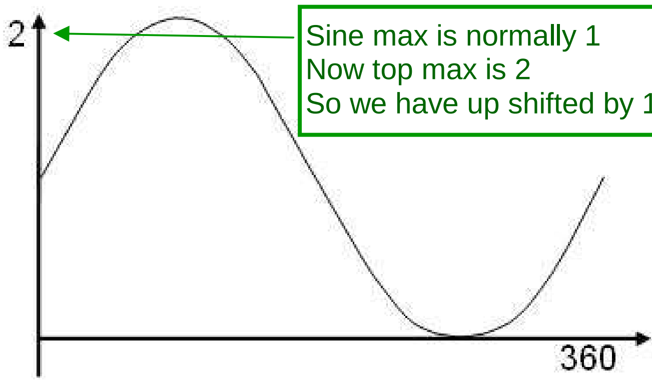
This is sin x shifted by 90 degrees in the negative x direction



Sign is opposite to what you think

y = …… **Sin (x + 90)** ✓ ………..

This is a sin x shifted up by 1 in the y-direction



Sine max is normally 1
Now top max is 2
So we have up shifted by 1

y = ……. **Sin(x) + 1** ✓ ……..

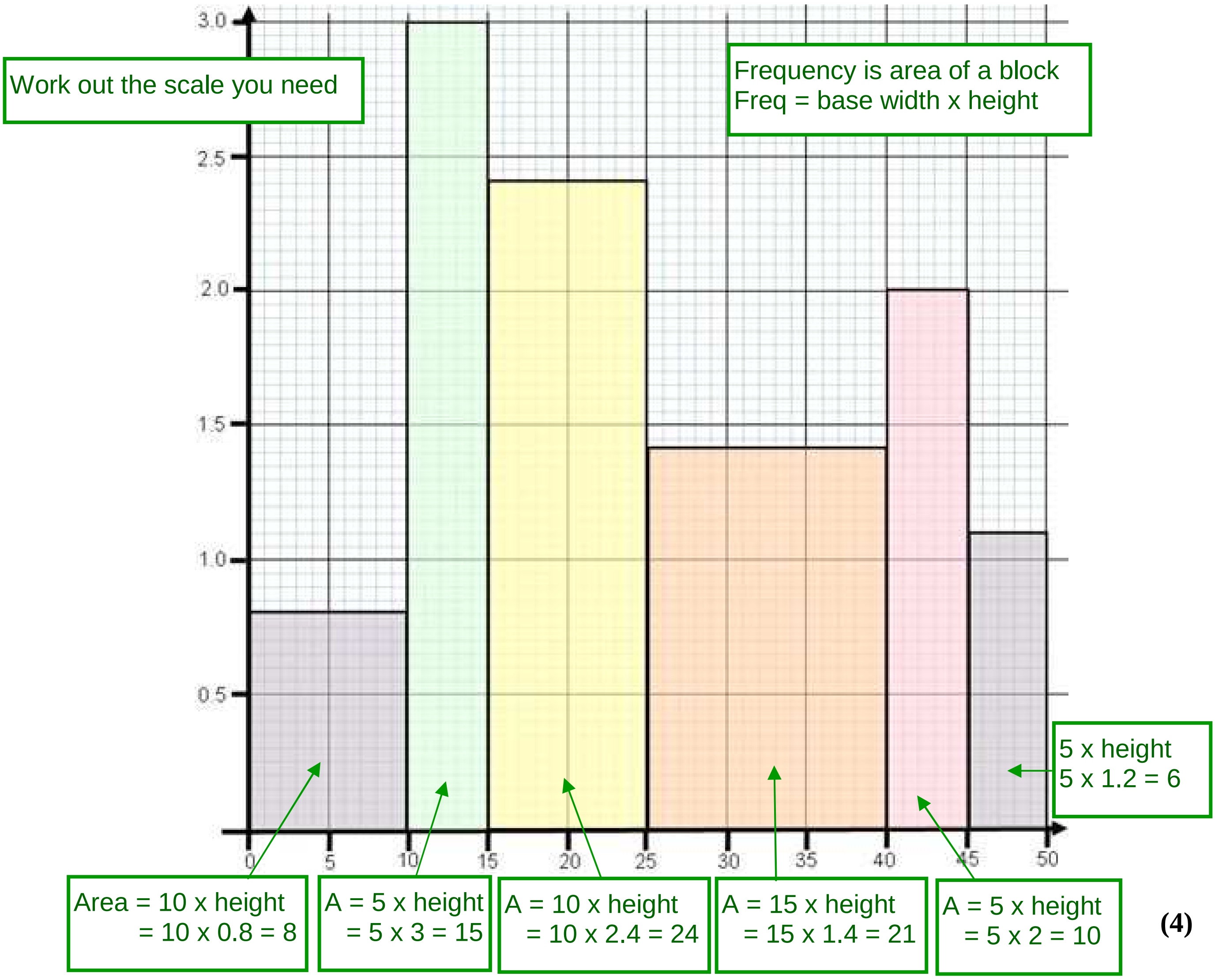
(4)

24. A survey of 84 children was made to see how long they spent revising for their GCSE exams in the term before the exam.

The table below shows how long in hours the children spent.

Time (t hours)	Frequency
0 < t <10	8
10 < t < 15	15
15 < t <25	24
25 < t < 40	21
40 < t < 45	10
45 < t < 50	6

Draw a histogram of this information on the grid below.



(4)

TOTAL FOR PAPER: 100 MARKS
END