Kirkhill Primary School

Curriculum for Excellence

A Guide for Parents and Carers to Support Learning at Home

NUMERACY
&
MATHEMATICS

This booklet outlines the skills pupils will develop in Numeracy and Mathematics within the Third Level.

This document makes clear the correct use of language and agreed methodology for delivering Curriculum for Excellence Numeracy and Mathematics experiences and outcomes within the Mearns Castle Cluster. The aim is to ensure continuity and progression for pupils which will impact on attainment.

We hope you will find this booklet useful in helping you to support your child at home.

Estimation and Rounding

I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem.

Example	**Methodology**
Round to 3 significant figures: 65364 $6\ 5\ 3\ 6\,|\,4$ *so the answer is 65400*	When rounding to a specified number of significant figures, draw a line after the number of significant figures that you need. If the digit to the right of the line is 5 or more round the digit to the left of the line up. If it is 4 or less the digit to the left stays the same.

Number and Number Processes

I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.

I can continue to recall number facts quickly and use them accurately when making calculations.

Example	**Methodology**
$$\begin{array}{r} 4\ 7 \\ \times\, 5_4\, 6 \\ \hline 2\ 8\ 2 \\ 2\ {}^3 3_1\, 5\ 0 \\ \hline 2\ 6\ 3\ 2 \\ \hline \end{array}$$ **Correct Use of Language** For multiplying by 10, promote the digits up a column and add a zero for place holder. For dividing by 10, demote the digits down a column and add a zero in the units' column for place holder if necessary.	Decimal point stays fixed and the numbers move when multiplying and dividing. **DO NOT** say add on a zero, when multiplying by 10. This can result in 3·6×10=3·60.

Number and Number Processes

I can use my understanding of numbers less than zero to solve simple problems in context.

Term/Definition

Negative numbers

Integer: all the positive whole numbers, negative whole numbers and zero
(…–3, –2, –1, 0, 1, 2, 3, …)

Correct Use of Language

Say <u>negative</u> four **NOT** minus four.
Use minus as an operation for subtract.
(For 4 – (-4) = 8 say four minus negative four equals eight)

Pupils should be aware of this as a common mistake, even in the media
e.g. the weather.

-20ºC - Negative twenty degrees Celsius, **NOT** minus or centigrade.

Multiples, Factors and Primes

I have investigated strategies for identifying common multiples and common factors, explaining my ideas to others, and can apply my understanding to solve related problems.

I can apply my understanding of factors to investigate and identify when a number is prime.

Term/Definition

Prime numbers: numbers with exactly 2 factors.
One is not defined as a prime number.
2, 3, 5, 7, 11, 13, 17, 19, …

Factor: a factor divides exactly into a number leaving no remainder.

Example

Factors of 4 are 1, 2 and 4.

Powers and Roots

Having explored the notation and vocabulary associated with whole number powers and the advantages of writing numbers in this form, I can evaluate powers of whole numbers mentally or using technology.

Term/Definition

Index: shows the number of times a number is multiplied by itself.

Example

2^3

Correct Use of Language

3 is the index.

Fractions, Decimal Fractions and Percentages

I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations.

By applying my knowledge of equivalent fractions and common multiples, I can add and subtract commonly used fractions.

Having used practical, pictorial and written methods to develop my understanding, I can convert between whole or mixed numbers and fractions.

Fractions	**Methodology**
Example	*Fractions*

Fractions

Example

Start with $4\frac{1}{10}$ is written $4{\cdot}1$
$7\frac{9}{10}$ is written $7{\cdot}9$ etc.

Then $3\frac{37}{100}$ is written $3{\cdot}37$ etc.

Finally $6\frac{3}{4}$ is the same as

$6\frac{75}{100}$ which is $6{\cdot}75$

Correct Use of Language

Pupils should be aware of: "state in lowest terms" or "reduce".

Talk about "decimal fractions" and "common fractions" to help pupils make the connection between the two.

Methodology

Fractions

To find $\frac{3}{4}$ of a number, find one quarter first and then multiply by 3.

Simplifying fractions – Say what is the highest number that you can divide the numerator and denominator by? Check by asking, "Can you simplify again?"
Finding equivalent fractions, particularly tenths and hundredths.

Teach fractions first then introduce the relationship with decimals (tenths, hundredths emphasise connection to tens, units etc) then other common fractions e.g. $\frac{1}{4} = \frac{25}{100} = 0{\cdot}25$.

Need to keep emphasising equivalent fractions.

Starting with fractions, then teach the relationship with percentages, finally link percentages to decimals.
$60\% = \frac{60}{100} = 0{\cdot}6$

Decimals	
Term/Definition **Recurring decimals:** a decimal which has a repeated digit or a repeating pattern of digits. **Example** Recurring decimals: $\frac{1}{9} = 0\cdot11\dot{1}$ **Correct Use of Language** Recurring decimals: $\frac{1}{3}$ and $\frac{1}{9}$ link to decimals. Record the number three times and place a "dot" above the final digit.	

Percentages	*Percentages*
Example $1\% = \frac{1}{100}$, $10\% = \frac{1}{10}$ $25\% = \frac{1}{4}$, $50\% = \frac{1}{2}$ $20\% = \frac{1}{5}$, $75\% = \frac{3}{4}$ $33\frac{1}{3}\% = \frac{1}{3}$ 30% of 80 = 24 Find 10% then multiply by 3. 15% of 60 = 9 Find 10% then half that to get 5%, then add. Find 23% of £300 $23 \div 100 \times 300 = £69$	Pupils need to be secure at finding common percentages of a quantity, by linking the percentage to fractions. e.g. 1%, 10%, 20%, 25%, 50%, 75% and 100%. Pupils should be able to find common percentages by converting to a fraction. Pupils can then build other percentages from these. The aim here is to build up mental agility. The pupils should, in time, be able to select the most appropriate strategy. **Percentages without a calculator** For more complicated percentages use the following method: **34% of 410 = 139·4 (working shown below)** 10% of 410 = 41 30% of 410 = 123 1% of 410 = 4·1 4% of 410 = 16·4 **Percentages with a calculator** Move towards: $0\cdot23 \times 300 = £69$ as pupils become secure in converting percentages to decimals.

Time

Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance.

Term/Definition

Speed

Example

8km/h
4m/s

Correct Use of Language

Say eight kilometres per hour.
Say sixteen metres per second.

Measurement

I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required.

Having investigated different routes to a solution, I can find the area of compound 2D shapes and the volume of compound 3D objects, applying my knowledge to solve practical problems.

Term/Definition	Methodology
1 hectare = 10000m^2 100m by 100m **Example** *A1 = lb* *= 12 × 4* *= 48cm^2* *A2 = lb* *= 5 × 4* *= 20cm^2* *Total Area = A1 + A2* *= 48 + 20* *= 68cm^2* *1cm^3=1ml* *1000cm^3 = 1000ml* *= 1litre*	To find the area of compound shapes: • Split the shape into rectangles • Label them as shown • Fill in any missing lengths
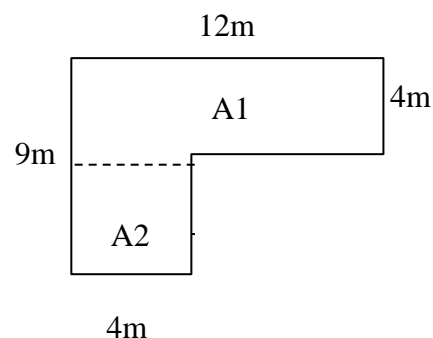
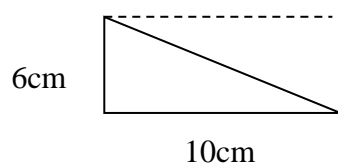|	
Correct Use of Language 3cm^2 Say 3 square centimetres not 3 centimetres squared or 3 cm two. Abbreviation of *l* for litre. Say 3 litres. *(3l)* Abbreviation of ml for millilitres. Say seven hundred millilitres. *(700ml)* *2.30m* *5·43m* *6·124kg*	

Pupils should understand how to write measurements (in m, cm, kg, g), how to say them and what they mean e.g. 5 metres 43cm. Six kilograms and 124 grams, say six point one two four kilograms. Emphasise that perimeter is the distance around the <u>outside</u> of the shape. $A = l \times b$ Start with this and move to A = *lb* when appropriate. 6cm 10cm **DO NOT USE** $A = \frac{1}{2} l \times b$ or $A = \frac{1}{2} lb$ as this leads to confusion later on with the base and height of a triangle. 80 cm^3	 Complete the surrounding rectangle if necessary. Area of rectangle = 10 × 6 $\qquad\qquad\qquad = 60\text{cm}^2$ Area of Triangle = $\frac{1}{2}$ the Area of rectangle $\qquad\qquad = \frac{1}{2}$ of 60 $\qquad\qquad = 30\text{cm}^2$ Say 80 cubic centimetres **NOT** 80 centimetres cubed. Use litres or millilitres for volume with liquids. Use cm^3 or m^3 for capacity.

Patterns and Relationships

Having explored number sequences, I can establish the set of numbers generated by a given rule and determine a rule for a given sequence, expressing it using appropriate notation.

Example	Methodology
Find the nth term for a sequence. Complete the table and find the 20th term	Pupils need to be able to deal with numbers set out in a table vertically, horizontally or given as a sequence. A method should be used rather than trial and error.

Expressions and Equations

I can collect like algebraic terms, simplify expressions and evaluate using substitution.

Term/Definition

Please refer to the Algebra Appendix

Example

3a+6+7a-5   Expression

2a+7=13   Equation

Correct Use of Language

Teachers should make it clear the difference between an algebraic expression that can be simplified and an equation (which involves an equals sign).

Expressions and Equations

Having discussed ways to express problems or statements using mathematical language, I can construct, and use appropriate methods to solve, a range of simple equations.

I can create and evaluate a simple formula representing information contained in a diagram, problem or statement.

Please refer to the Algebra Appendix

Angle symmetry and transformation

I can name angles and find their sizes using my knowledge of the properties of a range of 2D shapes and the angle properties associated with intersecting and parallel lines.

Having investigated navigation in the world, I can apply my understanding of bearings and scale to interpret maps and plans and create accurate plans, and scale drawings of routes and journeys.

I can apply my understanding of scale when enlarging or reducing pictures and shapes, using different methods, including technology.

Example

Bearing: 060º

Correct Use of Language

For Bearings: Say zero six zero degrees.

Data and Analysis

I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs, making effective use of technology.

Term/Definition	Methodology
Histogram: no spaces between the bars, unlike a bar graph. *(Used to display grouped data.)* **Continuous Data:** can have an infinite number of possible values within a selected range. *(Temperature, height or length)* **Discrete Data:** can only have a finite or limited number of possible values. *(Shoe size, number of siblings)* **Non-numerical data:** data which is non-numerical *(Favourite flavour of crisps)* Use a bar graph, pictogram or pie chart to display discrete data or non-numerical data. **Stem and Leaf Diagram:** Please refer to the Information Handling Appendix	**Please refer to the Information Handling Appendix**

Appendix 1:
Common Methodology
for Algebra

Common Methodology - Algebra

Overview

Algebra is a way of thinking, i.e. a method of seeing and expressing relationships, and generalising patterns - it involves active exploration and conjecture. Algebraic thinking is not the formal manipulation of symbols.

Algebra is not simply a topic that pupils cover in Secondary school. From Primary One, pupils **lay the foundations for algebra**. This includes:

Early, First and Second Level

- Writing equations e.g. 16 add 8 equals?
- Solving equations e.g. $2 + \square = 7$
- Finding equivalent forms

e.g. $24 = 20 + 4 = 30 - 6$

$24 = 6 \times 4 = 3 \times 2 \times 2 \times 2$

- Using inverses or reversing e.g. $4 + 7 = 11 \rightarrow 11 - 7 = 4$
- Identifying number patterns

Early/First Level - Language

$4 + 5 = 9$ is the start of thinking about equations, as it is a statement of equality between two expressions.

Move from "makes" towards "equals" when concrete material is no longer necessary. Pupils should become familiar with the different vocabulary for addition and subtraction as it is encountered.

Second, Third and Fourth Level

Expressing relationships
- Drawing graphs
- Factorising numbers and expressions
- Understanding the commutative, associative and distributive laws

Second/Third Level – Using formulae

Pupils meet formulae in 'Area', 'Volume', 'Circle', 'Speed, Distance, Time' etc. In all circumstances, working must be shown which clearly demonstrates strategy, (i.e. selecting the correct formula), substitution and evaluation.
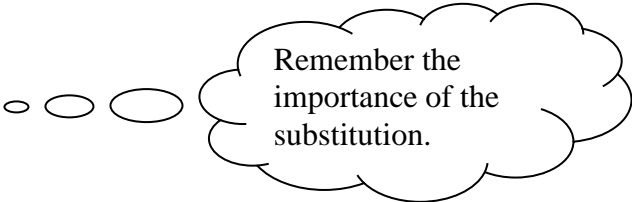
Example :

Find the area of a triangle with base 8cm and height 5cm.

$A = \frac{1}{2}bh$

$A = \frac{1}{2} \times 8 \times 5$

$A = 20$

Remember the importance of the substitution.

Area of triangle is 20 cm^2

Third Level – Collecting like terms (Simplifying Expressions)

The examples below are *expressions* not equations.

Have the pupils rewrite expressions with the like terms gathered together as in the second line of examples 2, 3 & 4 below, before they get to their final answer. The operator (+, −) and the term (7x) stay together at all times. It does not matter where the operator and term (−7x) are moved within the expression. (see example 3).
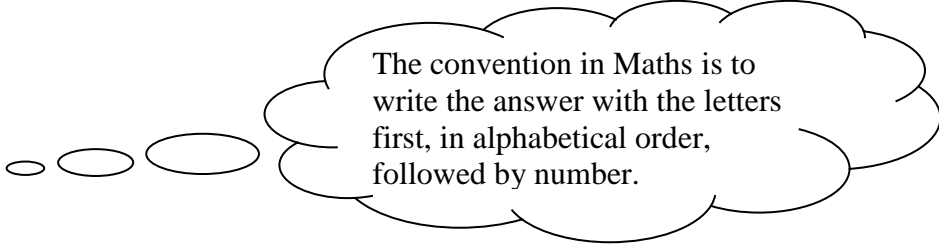
<u>Example 1</u>

Simplify

$x + 2x + 5x$
$= 8x$

<u>Example 2</u>

Simplify

$3a + 2 + 6 + 7a$
$= 3a + 7a + 2 + 6$
$= 10a + 8$

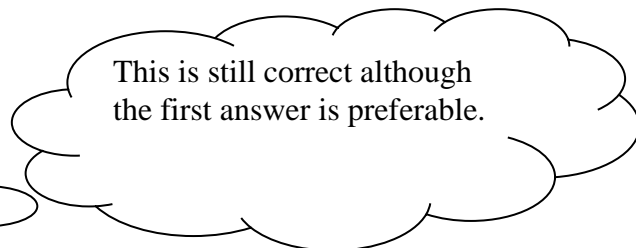The convention in Maths is to write the answer with the letters first, in alphabetical order, followed by number.

<u>Example 3</u>

Simplify

$3 + 5x + 4 - 7x$ $3 + 5x + 4 - 7x$
$= 5x - 7x + 3 + 4$ or $= 3 + 4 + 5x - 7x$
$= -2x + 7$ $= 7 - 2x$

This is still correct although the first answer is preferable.

<u>Example 4</u>

Simplify

$5m + 3n - 2m - n$ $5m + 3n - 2m - n$
$= 5m - 2m + 3n - n$ or $= 3n - n + 5m - 3n$
$= 3m + 2n$ $= 2n + 3m$

Third Level – Evaluating expressions

If $x = 2$, $y = 3$ and $z = -4$

Find the value of:

(a) $5x - 2y$
(b) $x + y - 2z$
(c) $2(x + z) - y$
(d) $x^2 + y^2 + z^2$

$a) 5x - 2y$

$= 5 \times 2 - 2 \times 3$

$= 10 - 6$

$= 4$

$b) x + y - 2z$

$= 2 + 3 - 2 \times (-4)$

$= 5 - (-8)$

$= 13$

This line where the substitution takes place must be shown.
Marks are awarded in examinations for demonstrating this step.

$c) 2(x + z) - y$

$= 2(2 + (-4)) - 3$

$= 2 \times (-2) - 3$

$= -4 - 3$

$= -7$

There is a bracket around the -4 as mathematicians do not write two operators side by side.

$d) x^2 + y^2 + z^2$

$= 2^2 + 3^2 + (-4)^2$

$= 4 + 9 + 16$

$= 29$

Third Level – Solve simple equations

The method used for solving equations is balancing. Each equation should be set out like the examples below. It is useful to use scales like the ones below to introduce this method as pupils can visibly see how the equation can be solved.
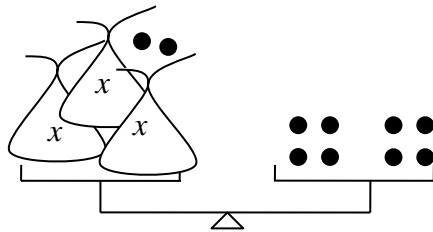
This represents the equation
$$3x + 2 = 8$$
See example 2 below

Example 1: Solve $6w - 5 = 1$

$$
\begin{aligned}
6w - 5 &= 1 \\
+5 \quad &+5 \\
6w &= 6 \\
\div 6 \quad &\div 6 \\
\underline{w &= 1}
\end{aligned}
$$

Example 2: Solve $3x + 2 = 8$

$$
\begin{aligned}
3x + 2 &= 8 \\
-2 \quad &-2 \\
3x &= 6 \\
\div 3 \quad &\div 3 \\
\underline{x &= 2}
\end{aligned}
$$

Example 3: Solve $7 = 22 - 3a$

$$
\begin{aligned}
7 &= 22 - 3a \\
+3a \quad &\quad +3a \\
3a + 7 &= 22 \\
-7 \quad &-7 \\
3a &= 15 \\
\div 3 \quad &\div 3 \\
\underline{a &= 5}
\end{aligned}
$$

Example 4:   Solve $4x - 20 = x + 49$

$$4x - 20 = x + 49$$
$$4x - x = 49 + 20$$
$$3x = 69$$
$$\underline{\boldsymbol{x = 23}}$$

Example 5:   Solve $2(10 - 2x) = 3(3x - 2)$

$$2(10 - 2x) = 3(3x - 2)$$
$$20 - 4x = 9x - 6$$
$$20 + 6 = 9x + 4x$$
$$26 = 13x$$
$$\underline{\boldsymbol{x = 2}}$$

At Third Level pupils should be encouraged to carry out the steps mentally, however if pupils find this difficult they should continue to show the working.

Other equations at this stage should include ones where x is a negative number or fraction. Pupils should be encouraged to write their answers as a fraction and not as a decimal. Use the language add, subtract, multiply (not times) and divide.

Also when referring to the number '−5' we say 'negative 5' **NOT** 'minus 5' as minus should be treated as an operation (verb).

Appendix 2:
Common Methodology
for Information Handling

Information Handling

Discrete Data

Discrete data can only have a finite or limited number of possible values.

Shoe sizes are an example of **discrete** data because sizes 39 and 40 mean something, but size 39·2, for example, does not.

Continuous Data

Continuous data can have an infinite number of possible values within a selected range.
e.g. temperature, height, length.

Non-Numerical Data (Nominal Data)

Data which is non-numerical.
e.g. favourite TV programme, favourite flavour of crisps.

Tally Chart/Table (Frequency table)

A tally chart is used to collect and organise data prior to representing it in a graph.

Averages

Pupils should be aware that mean, median and mode are different types of average.

Mean: add up all the values and divide by the number of values.
Mode: is the value that occurs most often.
Median: is the middle value or the mean of the middle pair of an ordered set of values.

Pupils are introduced to the mean using the word average. In society average is commonly used to refer to the mean.

Range

The difference between the highest and lowest value.

Pictogram/pictograph

A pictogram/pictograph should have a title and appropriate x (horizontal) and y-axis (vertical) labels. If each picture represents a value of more than one, then a key should be used.

| NAMES	WEIGHTS
ANDREW	3
HELEN	6
GARY	4
ALEX	7
ELAINE	5
THERESA	4
KEVIN	2
TOTAL	31
MEAN	4.4

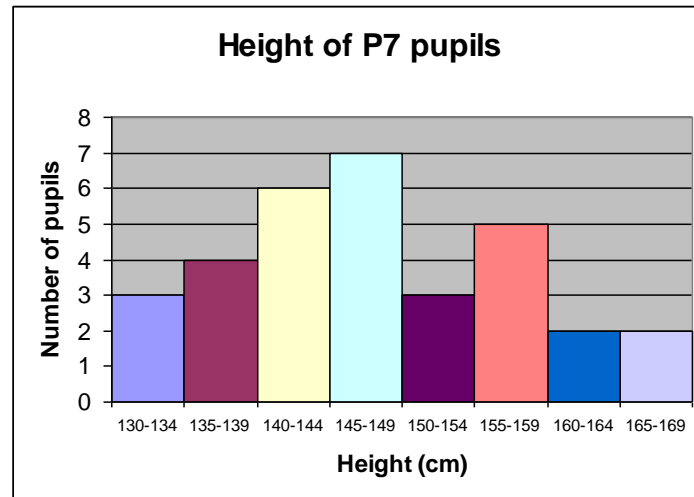The weight each pupil managed to lift
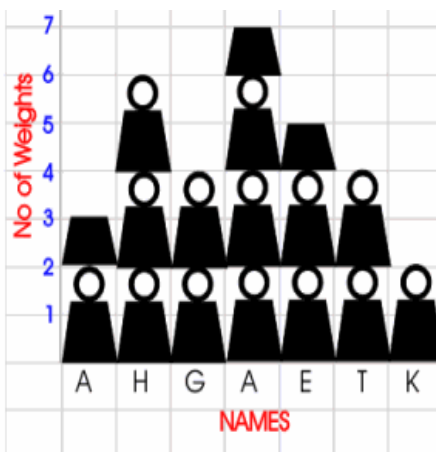
represents two units

Bar Chart/Graph

A bar chart is a way of displaying discrete or non-numerical data. A bar chart should have a title and appropriate x and y-axis labels. An even space should be between each bar and each bar should be of an equal width. Leave a space between the y-axis and the first bar. When using a graduated axis, the intervals must be evenly spaced.
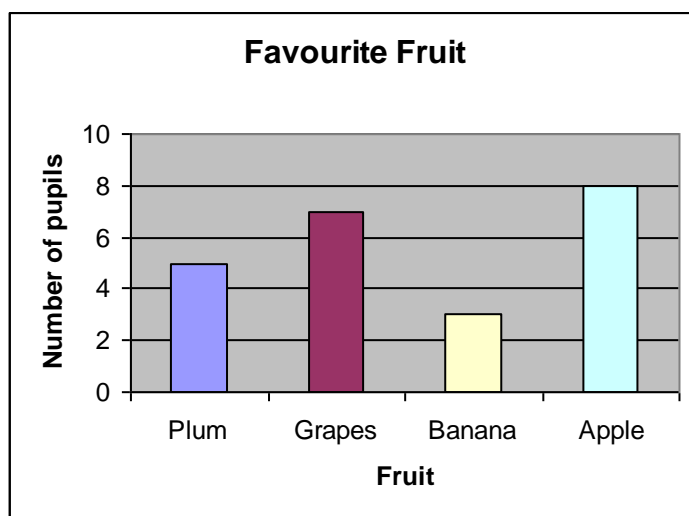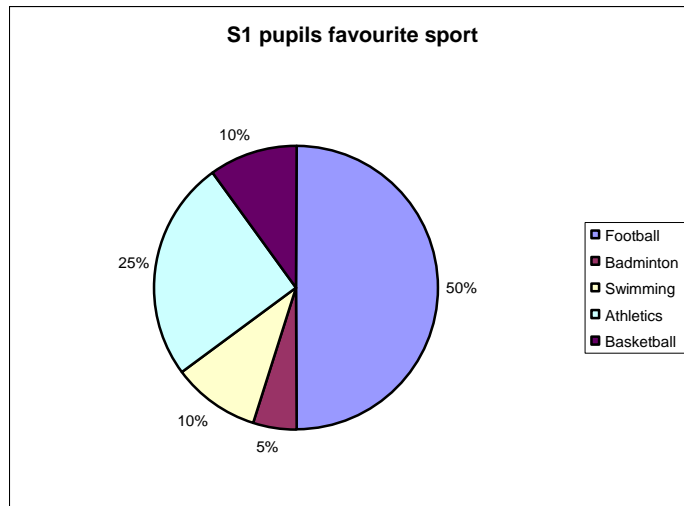
1. Histogram

A histogram is a way of displaying grouped data. A histogram should have a title and appropriate *x* and *y*-axis labels. There should be no space between each bar. Each bar should be of an equal width. When using a graduated axis, the intervals must be evenly spaced.

Height of P7 pupils

A histogram with y-axis labelled "Number of pupils" ranging from 0 to 8, and x-axis labelled "Height (cm)". The bars show:
- 130-134: 3
- 135-139: 4
- 140-144: 6
- 145-149: 7
- 150-154: 3
- 155-159: 5
- 160-164: 2
- 165-169: 2

<u>Pie Charts</u>

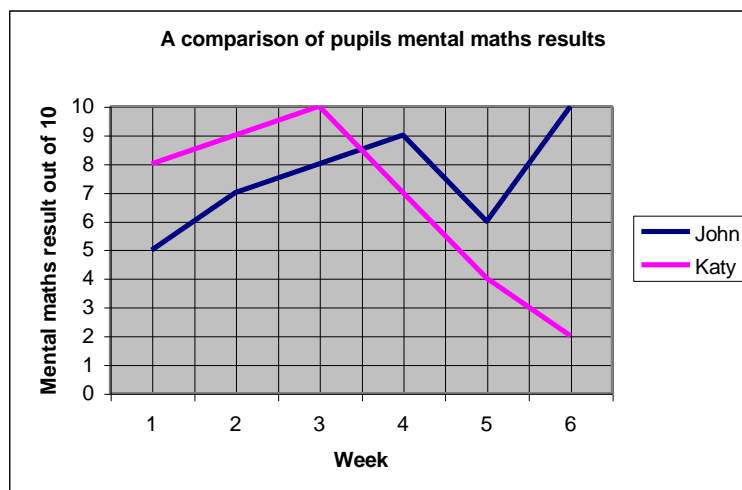A pie chart is a way of displaying discrete or non-numerical data.

It uses percentages or fractions to compare the data. The whole circle (100% or one whole) is then split up into sections representing those percentages or fractions. A pie chart needs a title and a key.

S1 pupils favourite sport

10%

25%

50%

□ Football
■ Badminton
□ Swimming
□ Athletics
■ Basketball

10%

5%

Line Graphs

Line graphs compare two quantities (or variables). Each variable is plotted along an axis. A line graph has a vertical and horizontal axis. So, for example, if you wanted to graph the height of a ball after you have thrown it, you could put time along the horizontal, or x-axis, and height along the vertical, or y-axis.

A line graph needs a title and appropriate x and y-axis labels. If there is more than one line graph on the same axes, the graph needs a key.

A comparison of pupils mental maths results

Mental maths result out of 10

10
9
8
7
6
5
4
3
2
1
0

1   2   3   4   5   6

Week

—— John
—— Katy

Scattergraphs (Scatter diagrams)

A scattergraph allows you to compare two quantities (or variables). Each variable is plotted along an axis. A scattergraph has a vertical and hrizontal axis. It needs a title and appropriate *x* and *y*-axis labels. For each piece of data a point is plotted on the diagram. The points are not joined up.

A scattergraph allows you to see if there is a connection (correlation) between the two quantities. There may be a positive correlation when the two quantities increase together e.g. sale of umbrellas and rainfall. There may be a negative correlation were as one quantity increases the other decreases e.g. price of a car and the age of the car. There may be no correlation e.g. distance pupils travel to school and pupils' heights.