

**Common Language and
Methodology for Teaching
Information Handling
St Ninian's Cluster**

Information Handling – Teacher Information

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, weight etc.


Non-Numerical Data (Nominal Data)


Data which is non-numerical.

e.g. favourite TV programme, favourite flavour of crisps, favourite subject etc.

Tally Chart/Table (Frequency table)

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

Early Level 'pre tally marks': 

Tally marks: 

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 – From Early Years

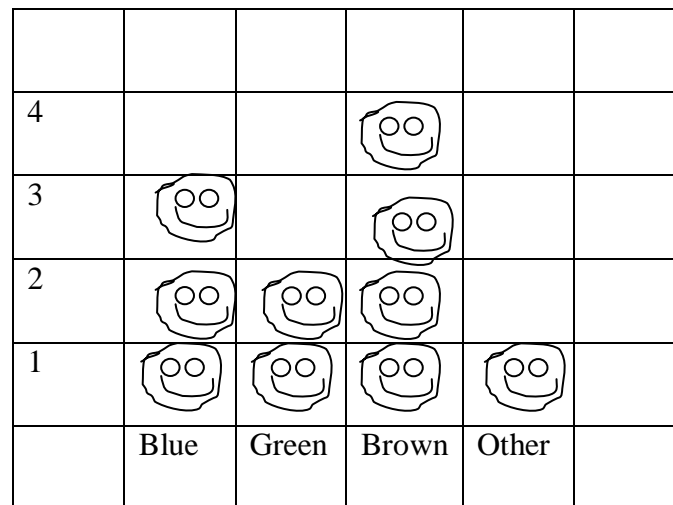
Early Years

Eye Colour	Number of children
Blue	3
Green	2
Brown	4
Other	1

When creating a pictogram the images are added from the bottom axis and built upwards.

The colour of our eyes

Number of Children



Eye Colour

At Early Level, pictograms and bar graphs may be interpreted using the following questions:

- Who has the most/least?
- What is the most/least popular?
- Why is this the most popular?
- How can we use this information?

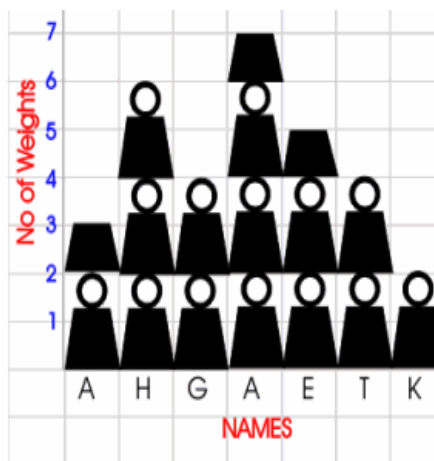
First/ Second Level

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

Emphasis should be put on the use of a key as a guide to the value of each of the pictures and what they represent.

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



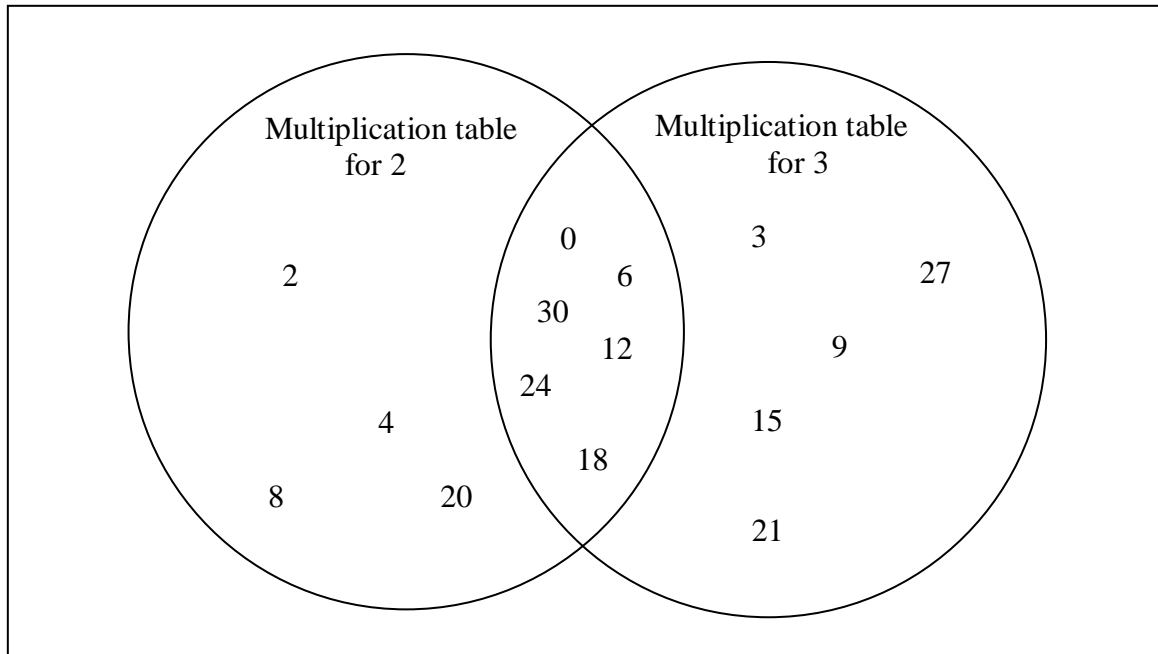
 represents two units

Venn Diagrams - from First level

Venn Diagrams are a way of picturing relationships between different sets of things. They are used to identify and classify.

The example below looks at numbers that feature in the 2 and 3 multiplication tables. Students would be asked to work methodically through each multiplication table, classifying each number. This could be achieved using number cards rather than asking children to write the numbers in. It should be taught that numbers which are common to both multiplication tables are placed in the central section.

Example:



Children would then be asked to retrieve/interpret information from the diagram.

For example: 'Give me a number that features in both the 2 and 3 multiplication tables'.

Carroll Diagrams - From First level

Carroll diagrams are used to classify and sort information in a yes/no fashion. Students would collect information from a range of sources including pictures, diagrams, people etc. In the first instance, this would be displayed in a table. It would then be entered into a Carroll diagram.

Example

Has a pet	Doesn't have a pet
John	Sarah
Mary	Christopher
Paul	Hannah
Scott	Peter
Mark	

Carroll diagram to show which of my friends have a pet

	Has a pet	Doesn't have a pet
Boys	John Paul Scott Mark	Christopher Peter
Girls	Mary	Sarah Hannah

Children should be encouraged to formulate simple questions about the diagram and be able to retrieve information from it.

For example: "Which girls do not have pets?"
 "How many more boys have pets than girls?"
 "Who is the only girl that has a pet?"

Bar Chart/Graph – From Early Level

Graphs and Diagrams

Bar graphs and line graphs should always be drawn on squared paper or graph paper.

Bar Graphs

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

All students should be able to draw bar graphs, but they will frequently draw them incorrectly. The way in which a graph is drawn depends on the type of data being represented. Graphs should be drawn with gaps between the bars if the data categories are not numeric (colours, types of vehicle, names of football teams etc.). There should also be gaps between the bars if the categories are numeric but can only take particular values, (eg. shoe size). If the data categories are numeric and continuous they can take any value within the range (heights of children, time taken to complete a marathon etc.). In this case the data will be grouped, the horizontal axis should be labelled as when plotting co-ordinates rather than under the bars and there should be no gaps between the bars.

It is also important to emphasise the need to label axes correctly. In a bar graph with separate columns, the labels should be underneath the columns on the horizontal axis. On the vertical axis, the labels should be on the lines. Bars and gaps should be of equal width.

A bar chart is a way of displaying discrete or non-numerical data e.g. Favourite sports, number of pets etc.

The following features should be included and emphasised to students:

- Title
- Appropriate x and y -axis labels
- An even space should be between each bar
- Each bar should be of an equal width
- A space should be left between the y -axis and the first bar
- When using a graduated axis, the intervals must be evenly spaced.

Discussion points: Why is a title important?
Why is it important to use evenly spaced intervals?
When might you use a graduated axis?

Early Level

At Early Level, pictograms and bar graphs may be interpreted using the following questions:

- Who has the most/least?
- What is the most/least popular?
- Why is this the most popular?
- How can we use this information?

At this stage, bar charts would be provided for the students, they would not be expected to construct a bar chart.

First Level

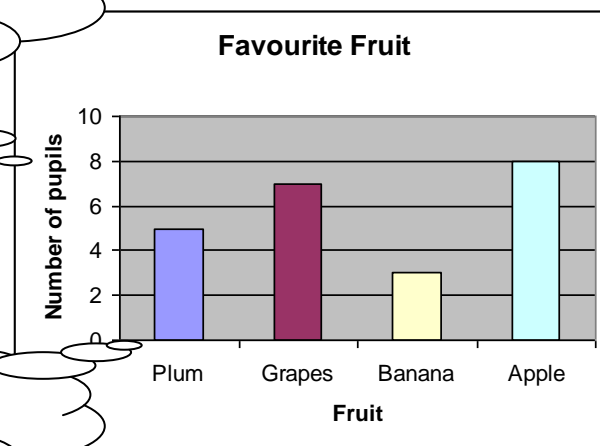
Students should be able to organise data into a bar chart. The data used can either be given to the students or gathered by them from surveys or investigations.

Students should also be able to produce a bar chart using a spreadsheet.

Example:

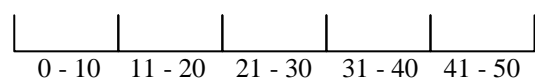
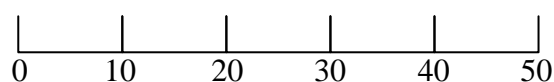
Favourite Fruit	Number of Pupils
Plum	5
Grapes	7
Banana	3
Apple	8

Remind pupils that frequency always goes on the y-axis.



Space should be left between vertical axis and first bar.

Where data are continuous e.g. lengths, the horizontal scale should be like the scale used for a graph on which points are plotted.



Second Level

Students should be able to use gathered or given data to create a bar chart/graph where a graduated axis would be used.

For a graduated x -axis, students should be reminded that the intervals they have chosen should be evenly spaced and appropriate for the data that they are working with.

Example:

Students may choose to use a graduated axis when organising the following data into a bar graph:

Favourite Subject	Number of Pupils
Mathematics	22
Music	18
P.E.	40
Art	24
Science	16

Students should be guided as to which intervals are appropriate for the data they have in front of them

e.g. for this data it would be appropriate to go up in twos or fives, however tens might not be appropriate as it would be difficult to plot accurately unless working on graph paper.

Class Intervals

When deciding on class intervals, students should be reminded that intervals chosen should be equal in size and there should be between six and ten different intervals to ensure that the range is not too small or too wide.

Frequency diagrams

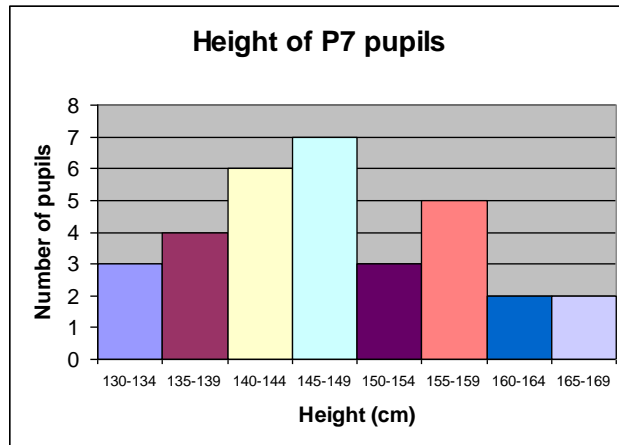
1. Histogram

A histogram is a way of displaying grouped data.

The following features should be included and emphasised to students:

- Title
- Appropriate x and y -axis labels
- No space between each bar
- Each bar should be of an equal width
- When using a graduated axis, the intervals must be evenly spaced.

Emphasise as the main difference between bar graphs and histograms.

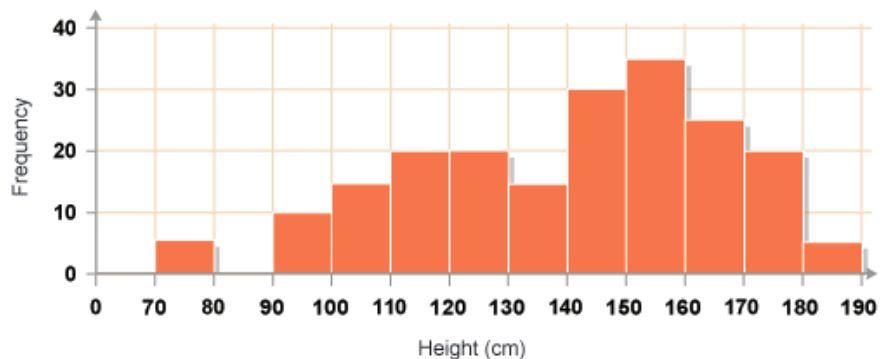


2. Frequency Polygon – From Third Level

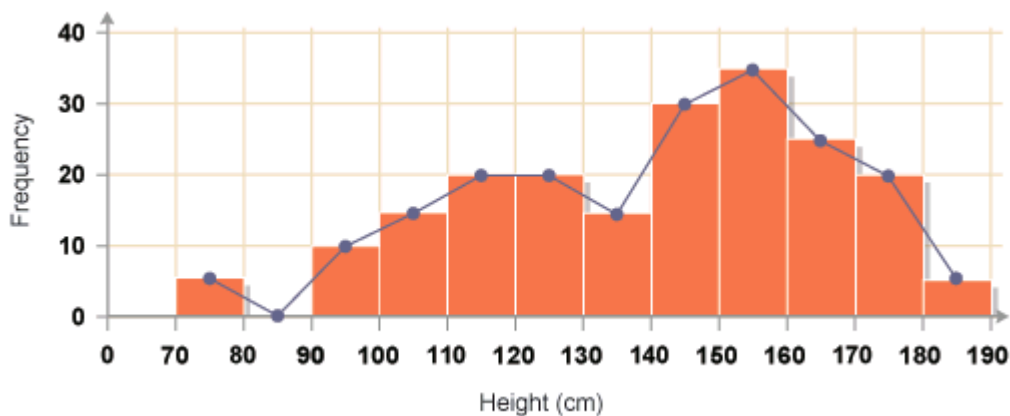
To draw a frequency polygon, draw a histogram then join the midpoints of the top of each bar. It is then optional, whether or not you remove the bars.

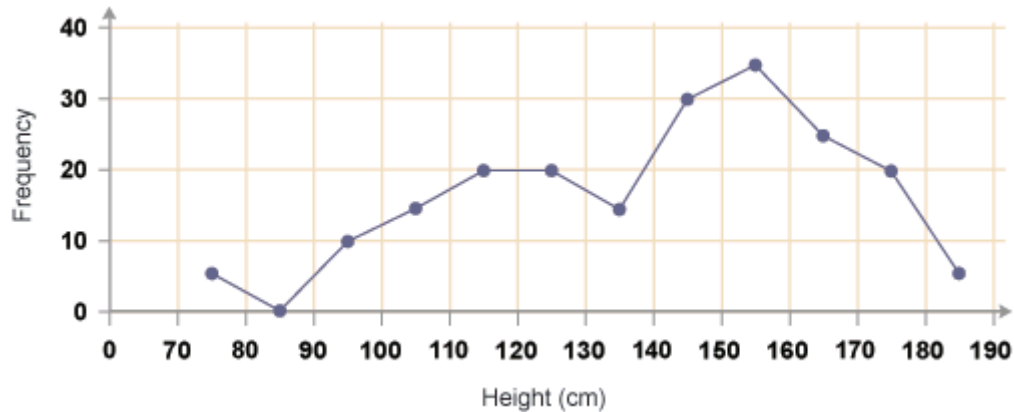
Example:

This frequency diagram shows the heights of 200 people:

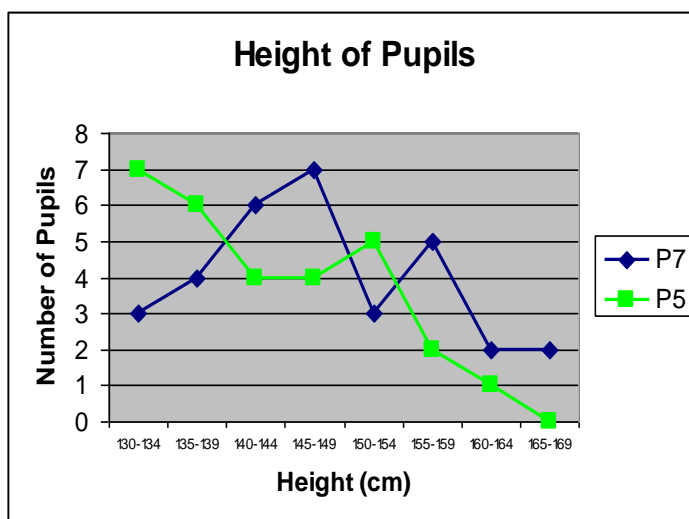


You can construct a frequency polygon by joining the midpoints of the tops of the bars.





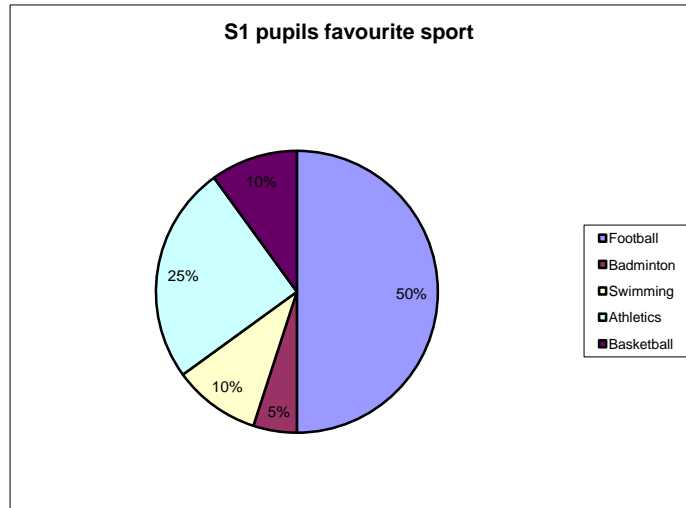
Frequency polygons are useful when comparing two sets of data.



You would need to include a KEY for an example involving two sets of data

Pie Charts – From Second Level

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.



The angle for each segment of the pie chart is calculated as a fraction of 360° . The example below illustrates how this is done with simple fractions but the same technique is used with real data.

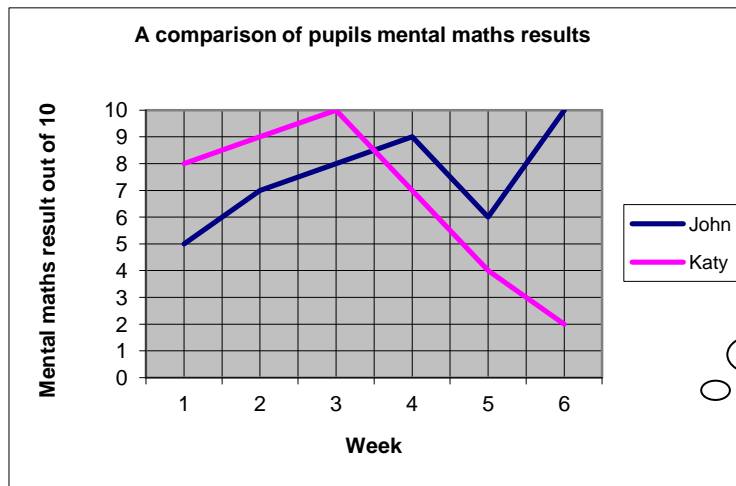
e.g

Type of Vehicle	Frequency	Fraction	Angle
Car	20	$\frac{20}{40} = \frac{1}{2}$	$\frac{1}{2}$ of $360^\circ = 180^\circ$
Lorry	5	$\frac{5}{40} = \frac{1}{8}$	$\frac{1}{8}$ of $360^\circ = 45^\circ$
Van	10	$\frac{10}{40} = \frac{1}{4}$	$\frac{1}{4}$ of $360^\circ = 90^\circ$
Bus	5	$\frac{5}{40} = \frac{1}{8}$	$\frac{1}{8}$ of $360^\circ = 45^\circ$
<u>Total</u>	40	1	360°

Line Graphs – From Level 2

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.



Students should be reminded that numbers go on the line on each axis, not inside the boxes.

Stem-and-leaf diagram – From Fourth Level

A stem-and-leaf diagram is another way of displaying discrete or continuous data. A stem-and-leaf diagram needs a title, a key and should be ordered. It is useful for finding the median and mode. If we have two sets of data to compare we can draw a back-to-back stem-and-leaf diagram.

Example 1: The following marks were obtained in a test marked out of 50. Draw a stem and leaf diagram to represent the data.

3, 23, 44, 41, 39, 29, 11, 18, 28, 48.

Split the data into a stem and a leaf. Here the tens part of the test mark is the stem. The units part of the test mark is called the leaf.

Unordered stem-and-leaf diagram showing test marks out of 50

```

0 | 3
1 | 1 8
2 | 3 9 8
3 | 9
4 | 4 1 8

```

1| 3 means 13 out of 50

n = 10

The diagram can be ordered to produce an ordered stem and leaf diagram.

Ordered stem-and-leaf diagram showing test marks out of 50

The key should be highlighted as an essential feature.

0	3
1	1 8
2	3 8 9
3	9
4	1 4 8

1 | 3 means 13 out of 50

n = 10

Example 2: Two classes sat a Block test and the results were as follows:

Class 1 Percentages

54 64 73 78 69 65
75 80 58 59 63 64
55 66 68 68 54 77

Class 2 Percentages

87 92 80 79 95 77
83 84 90 99 76 74
81 81 80 93 96 88

Block Tests Results Comparison

9 8 5 5 4	5	
9 8 8 6 5 4 4 3	6	
8 7 5 3	7	4 6 7 9
0	8	0 0 1 1 3 4 7 8
	9	0 2 3 5 6 9

7 | 4 means 74% n = 36

Data in a back-to-back stem-and-leaf diagram can then be compared and analysed

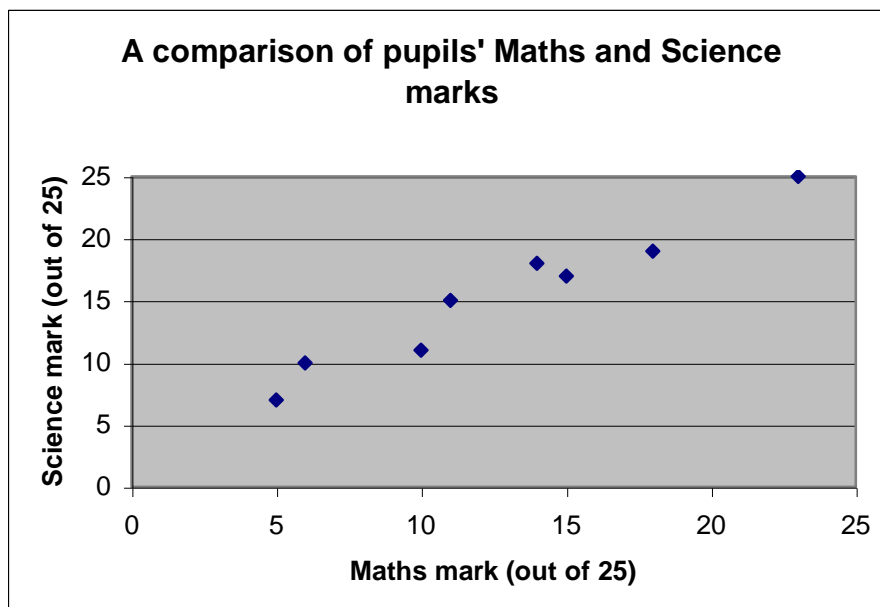
- e.g. “Which class did better in the Block Test?”
 “How many pupils in Class 2 scored in the 70’s?”
 “How many pupils were in each class?”

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 horizontal 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.



Using Data

Range

The range of a set of data is the difference between the highest and lowest data values.

e.g. If in an examination the highest mark is 80% and the lowest mark is 45%, the range is 35%, since $80\% - 45\% = 35\%$.

The range is always a positive number.

Averages

Three different averages are commonly used:

- The **mean** is calculated by adding up all of the values and dividing by the number of values.
- The **median** is the middle value when the values have been arranged in order.
- The **mode** is the most common value. It is sometimes called the **modal value**.

e.g. for the values: 3, 2, 5, 8, 4, 3, 6, 3, 2

- **Mean** $\frac{3+2+5+8+4+3+6+3+2}{9} = \frac{36}{9} = 4$

- The **median** is 3 because 3 is in the middle when the values are put in order.

2 , 2 , 3 , 3 , 3 , 4 , 5 , 6 , 8

- The **mode** is 3 because 3 is the value which occurs most often.