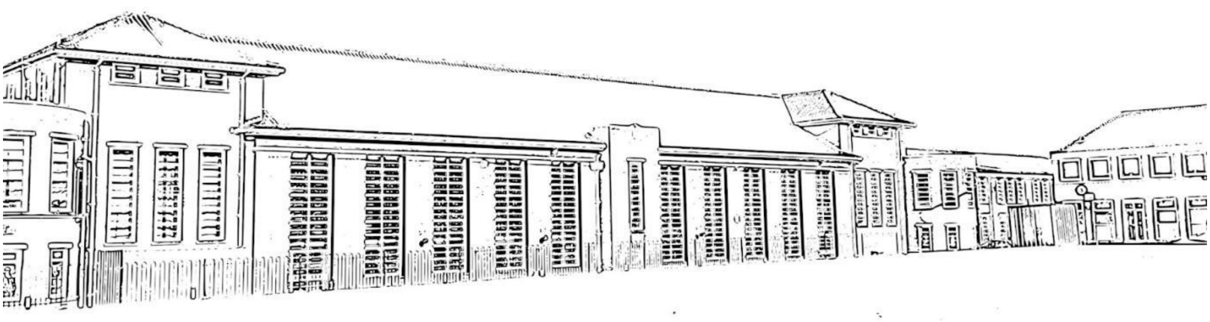
Numeracy Handbook
Llawlyfr Rhifedd



At St Julian's School we believe that all of our students should have the opportunity to **improve and apply** their literacy, numeracy and digital competency skills to **deepen their subject knowledge** and **develop skills for life** across all areas of the curriculum. This Numeracy Handbook has been designed to give guidance and help staff, students and parents/carers. It includes the numerical methods used by the Maths Department and throughout St. Julian's. It is believed that by having consistent approaches to our numeracy skills it will be easier for our students to apply these skills across the curriculum and in turn make greater progress.

Whenever possible mental methods should be encouraged and the ability to use written methods checked. Students should ensure they always have their calculators with them to develop their confidence in using their calculator as well and using the correct calculator methods. Students should be encouraged to estimate their answers prior to completing their calculations reinforcing place value expectations and understanding.

The main strands of numeracy have been covered in this handbook which will support every St. Julian's' student in becoming numerate and confident with applying their skills in context. If you have any questions or would like further clarification, please contact the Maths
Department directly.

A numerate Student is able to:

- have a sense of the size of a number and where it fits into the number size;
- recall mathematical facts confidently;
- calculate accurately and efficiently, both mentally and with pencil and paper, drawing on a range of calculator strategies;
- use proportional reasoning to simplify and solve problems;
- use calculators and other ICT resources appropriately and effectively to solve mathematical problems, and select from the display the number of figures appropriate to the context of a calculation;
- use simple formulae and substitute numbers in them;
- measure and estimate measurements, choosing suitable units, and reading numbers correctly from a range of meters, dials and scales;
- calculate simple perimeters, areas and volumes, recognising the degree of accuracy that can be achieved;
- understand and use measures of time and speed, and rates such as £ per hour or miles per litre;
- draw plane figures to given specifications and appreciate the concept of scale in geometrical drawings and maths;
- understand the difference between the mean, median and mode and the purpose for which each is used;
- collect data, discrete and continuous, and draw, interpret and predict form graphs, diagrams, charts and tables;
- have some understanding of the measurement of probability and risk;
- explain methods and justify reasoning and conclusions, using correct mathematical terms;
- judge the reasonableness of solutions and check them when necessary;
- give results to a degree of accuracy to the context.

Place Value

Thousands (1000)	Hundreds (100)	Tens (10)	Units (1)	.	Tenths $\frac{1}{10}$	Hundredths $\frac{1}{100}$	Thousandths $\frac{1}{1000}$

The placement of the digits within the number gives us the value of that digit.

Within the number: 284.567

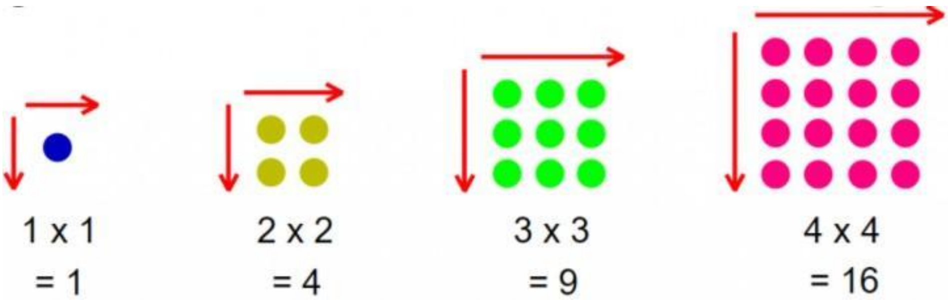
The digit 8 has the value of 8 tens and the digit 5 has the value of 5 tenths (5/10)

Number Facts

Even Numbers: 2 , 4, 6, 8, 10 ,12 (all even numbers can be divided by 2)

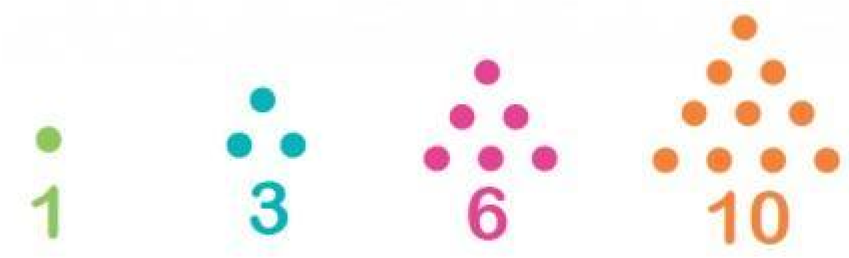
Odd Numbers: 1 , 3 , 5, 7 , 9, 11

Square Numbers are numbers multiplied by themselves:



Cube Numbers are numbers multiplied by themselves and then multiplied again:

Triangular Numbers:



Multiples of a number are found by multiplying that number by another whole number:

$4 \times 1 = 4$
$4 \times 2 = 8$
$4 \times 3 = 12$
$4 \times 4 = 16$
$4 \times 5 = 20$
$4 \times 6 = 24$

4, 8, 12, 16, 20 and 24 are multiples of 4.

Factors are numbers that divide exactly into another number. The factors of 12 are
1, 2, 3, 4, 6, 12.

Prime Numbers have exactly two factors; 1 and itself. Remember 1 is **NOT** a prime number.

Prime numbers to 100

2	3	5	7	11
13	17	19	23	29
31	37	41	43	47
53	59	61	67	71
73	79	83	89	97

Four Rules of Number

Mental Methods Addition ⏯ Addition

54 + 27

Method 1	Method 2	Method 3
Add the tens, then the units, then add together.	Split the number to added be into tens and units.	Round up to the next 10, then subtract.
50 + 20 = 70 4 + 7 = 11 70 + 11 = 81	54 + 20 = 74 74 + 7 = 81	54 + 30 = 84 30 is 3 too many 84 – 3 = 81

Subtraction ⏯ Subtraction

93 - 56

Method 1	Method 2
Count on	Break up the number being subtracted
Count on from 56 until you reach 93 4 + 30 + 3 = 37	e.g. subtract 50 then subtract 6 93 – 50 = 43 43 – 6 = 37
Addition	**Subtraction**
+ 2678 Line up the digits in the correct "place value." Begin by adding the units. Show working out. With addition the larger number does not NEED to go on the top.	– 749 Line up the digits in the correct place value. Begin by subtracting the units. is smaller than 9, so take one "ten" from the eight "tens" to make the 6 units 16 units. Now continue subtracting. You will have to take 1 "thousand" from the "thousands" column when you subtract the "hundreds."

Written Methods for Addition and Subtraction ⏯ Adding and Subtracting Decimals **Mental Methods**

Th	H	T	U
	5	3	4
+ 2	6	7	8
1 3	1 2	1 1	2

	Th	H	T	U
	6 ~~7~~	1 6	7 ~~8~~	1 6
-		7	4	9
	6	9	3	7

Multiplication

Students should know their times tables from 1 x 1 up to 12 x 12. If students are not secure on these, they need to continue to practise until they are. Numeracy Ninjas in form time gives them the opportunity to practise these.

x	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	60	72	84	96	108	120	132	144

Division

Dividing by 10 or 100 move digits 1 or 2 places respectively to the right.

Dividing by single digits – work backwards from tables.

e.g. to find 48 ÷ 6

think 6 x ? = 48 answer:

8 **Written Methods for**

Multiplication ⏯ **Long**

Multiplication ⏯

Multiplying Decimals

Method 1	Method 2
The column method	Napier Bones or Chinese Method (Preferred)

Method 1 – The column method

56 x 34

Line up the digits in their correct place values.

Multiply the top number by the units in the bottom number, then by the tens in the bottom number* and so on.

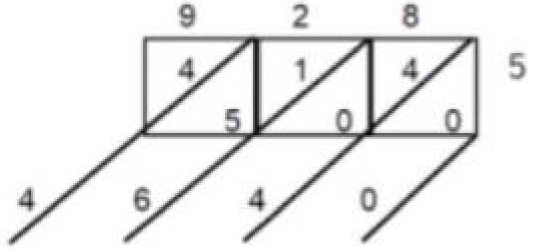
Add the products to get the final answer.

		T	U
		5	6
	x	**3**	4
	2	2 $_2$	4
+ 1	6 $_1$	8	**0**
1	**9**	**0**	**4**
	1		

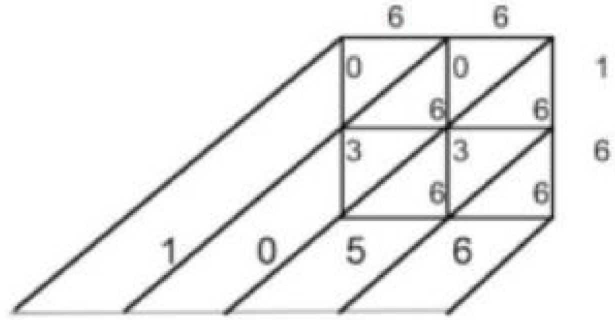
*Note the highlighted "0" – this is because the highlighted "3" represents

Method 2 – Napier Bones or Chinese Method (Preferred)

928 x 5 = 4640



66 x 16 = 1056



Written Methods for Division ⏯Division ⏯ Dividing by Decimals

Method 1	Method 2
Short division	**Chunking**

Method 1 – Short division

This method is also known as the "bus stop."

Write the number you are dividing by outside the "bus stop", and the other number under it.

There are 2 fours in 9 with remainder 1 so the 2 goes above the 9 on top of the bus stop and the remainder 1 is placed in front of the 8.

There are 4 fours in 18 with remainder 2.

There are 5 fours in 20 with no remainder.

	2	4	5
4	9	^{1}8	^{2}0

The answer is 245.

Method 2 – Chunking

Since we are dividing by 4, we need to work out how many 4s are needed to make 980.

We can do this by calculating multiples of 4 subtracting them from 980 until we get down to zero.

			980
100 x 4 =	400	980 - 400	580
100 x 4 =	400	580 - 400	180
10 x 4 =	40	180 - 40	140
10 x 4 =	40	140 - 40	100
10 x 4 =	40	100 - 40	60
10 x 4 =	40	60 - 40	20
5 x 4 =	20	20 - 20	0
245 x 4 =	980		

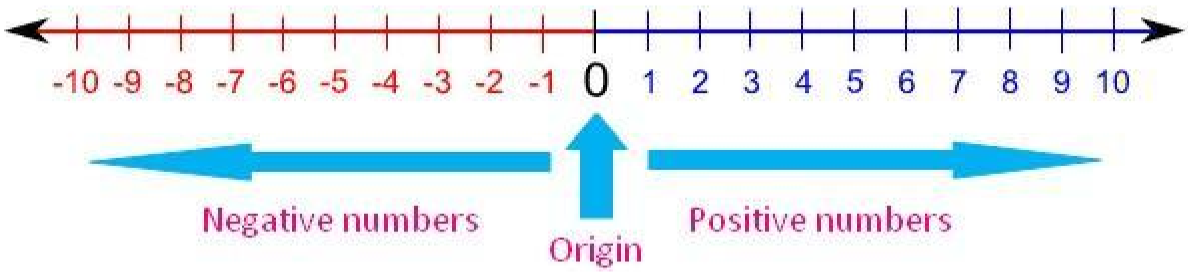
The answer is 245.

Inverse Operations

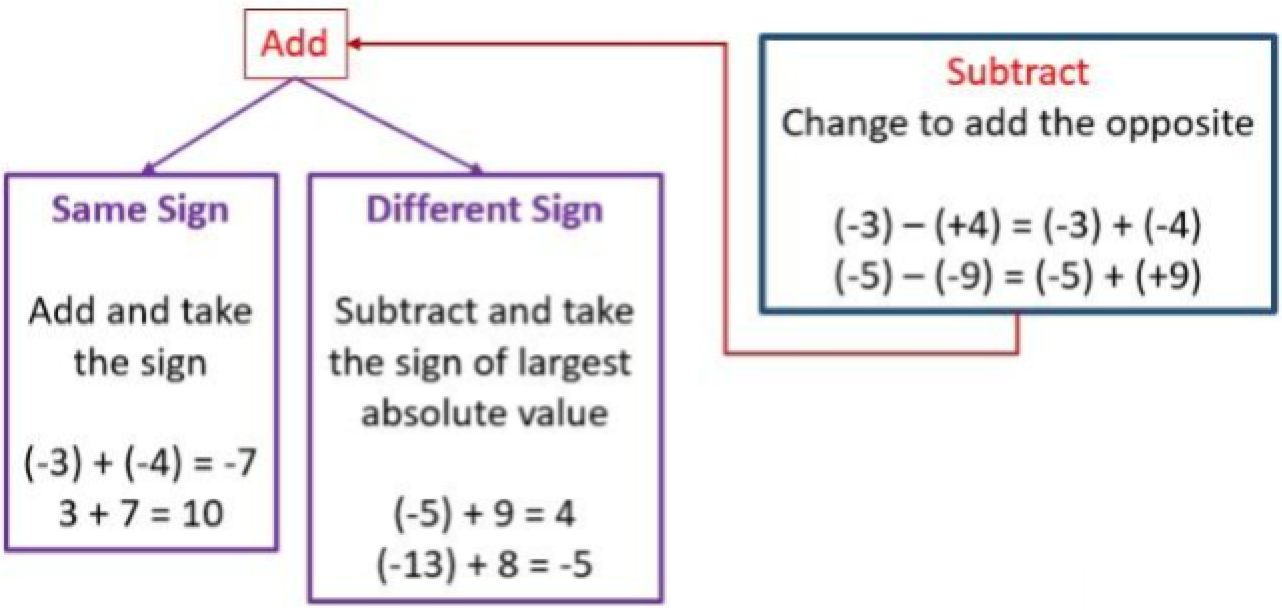
Inverse operations allow you to undo a calculation and check your answers.

Directed Numbers

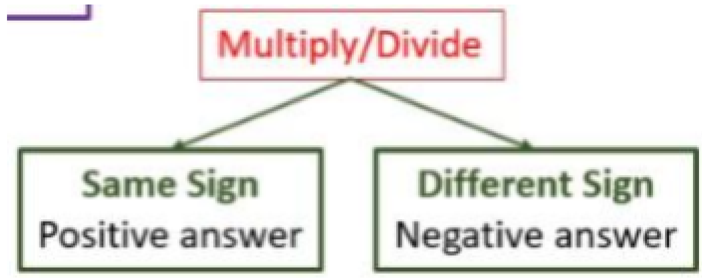
The negative sign (-) tells us the number is below zero e.g. **-4**. The number line is useful when working with negative numbers:



Adding and Subtracting Directed Numbers



Multiplying and Dividing Directed Numbers



Examples:

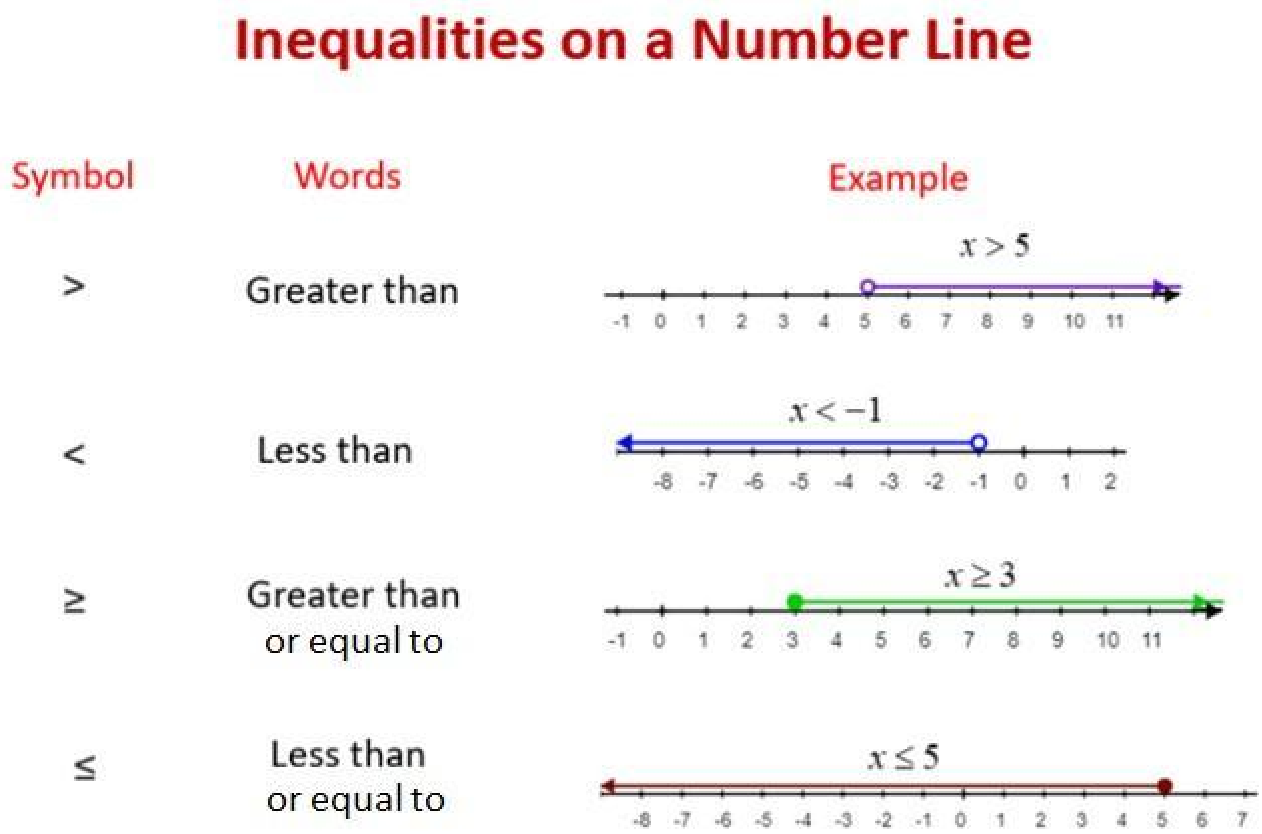
4 x 3 = 12

-4 x -3 = 12 -4

x 3 = -12

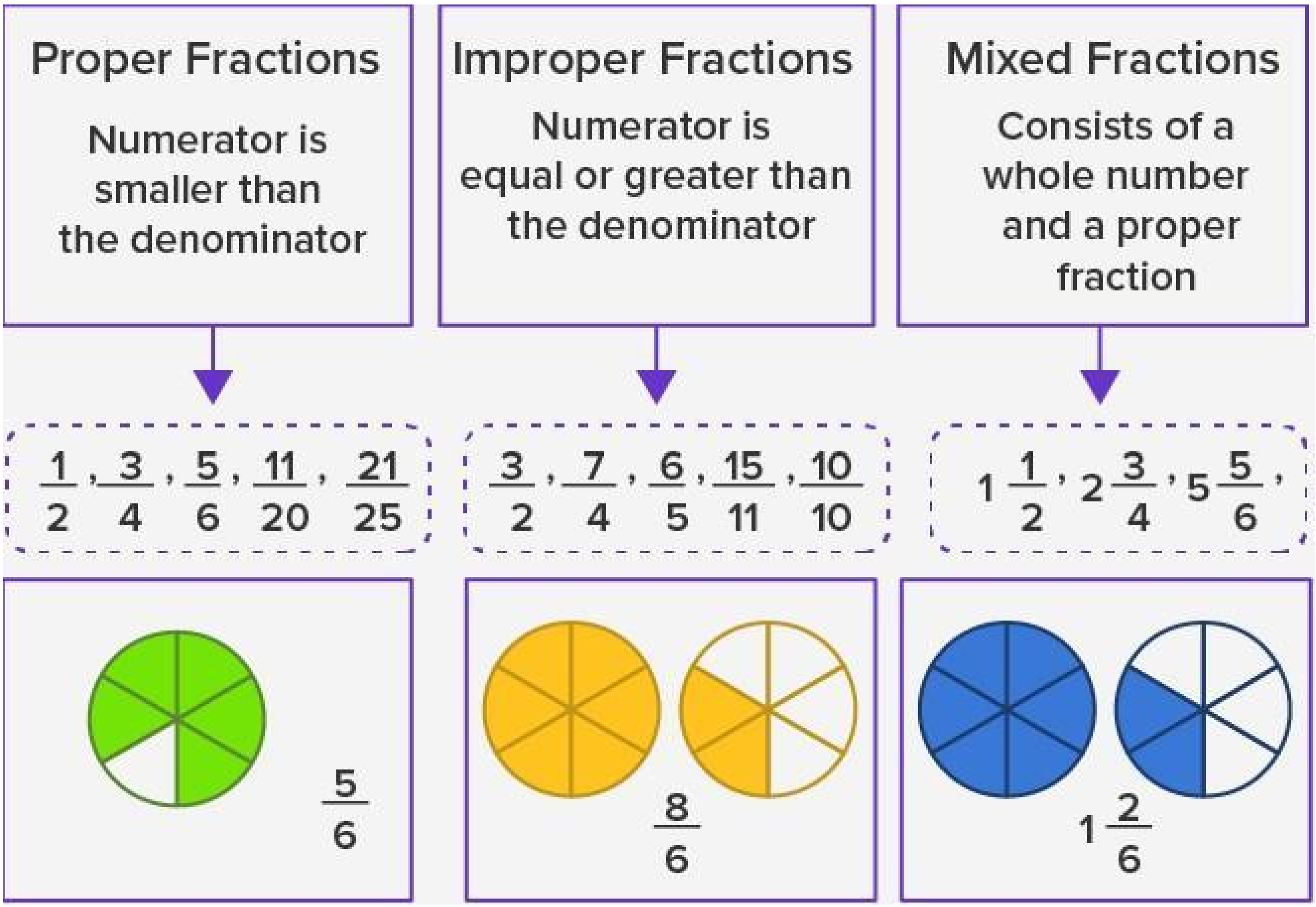
4 x -3 = -12

Inequalities

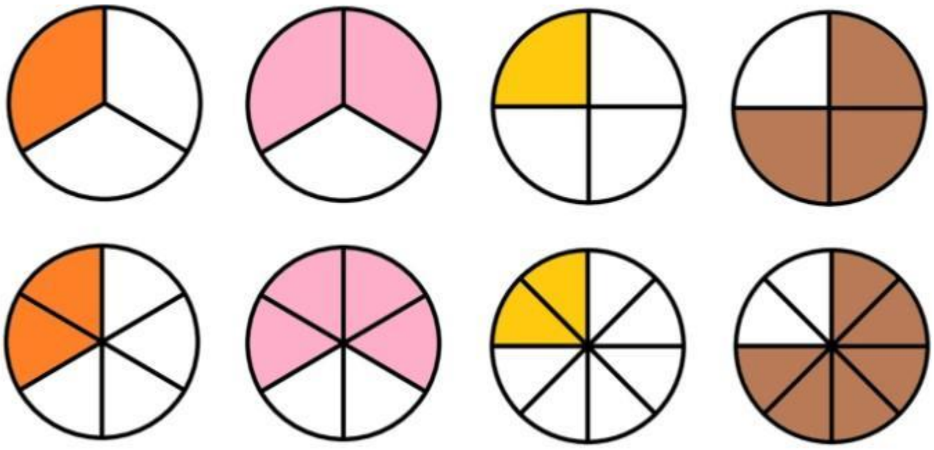


Fractions

Types of Fractions

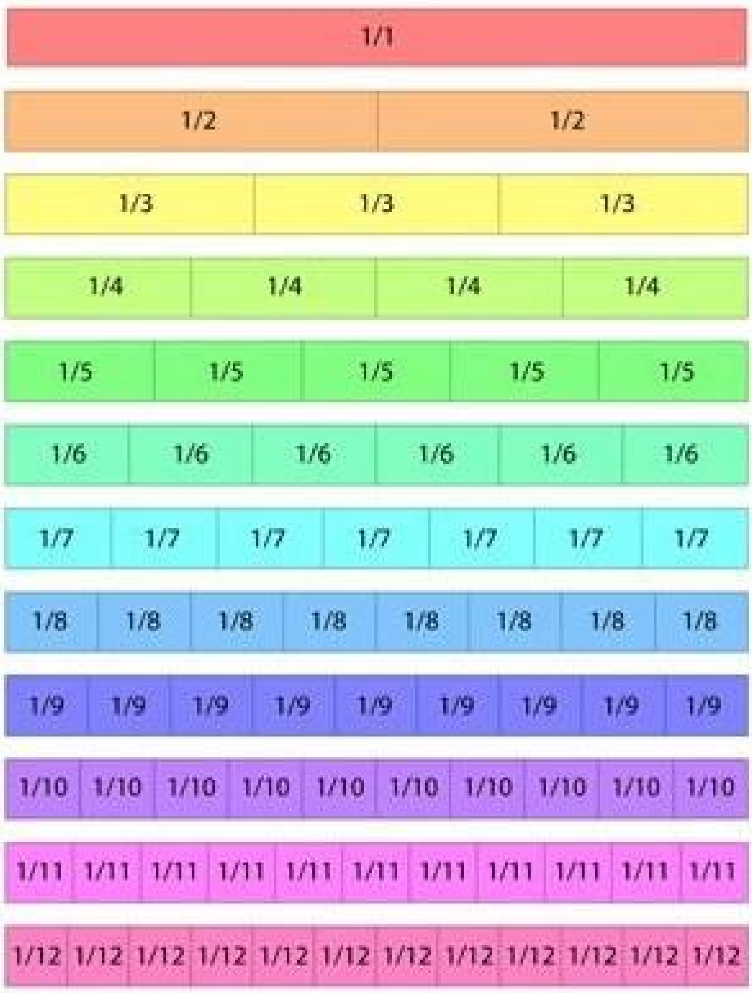


Fraction of an Amount



$$\frac{1}{3} = \frac{2}{6} \qquad \frac{2}{3} = \frac{4}{6} \qquad \frac{1}{4} = \frac{2}{8} \qquad \frac{3}{4} = \frac{6}{8}$$

Equivalent Fractions



Addition and Subtraction of Fractions

⏯[Adding and Subtracting Fractions with the Same Denominator]

⏯[Adding and Subtracting Fractions with Different Denominators]

Adding Fractions

Adding Fractions with Like Denominators

$$\frac{1}{7}+\frac{3}{7}$$

Add the numerators.
Denominator is unchanged.

$$\frac{1+3}{7}$$

$$\frac{4}{7}$$

Adding Fractions with Unlike Denominators

$$\frac{1}{8}+\frac{2}{3}$$

Rewrite with common denominator

$$\frac{3\times 1}{3\times 8}+\frac{2\times 8}{3\times 8}$$

Add the numerators

$$\frac{3}{24}+\frac{16}{24}$$

$$\frac{19}{24}$$

Subtracting Fractions

Same Denominators

Subtract the Numerators

$$\frac{5}{6}-\frac{2}{6}=\frac{3}{6}$$

Simplify if possible

$$\frac{3\div 3}{6\div 3}=\frac{1}{2}$$

Different Denominators

Use equivalent fractions

$$\frac{5}{6}-\frac{7}{12}=\frac{5\times 2}{6\times 2}-\frac{7}{12}=\frac{10}{12}-\frac{7}{12}$$

Subtract the Numerators

$$\frac{10}{12}-\frac{7}{12}=\frac{3}{12}$$

Simplify if possible

$$\frac{3\div 3}{12\div 3}=\frac{1}{4}$$

Multiplying Fractions ⏯Multiplying and Dividing Fractions

Example 1

$$\frac{1}{5} \times \frac{2}{3} = \frac{1 \times 2}{5 \times 3} = \frac{2}{15}$$

Example 2

$$\frac{1}{5} \times \frac{1}{2} = \frac{1}{10}$$

Dividing Fractions Example:

$$\frac{3}{4} \div \frac{5}{6} = \frac{3}{4} \times \frac{6}{5} = \frac{3 \times 6}{4 \times 5} = \frac{18}{20}$$

Percentages

The Basics

"%" means out of 100

63% means 63/100

100% means 100/100 or the whole amount.

Percentages can be more than 100, e.g. 120%

Percentages do not have to be whole numbers e.g. 12.5%

Finding a Percentage of an Amount

⏯Percentage of An Amount Including Increase and Decrease **Mental methods**

50% - halve (÷2)

25% - halve and halve again (or divide by 4)

10% - divide by 10

5% - halve 10%

1% - divide by 10 and 10 again, (or ÷100)

Other values – add/subtract multiples of these

Written Methods

Method 1	**Method 2**	**Method 3**
Use equivalent fractions	Use decimal multiplier (Use of calculator needed here)	Use 10% (if percentage is a multiple of 10)

Find the equivalent fraction. Simplify it (if possible). Find that fraction of the amount.	Change the fraction to a decimal and then multiply.	10% = 10/100 = 1/10 (÷10) Find 10% of the amount and then use this to find the required percentage.
Find 50% of 2000 kg 50% = 50/100 = 1/2 1/2 of 2000 kg = 2000 ÷ 2 = **1000 kg**	Find 65% of 450g 65% = 65 ÷100 = 0.65 0.65 x 450 = **292.5g**	Find 70% of £35 10% of £35 = £35 ÷10 = £3.50 70% = 7 x 10% 7 x £3.50 = **£24.50**

Increasing/Decreasing a Value by a Given Amount Written method

Find the amount of increase or decrease and add/subtract from original.

Example 1: Increase £275 by 24% we need 124% of original

Method 1

24% of £275 = £66

Increased value is 275 + 66 = £341

Method 2 (Multiply by decimal multiplier)

124% = 124/100 = 1.24

£275 x 1.24 = £341

Example 2: Decrease £275 by 24% we need 76% of original

100% - 24% = 76%

76 / 100 = 0.76

£275 x 0.76 = £209

Percentage Change **Percentage Change**

Percentage Change is all about comparing old to new values.

To find a percentage change:
1. Calculate the change
2. Find this change as a percentage of the original amount.

Percentage Change = Change x 100
Original **Example:**

A car is bought for £3200 and sold for £2400. What is the percentage loss?
Loss = £3200 - £2400 = £800
Percentage Change = 800 x 100 = 25% 3200

One value as a percentage of another ⏯ **Finding a Percentage** To find A as a percentage of B work out:

Expressing as a % = Given Amount x 100 Total

Example:

Emily got 60 out of 80 marks in a test Express her mark as a percentage.

Expressing as a % = $\frac{\text{Given Amount}}{\text{Total}} \times 100$

Expressing as a % = $\frac{60}{80} \times 100 = 75\%$

Decimals

A decimal is a number that contains a decimal point, the following are examples of decimals:

0.12, 0.459, 2.3, 3.68

Changing Decimals and Fractions into Percentages

To change a decimal to a percentage you have to multiply with 100%.

Example 1: 0·75 x 100% = 75%

Example 2: 0·13 x 100% = 13%

To change a fraction into a decimal you need to divide the numerator by the denominator:

$\frac{3}{8} = 3 \div 8 = 0.375$

Equivalent Fraction, Decimal and Percentages

Fraction	Percentage	Decimal
1/2	50%	0.5
1/3	33.3%	0. 3
2/3	66.7%	$0.\dot{6}$
1/4	25%	0.25
3/4	75%	0.75
1/5	20%	0.2

2/5	40%	0.4
1/10	10%	0.1
1/100	1%	0.01

⏯Rounding

Numbers can be rounded to give an **approximation**. Numbers must never be shortened without considering rounding.

To round:

1. Identify the place value to which we want to round

(E.g. rounding to nearest 10, 2 decimal places, 3 significant figures)

2. Look at the digit to the right:

- If less than 5 round down
- If 5 or more round up

3. Ensure number correct size, add zeros as necessary

Examples:

1. Round 4562 to nearest 10

    4562 number to right is less than 5 so round down = 4560

2. Round 0.0567 to 2 decimal places

    0.0567 number to right is 5 or more so round up = 0.06

    (NOTE: additional zeros not needed in this case)

3. Round 57852 to 3 significant figures

    57852 number to right is 5 or more so round up = 57900

⏯Ratio

A ratio is a comparison between the quantities of two things.

Example:

There are 3 triangles and 2 squares.

We can write the ratio as

3 : 2 or 3 to 2 or $\frac{3}{2}$

Ratio is used in a number of situations:

- In a cooking recipe
- In building when mixing concrete
- It is used in the scale of maps e.g. if a scale of **1 : 100 000** is used, it means that **1 cm** on the map represents **100 000 cm** in reality which is **1 km**.

Finding Ratio's of Amounts

Share £50 in the ratio $\boxed{2:3}$

1) Find the **total number of parts**

$2 + 3 = \boxed{5}$

2) Divide the **amount** by the **total number of parts**

£50 ÷ 5 = $\boxed{\textbf{£10}}$ = 1 part

3) Multiply each number in the **ratio** by the value of **1 part**

2:3

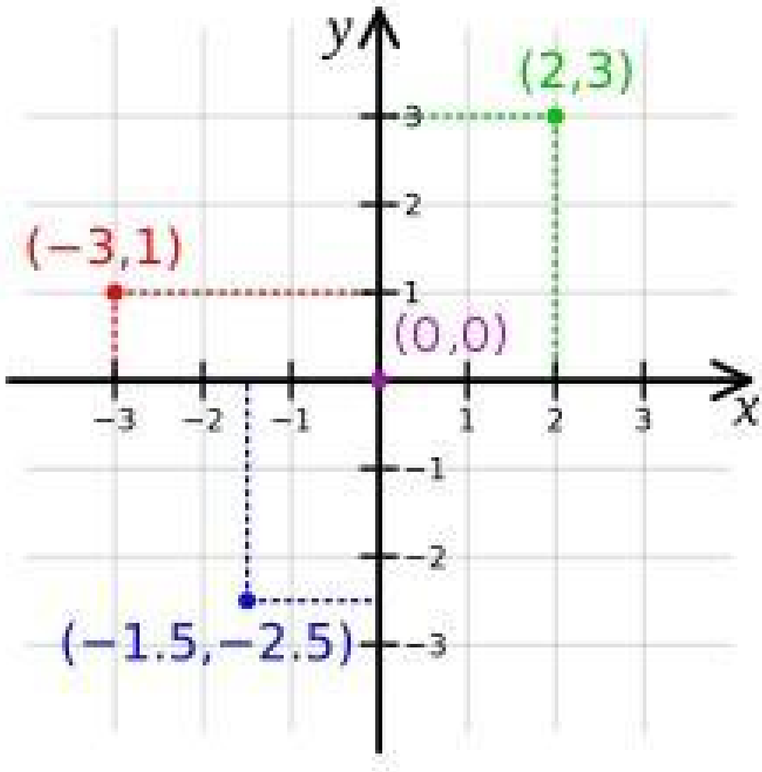
x £10 x £10

£20:£30

Coordinates

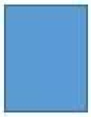
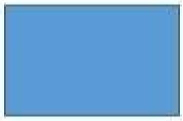
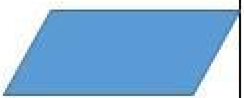
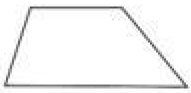
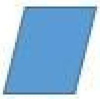
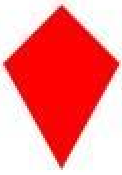
Coordinates are used to describe location. Coordinates are given as two numbers in a bracket separated by a comma.

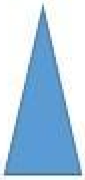
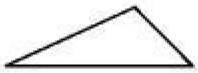
The first numbers is the x- coordinate and the second number is the y-coordinate



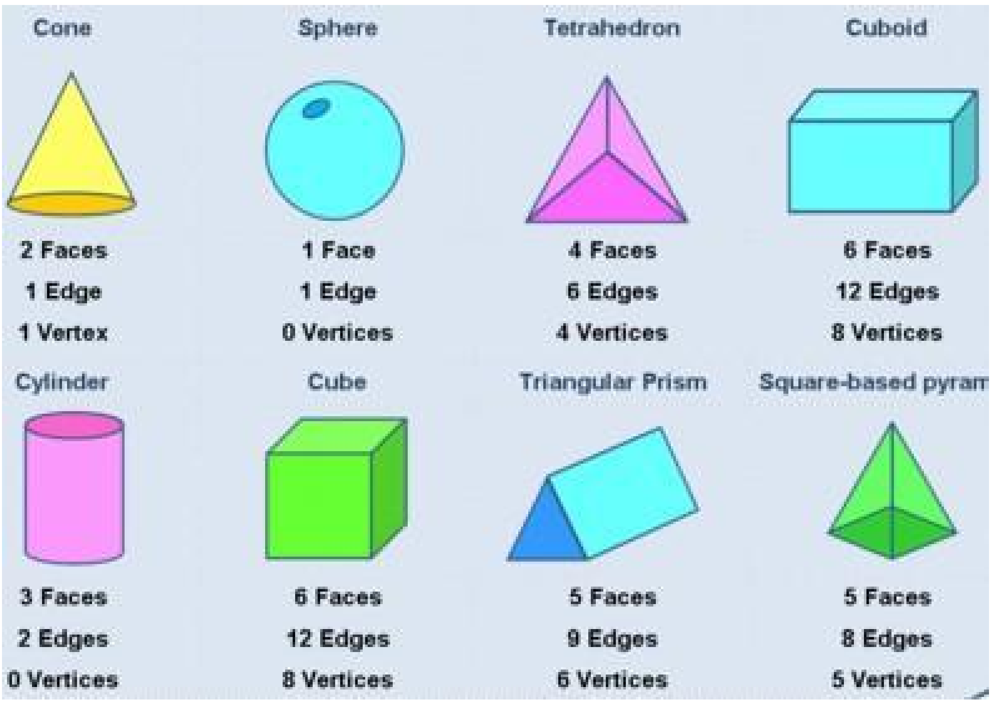
Remember: Along the corridor and either up or down the stairs!

2D Shapes

Name	Picture	Sides	Angles	Parallel sides	Lines of symmetry
Equilateral Triangle		3 sides the same length	3 angles the same size	No pairs of parallel sides	3 lines of symmetry
Square		4 sides the same length	4 right angles	2 pairs of parallel sides	4 lines of symmetry
Rectangle		Opposite sides equal	4 right angles	2 pairs of parallel sides	2 lines of symmetry
Parallelogram		Opposite sides equal	Opposite angles equal	2 pairs of parallel sides	0 lines of symmetry
Trapezium		4 sides		1 pair of parallel sides	
Rhombus		4 sides the same length	Opposite angles equal	2 pairs of parallel sides	2 lines of symmetry
Kite		2 pairs of adjacent sides equal	1 pair of opposite angles are equal	No pairs of parallel sides	1 line of symmetry

Regular Hexagon		6 sides the same length	6 angles the same size	3 pairs of parallel sides	6 lines of symmetry
Regular Pentagon		5 sides the same length	5 angles the same size	No parallel sides	5 lines of symmetry
Regular Octagon		8 sides the same length	8 angles the same size	4 pairs of parallel sides	8 lines of symmetry
Isosceles Triangle		2 sides the same length	2 angles the same size	No parallel lines	1 line of symmetry
Scalene Triangle		No equal sides	No equal angles	No parallel sides	No lines of symmetry

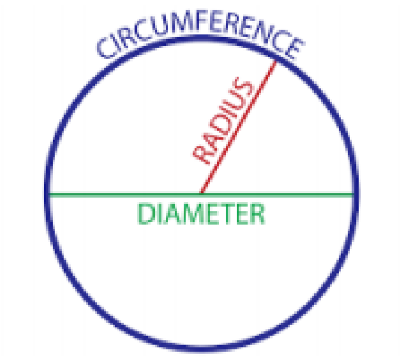
3D Shapes



The Circle

⏯Find the Circumference of a Circle Circumference = π x diameter ⏯Finding the Area of a Circle

Area = π x r^2

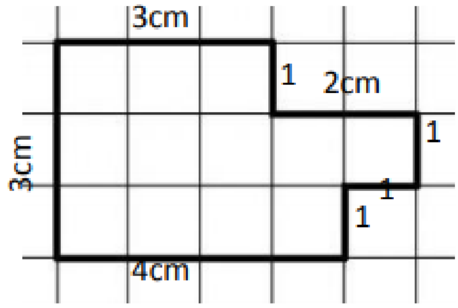


π (Pi) is approximately equal to 3.141592 or can be calculated by using the π button on the calculator.

Perimeter

The Perimeter is the distance around the outside edge of a shape (measured in cm, mm, m etc.)

Find the Perimeter of a Simple Shape Finding the Perimeter of a Compound Shape **Example:**

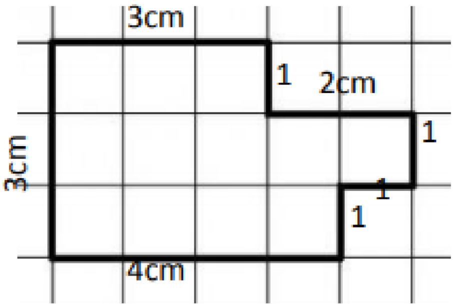


Perimeter = 3 + 1 + 2 + 1 + 1 + 1 + 4 + 3 = 16 cm

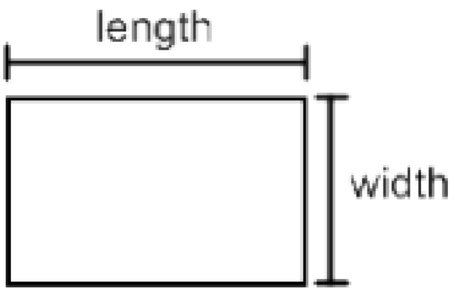
Area

The Area is the amount of space a 2D shape covers (measured in cm^2, mm^2, m^2 etc.)

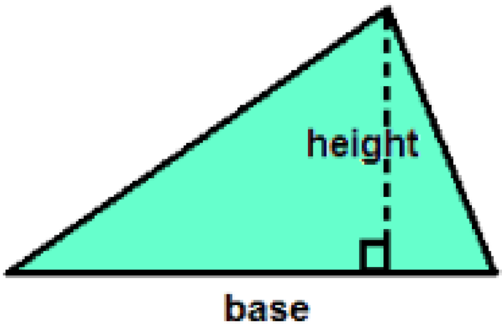
Example: Area can be found by counting squares = 12 cm^2



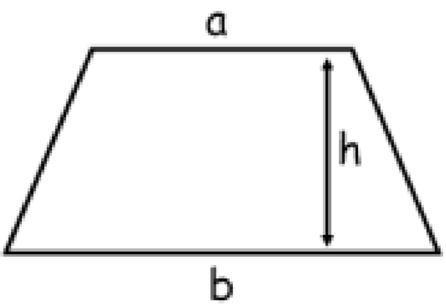
Area of rectangle = length x width [Area of a Rectangle]



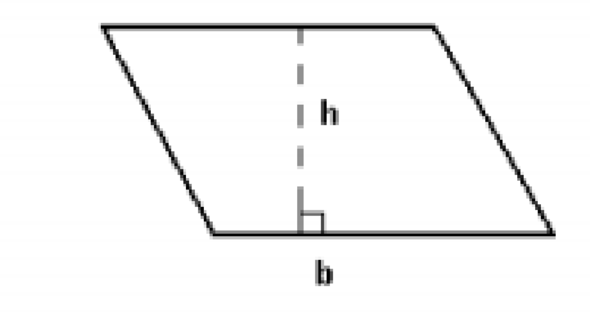
Area of triangle = ½ x base x perpendicular height [Area of a Triangle]



Area of trapezium = ½ x (a + b) x h ⏯Area of a Trapezium



Area of parallelogram = base x perpendicular height ⏯Area of a Parallelogram

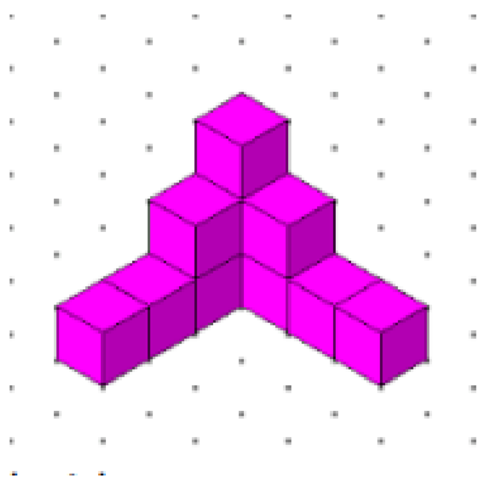


⏯Finding the Area of a Compound Shape

Volume

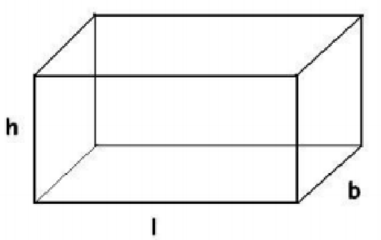
Volume is the amount of space a 3D shape occupies (measured in m^3, cm^3, mm^3) **Example**:

Volume can be found by counting cubes = $11cm^3$



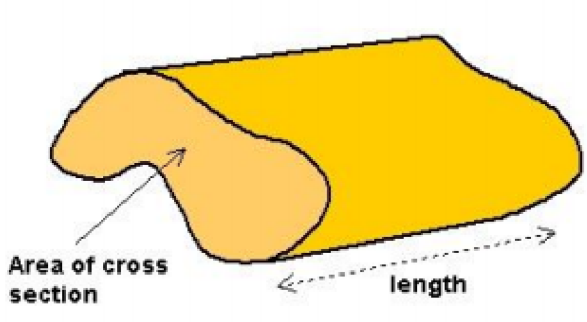
Formulae: Finding the Volume of a Cuboid

Volume = length x width x height



Prisms: Finding the Volume of a Prism

Volume = area of cross section x length



Metric Units of Measurement

⏯[How to Convert Between Different Metric Units]

METRIC CONVERSIONS					
1 centimetre	=	10 millimetres	1 cm	=	10 mm
1 decimetre	=	10 centimetres	1 dm	=	10 cm
1 metre	=	100 centimetres	1 m	=	100 cm
1 kilometre	=	1000 metres	1 km	=	1000 m

METRIC CONVERSIONS					
1 gram	=	1000 milligrams	1g	=	1000 mg
1 kilogram	=	1000 grams	1 kg	=	1000 g
1 tonne (1 megagram)	=	1000 kilograms	1 tonne (1 Mg)	=	1000 kg

METRIC CONVERSIONS					
1 centilitre	=	10 millilitres	1 cl	=	10 ml
1 litre	=	1000 millilitres	1 l	=	1000 ml
1 kilolitre	=	1000 litres	1 kl	=	1000 l

Conversion Between Metric and Imperial Units

Conversion Factors

'≈' means 'approximately equal to'

Length

1 inch ≈ 2.5 centimetres

1 foot ≈ 30 centimetres

1 mile ≈ 1.6 kilometres

5 miles ≈ 8 kilometres

Capacity

1 pint ≈ 570 millilitres

1 gallon ≈ 4.5 litres

1¾ pints ≈ 1 litre

Weight

1 pound ≈ 450 grams

2.2 pounds ≈ 1 kilogram

Time

Developing an understanding of time is one of the most important numeracy skills you can support your child to develop at home.

- Encourage students to tell you the time on both analogue and digital clocks. Get them to work out how long it is until certain events (dinner time, leaving for school etc.)
- ·Support your students to use timetables, both online and paper versions, in order to plan journeys.
- Encourage your students to use TV guides and to calculate the length of time different programmes will run for.
- Encourage your students to use an alarm clock and a watch so that they are able to start managing their own time on a day-to-day basis.

<u>24 hour clock conversion to 12 hour clock examples:</u>

24-hour	12-hour
13:25	1:25pm
10:50	10:50am
16:41	4:41pm
05:37	5:37am
12:10	12:10pm
09:29	9:29am
17:02	5:02pm

24-hour	12-hour
18:53	6:53pm
22:05	10:05pm
07:54	7:54am
00:17	12:17am
02:50	2:50am
21:12	9:12pm
23:46	11:46pm

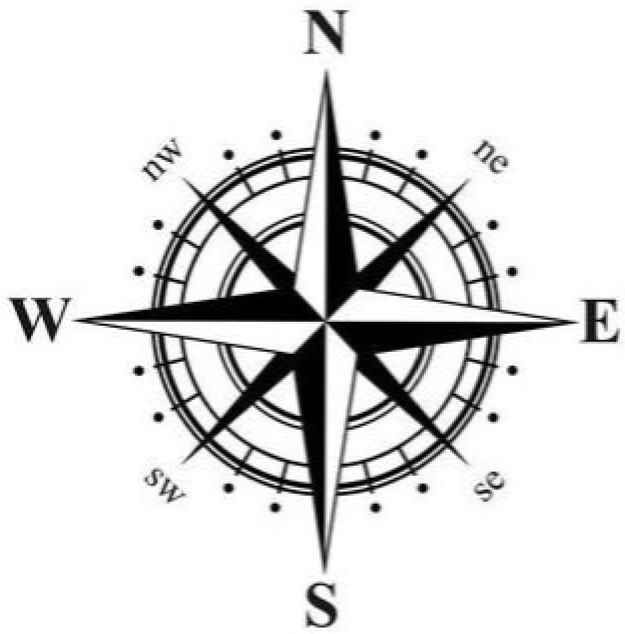
⏯ Completing Time Calculations

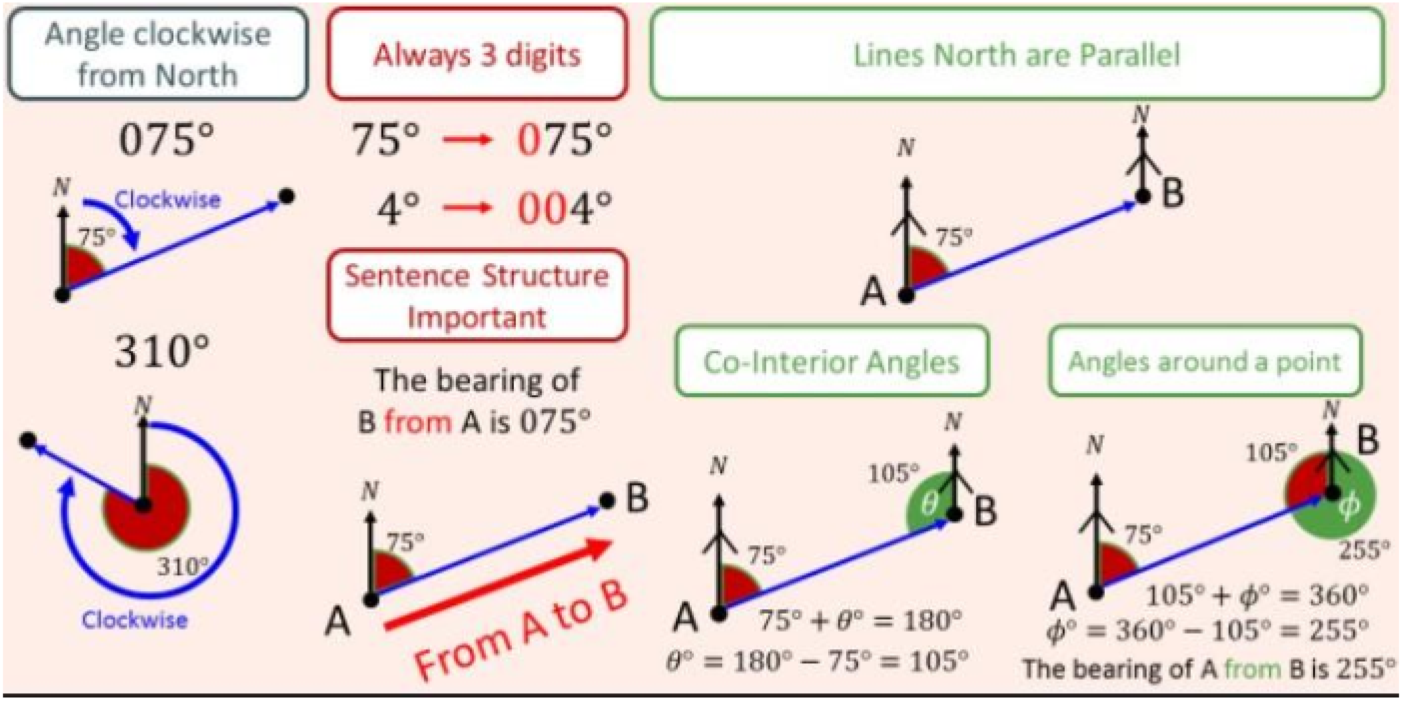
Units of Time

1 millennium	=	1000 years
1 century	=	100 years
1 decade	=	10 years
1 year	=	365 days
1 leap year	=	365 days
1 year	=	12 months
1 year	=	52 weeks
1 week	=	7 days
1 day	=	24 hours
1 hour	=	60 minutes
1 minute	=	60 seconds

Season	Month	Days
Winter	January	31
	February	28 (or 29)
Spring	March	31
	April	30
	May	31
Summer	June	30
	July	31
	August	31
Autumn	September	30
	October	31
	November	30
Winter	December	31

Bearings





Data

Statistical Diagrams

Wherever possible the interpretation of graphs should be of utmost importance. All diagrams should have the following:

- Title
- Both axes labelled
- Graph breaks used to show where a scale doesn't start at zero
- Scales equally spaced
- Make good use of available space
- Where appropriate have independent variable on the horizontal axis, and dependent on the vertical

Types of Data

We collect data in order to highlight information to be interpreted. There are two types of data:

Discrete data Things that are not measured:	**Continuous data** Things that are measured:
· Colours · Days of the week · Favourite drink · Number of boys in a family · Shoe size	· Pupil height · Volume of a bottle · Mass of a chocolate bar · Time to complete a test · Area of a television screen

Collecting and recording

We can record data in a list

e.g. here are the numbers of pets owned by pupils in form 9C: 1 , 2 , 1 , 1 , 2 , 3 , 2 , 1 , 2

, 1 , 1 , 2 , 4 , 2 , 1 , 5 , 2 , 3 , 1 , 1 , 4 , 1 , 3 , 2 , 5 , 1

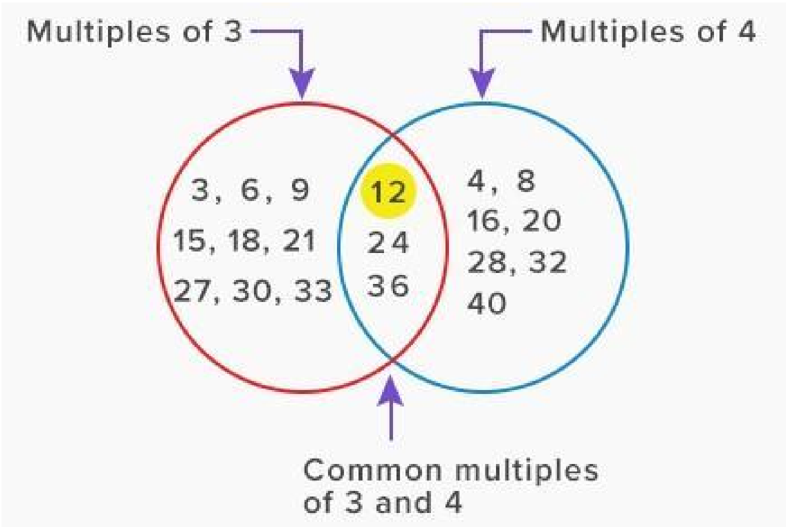
A frequency table is more structured and helps with processing the information:

⏯Frequency Tables

Number of Pets	Tally	Frequency
1	IIII IIII I	11
2	IIII III	8
3	III	3
4	II	2
5	II	2

Venn Diagrams: ⏯[Drawing Venn Diagrams]

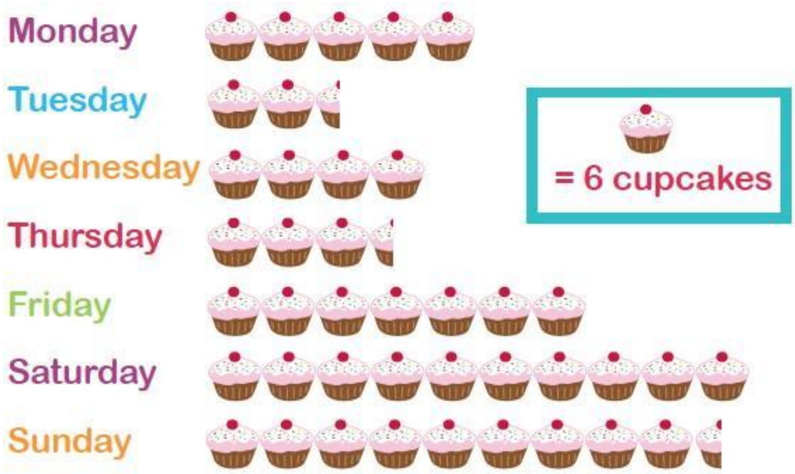
Venn diagrams enable students to organise information visually so they are able to see the relationships between two or three sets of items. They can then identify similarities and differences.
A **Venn diagram** consists of overlapping circles. Each circle contains all the elements of a set.



In order to communicate information, we use statistical diagrams. Here are some examples:

Pictograms: ⏯[Drawing Pictograms] ⏯[Interpreting Pictograms]

A pictogram uses symbols to represent frequency. We include a key to show the value of each symbol.



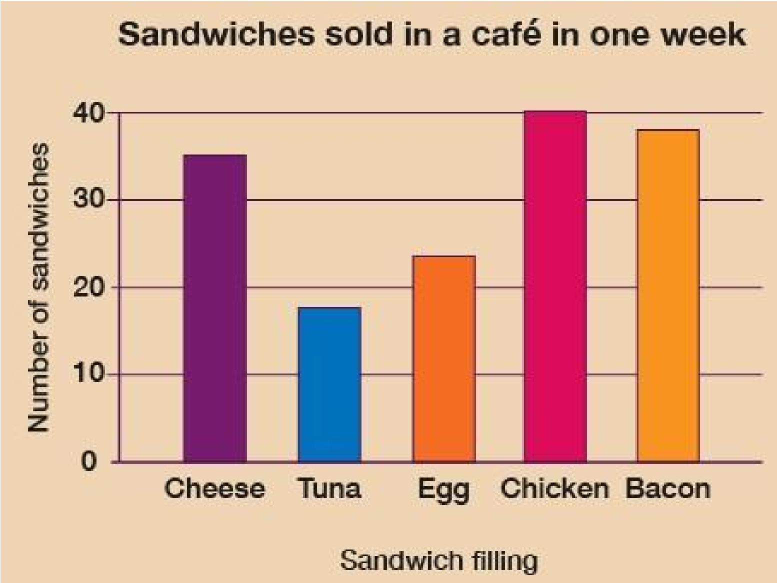
Bar Charts/Frequency Diagrams [Drawing Bar Graphs] [Interpreting Bar Charts]

The height of each bar represents the frequency. The vertical axis is often labelled "frequency".

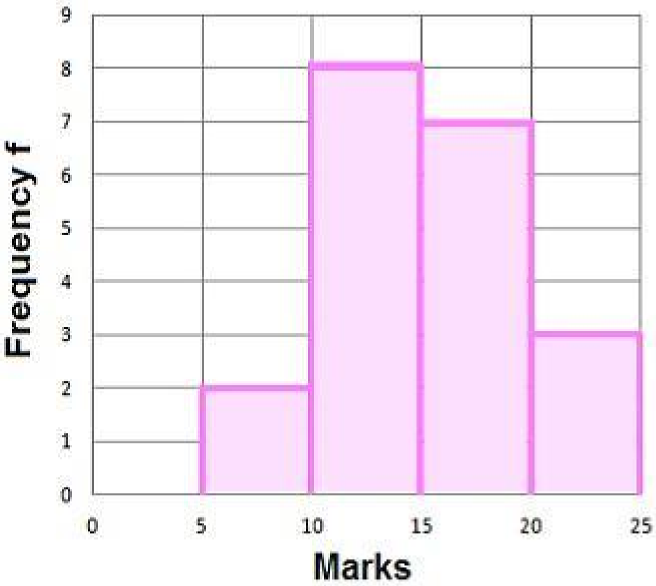
- All bars must be the same width and there must be equal sized gaps between the bars.
- Each bar should be clearly labelled.
- The scale on the vertical axis must be evenly spaced.
- If data is qualitative (words) or discrete (exact values) then leave spaces between bars. Label bars.

- If data continuous no spaces. Label lines at edges of bars.

Bar Chart Example:

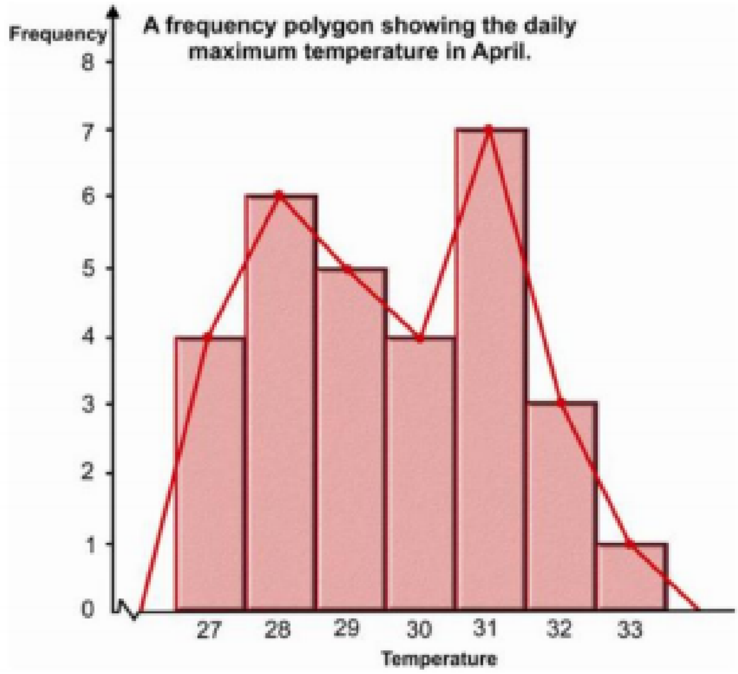


Frequency Diagram Example:



Frequency Polygons

A frequency diagram where the middle of each bar is joined.

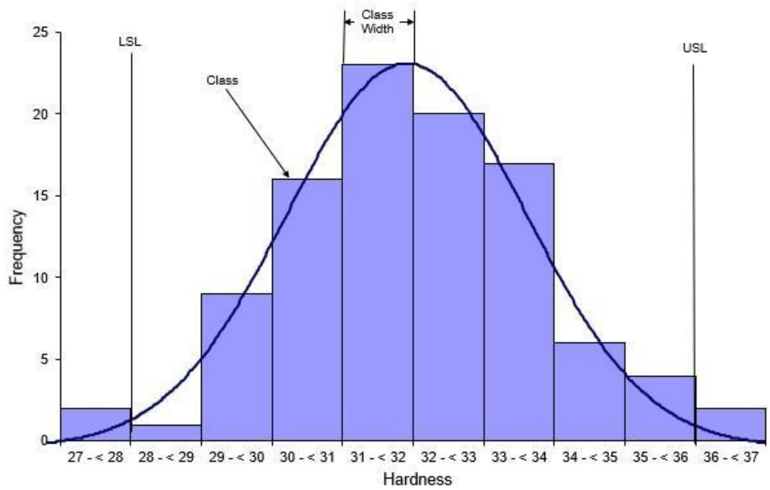


Histograms

In histograms the frequency is represented by the area of a bar, rather than its height. It is very easy to confuse histograms with bar charts. Unlike bar charts, histograms do not have gaps between their bars. This is because they are drawn for grouped continuous data – meaning that the data can take any value in a given range. Since it is the area of the bar that gives the frequency, in a histogram the widths of the bars do not have to be the same. The vertical axis should be labelled frequency density.

For curriculum areas outside of Mathematics, histograms normally have equal width bars. However, the vertical axis in these histograms is often incorrectly labelled as frequency, rather than frequency density.

$Frequency\ Density = \frac{Frequency}{Class\ Width}$ **Area of Bar = FREQUENCY**

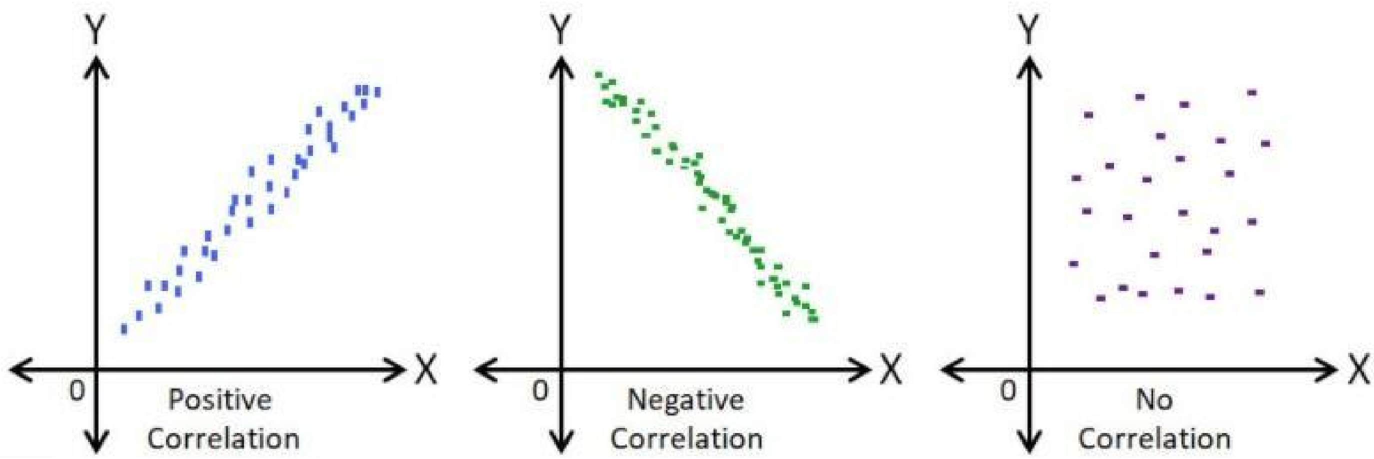


Line Graphs ⏯Drawing Line Graphs ⏯Interpreting Line Graphs

Line graphs are used across the curriculum to show how one variable changes as another one is increased. They are particularly useful in showing how things change over time. The two variables are represented along the horizontal and vertical axis. Data is plotted in points and the points are then joined with straight lines or a smooth curve as appropriate. Line graphs can also be used to show predictions for how things will change in the future. The only points that holds value are the points which have been plotted on the diagram.

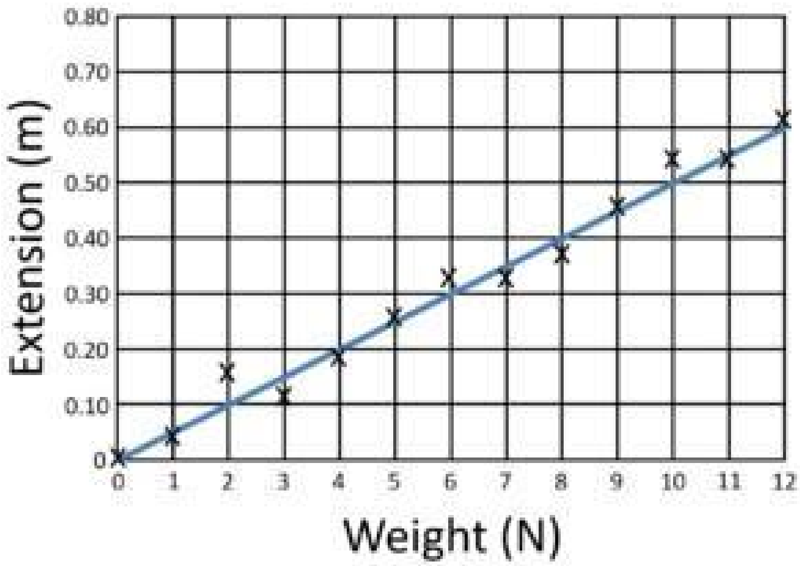
Scatter Graphs ⏯Drawing Scatter Graphs ⏯Interpreting Scatter Graphs

We plot points on the scatter diagram in the same way as for the line graph. One variable is plotted along the horizontal axis, the other along the vertical axis. We do not join the points but look for a correlation (relationship) between the two variables.



If there is a correlation, we can draw a line of best fit (must be a straight line, drawn with a pencil and ruler) on the diagram and use it to estimate the value of one variable given the other. There should be approximately the same number of points above and below the line.

Example:



The graph shows a POSITIVE CORRELATION between height and weight and you can determine values from the graph eg. for a weight of 6N the extension is 0.3m

Pie Charts ⏯[Drawing Pie Charts](#)⏯[Interpreting Pie Charts](#)

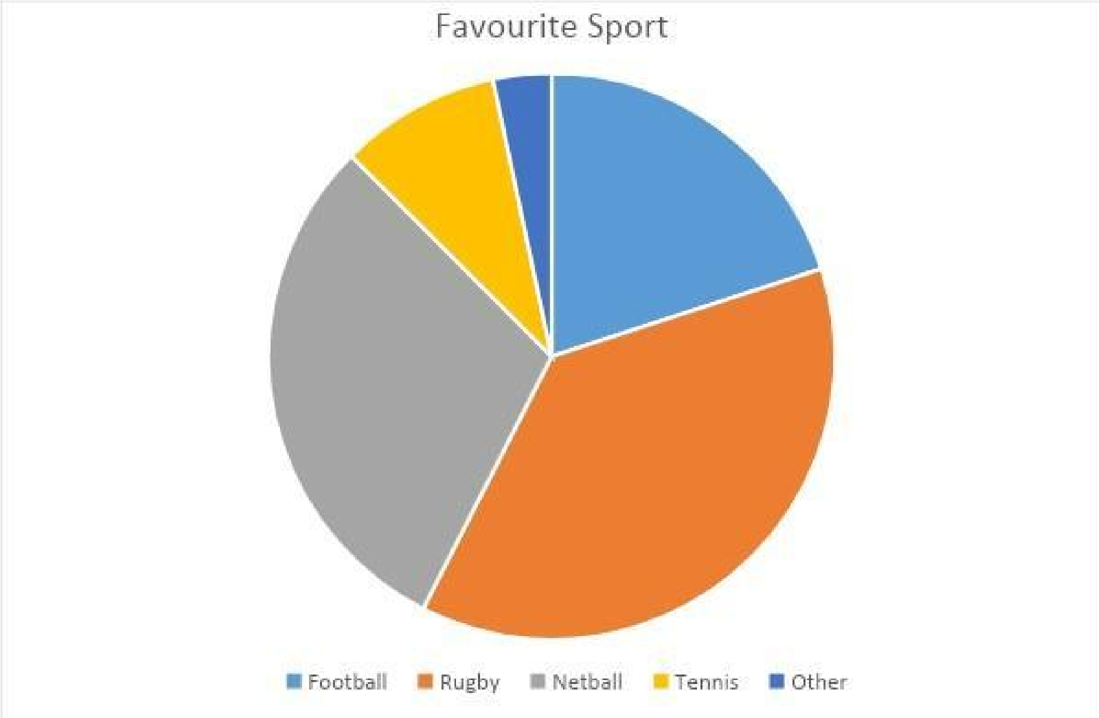
The complete circle represents the total frequency, a full turn is 360°, so the angle for each sector is calculated by:

They$Angle$are= (used360 ÷to$total$see) $x$the $individual$proportions $frequencies$making up the whole to

work out appropriate angles for each sector.

Favourite Sport	Frequency	Degrees
Football	24	24 x 3 = 72°
Rugby	45	45 x 3 = 135°
Netball	36	36 x 3 =108°
Tennis	11	11 x 3 = 33°
Other	4	4 x 3 = 12°
Total	120	360°

eg. 360 ÷ 120 = 3°

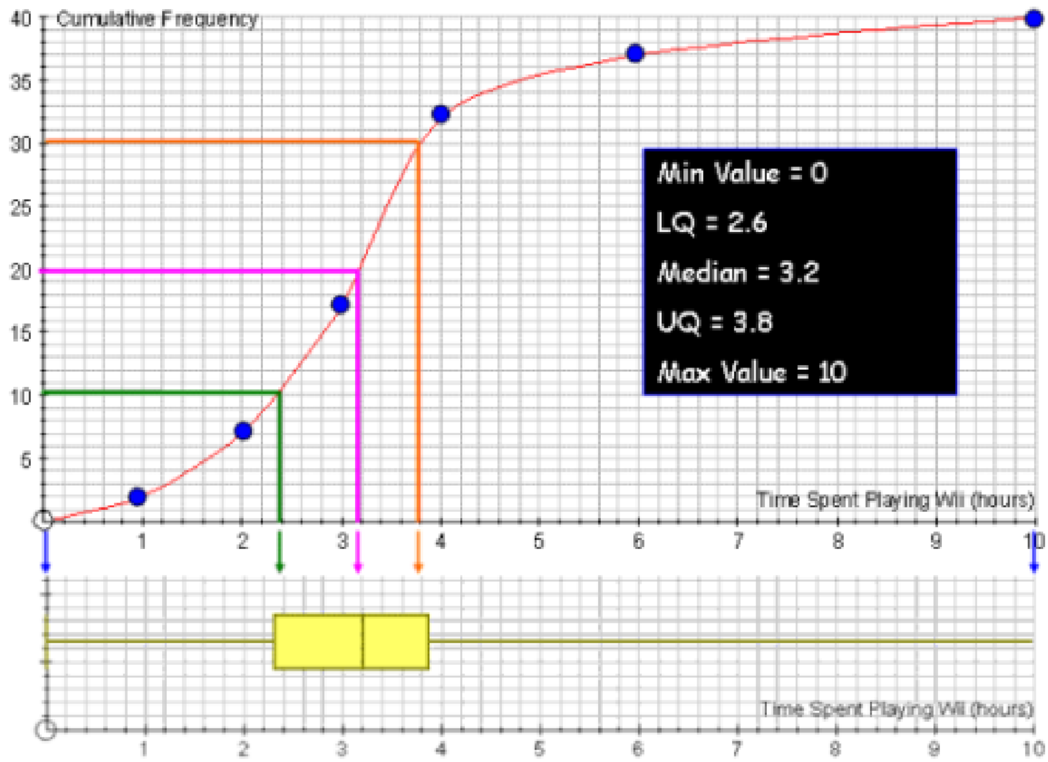


<u>Cumulative Frequency (running total) and Box Plots</u>

A cumulative frequency graph shows a running total of the frequencies. A cumulative frequency diagram reproduces this table as a graph. A cumulative frequency diagram is drawn by plotting the cumulative frequency against the upper-class boundary of the respective group. Using a cumulative frequency diagram is a good way to find an estimate of the median average, or middle, value, and interquartile range.

Box and whisker plots are a convenient way of visually displaying the data distribution through their quartiles. The lines extending parallel from the boxes are known as the “whiskers”, which are used to indicate variability outside the upper and lower quartiles. Outliers are sometimes plotted as individual dots that are in-line with whiskers. Box Plots can be drawn either vertically or horizontally.

Example: Graphs showing number of time spent on the Wifi



Averages

Definitions:

Mode - most common value in a set of data Mode

Median – middle value when data set in order Median

Mean – the sum of all values divided by the number of values in the data set. Mean

Range – describes the spread of the data (not the average of the data) Range Range = highest value – lowest value

Example:

For the data below find the mode, median, mean and range:

2, 6, 4, 7, 4… always put in ascending order 2, 4, 4, 6, 7,

Mode	4
Median	4
Mean	2 + 4 + 4 + 6 + 7 = 23 then 23 ÷ 5 = 4.6
Range	7 – 2 = 5

Estimated Mean Finding the Mean from a Table Finding the Estimated Mean

The estimated mean is used to fins an estimate for the mean from grouped data.

Steps to find the estimated mean:

1. Find the mid point

2. Multiply the mid-point by the frequency
3. Add up the frequency
4. Add up the mid-point x frequency
5. Estimated Mean = $\frac{\text{mid-point x frequency}}{\text{frequency total}}$

Class Interval	Mid-point	Frequency	Mid-point × Frequency
$140 \le h < 150$	145	6	$145 \times 6 = 870$
$150 \le h < 160$	155	16	$155 \times 16 = 2480$
$160 \le h < 170$	165	21	$165 \times 21 = 3465$
$170 \le h < 180$	175	8	$175 \times 8 = 1400$
	Totals	**51**	**8215**

Estimated mean = 8215 ÷ 51

= 161.08