Probability and Data Handling

I can work collaboratively, making appropriate use of technology, to source information presented in a range of ways, interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading.

MNU 3-20a

Having discussed the variety of ways and range of media used to present data, I can interpret and draw conclusions from the information displayed, recognising that the presentation may be misleading.

MNU 2-20a

I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way.

MNU 2-20b

Probability

Probability is how likely or unlikely an event is of happening.
If an event is certain to happen, it has a probability of 1.
If an event is impossible or unlikely it has a probability of 0.
Probability of an event E happening:

$$P(E) = \frac{\text{number of ways an event can occur}}{\text{total number of different outcomes}}$$

A die is rolled:

Example 1 What is the probability of rolling a 1?

$$P(1) = \frac{1}{6}$$

Example 2 What is the probability of rolling an even number?

3 even numbers

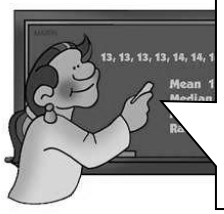
$$P(\text{even}) = \frac{3}{6} = \frac{1}{2}$$

Example 3 What is the probability of rolling a number greater than 4?

2 numbers greater than 4 (5 and 6)

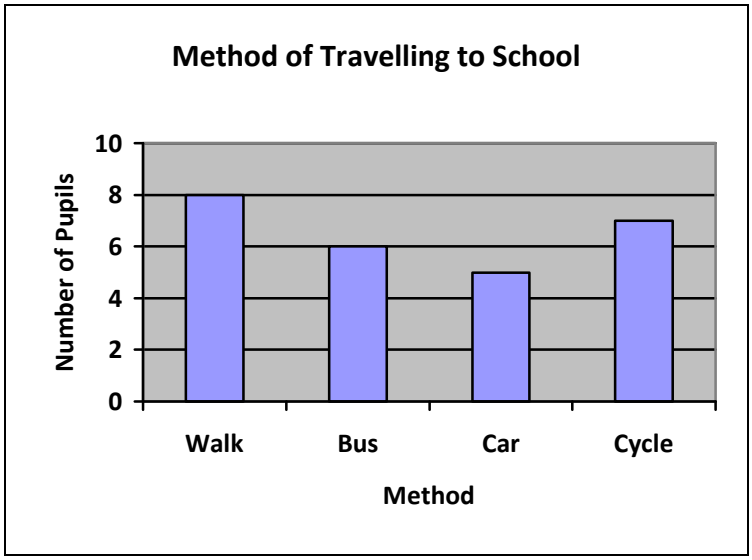
$$P(>4) = \frac{2}{6} = \frac{1}{3}$$

Information Handling : Bar Graphs



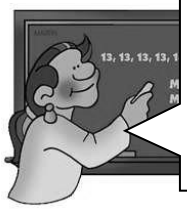
Bar graphs are often used to display data. The horizontal axis should show the categories or class intervals, and the vertical axis the frequency. All graphs should have a title, each axis must be labelled and a constant scale used.

Example How do pupils travel to school?



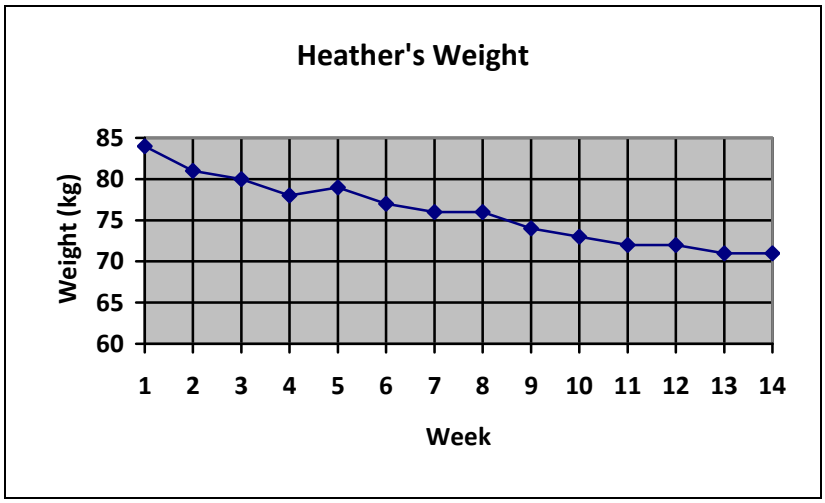
There should be equal spaces between each bar and a space at the beginning. Bars should be the same width.

Information Handling : Line Graphs



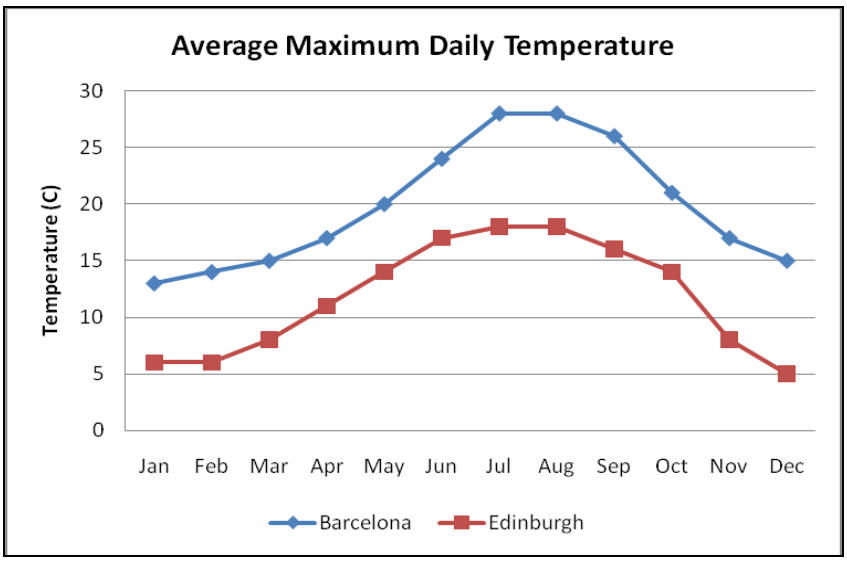
Line graphs consist of a series of points which are plotted, then joined by a line. All graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it.

Example 1 The graph below shows Heather's weight over 14 weeks as she follows an exercise programme.

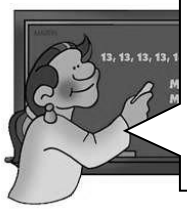


The trend of the graph is that her weight is decreasing.

Example 2 Graph of temperatures in Edinburgh and Barcelona.



Information Handling : Scatter Graphs

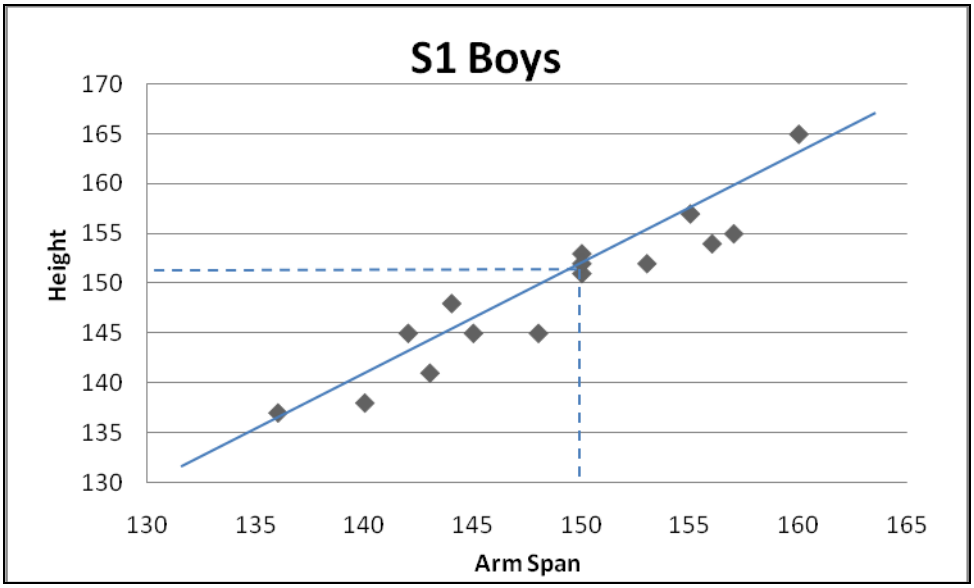


A scatter diagram is used to display the relationship between two variables.
A pattern may appear on the graph.
This is called a **correlation**.

Example The table below shows the height and arm span of a group of first year boys. This is then plotted as a series of points on the graph below.

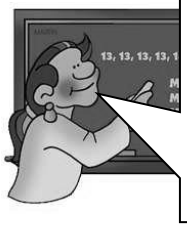
Arm Span (cm)	150	157	155	142	153	143	140	145	144	150	148	160	150	156	136
Height (cm)	153	155	157	145	152	141	138	145	148	151	145	165	152	154	137

The graph shows a general trend, that as the arm span increases, so does the height. This graph shows a positive correlation.



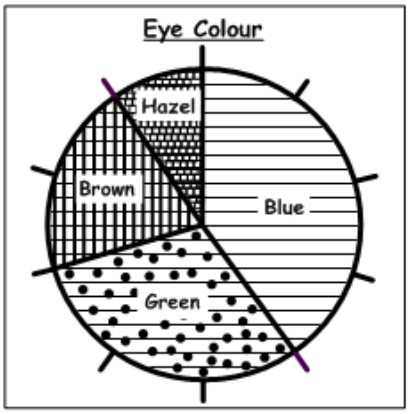
The line drawn is called the line of best fit. This line can be used to provide estimates. For example, a boy of arm span 150cm would be expected to have a height of around 151cm.

Information Handling : Pie Charts



A pie chart can be used to display information. Each sector (slice) of the chart represents a different category. The size of each category can be worked out as a fraction of the total using the number of divisions or by measuring angles.

Example 30 pupils were asked the colour of their eyes. The results are shown in the pie chart below.



How many pupils had brown eyes?
The pie chart is divided up into ten parts, so pupils with brown eyes represent $\frac{2}{10}$ of the total.

$\frac{2}{10}$ of 30 = 6 so 6 pupils had brown eyes.

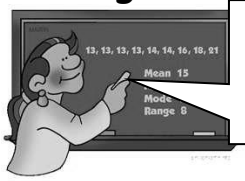
If no divisions are marked, we can work out the fraction by measuring the angle of each sector.

The angle in the brown sector is 72°.
so the number of pupils with brown eyes
= $\frac{72}{360}$ x 30 = 6 pupils.

If you find a value for each sector, this should add up to 30 pupils.

Information Handling : Pie Charts 2

Drawing Pie Charts



On a pie chart, the size of the angle for each sector is calculated as a fraction of 360°.

Example: In a survey about television programmes, a group of people were asked what was their favourite soap. Their answers are given in the table below. Draw a pie chart to illustrate the information.

Soap	Number of people
Eastenders	12
Coronation Street	24
Emmerdale	10
Hollyoaks	6
None	28

Total number of people = 80

Eastenders = $\frac{12}{80} \rightarrow \frac{12}{80} \times 360° = 54°$

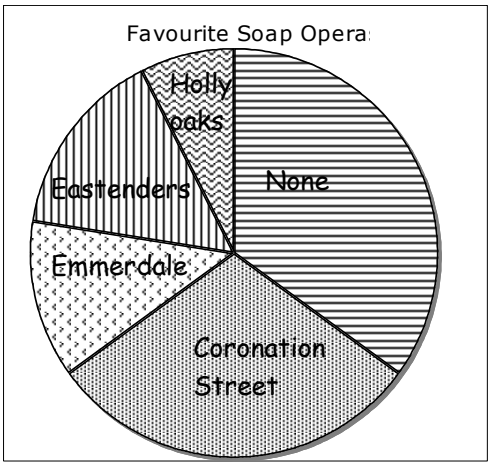
Coronation Street = $\frac{24}{80} \rightarrow \frac{24}{80} \times 360° = 108°$

Emmerdale = $\frac{10}{80} \rightarrow \frac{10}{80} \times 360° = 45°$

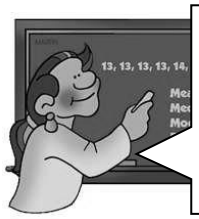
Hollyoaks = $\frac{6}{80} \rightarrow \frac{6}{80} \times 360° = 27°$

None = $\frac{28}{80} \rightarrow \frac{28}{80} \times 360° = 126°$

Check that the total = 360°



Information Handling : Averages



To provide information about a set of data, the average value may be given. There are 3 methods of finding the average value – the mean, the median and the mode.

Mean

The mean is found by adding all the data together and dividing by the number of values.

Median

The median is the middle value when all the data is written in numerical order from smallest to largest (if there are two middle values, the median is half-way between these values).

Mode

The mode is the value that occurs most often.

Range

The range of a set of data is a measure of spread.

Range = Highest value – Lowest value

Example 1 A class scored the following marks for their homework assignment. Find the mean, median, mode and range of the results.

7, 9, 7, 5, 6, 7, 10, 9, 8, 4, 8, 5, 7, 10

Mean = $\dfrac{7+9+7+5+6+7+10+9+8+4+8+5+7+10}{14}$

= $\dfrac{102}{14} = 7.285...$

Mean = 7•3 to 1 decimal place

Ordered values: 4, 5, 5, 6, 7, 7, 7, 7, 8, 8, 9, 9, 10, 10

Median = 7

(value is between two sevens, therefore half way between will also be seven)

7 is the most frequent mark, so **Mode** = 7

Range = 10 – 4 = 6

Example 2 Another class scored the following marks for their homework. Find the mean, median and mode of these results.

3, 7, 7, 9, 9, 5, 6, 8, 4

Mean = $\frac{3 + 7 + 7 + 9 + 9 + 5 + 6 + 8 + 4}{8}$

= $\frac{58}{8}$

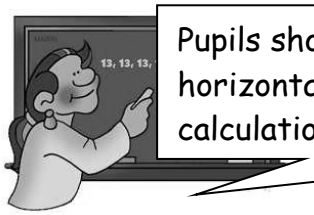
= 7•25

Values in order: 3, 4, 5, 6, 7, 7, 8, 9, 9

Median = 7 (middle value)

Mode = 7 and 9 (there are two values that appear most often)

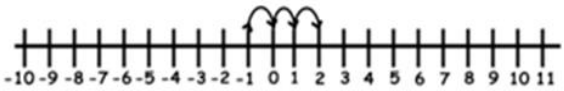
Negative Numbers



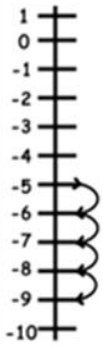
Pupils should be able to draw a number line, either horizontal or vertical, and use it to complete simple calculations.

Example 1 1 - 5 = -4

Example 2 (-1) + 3 = 2



Example 3 (-5) - 4 = -9



Examples in Context:

1. In winter the night time temperature at the North Pole is -41° Celsius. During the day, the temperature rises by 7° Celsius. What is the day time temperature?

   (-41) + 7 = -34

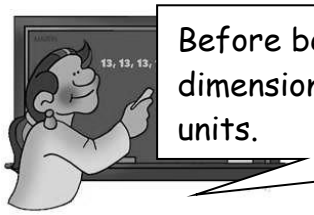
   Day time temperature is -34° Celsius.

2. Mr Debt's bank account had a balance of £36·00. Mr Debt splashed out on a pair of jeans costing £75·00. What is the balance of Mr Debt's bank account now?

   36 - 75 = -39

   Balance is now -£39·00.

Area and Volume



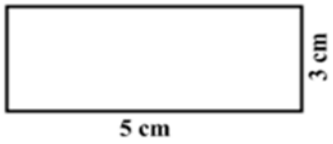
Before beginning a calculation, ensure that the dimensions of the shape are stated with consistent units.

Area of Rectangles

To calculate the area of a rectangle we use the formula

$$\text{Area} = \text{Length} \times \text{Breadth}$$

Example 1 Calculate the area of this rectangle.

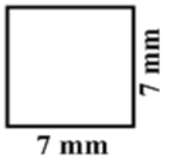


$\text{Area} = l \times b$

$\text{Area} = 5 \times 3$

$\text{Area} = 15\ \text{cm}^2$

Example 2 Calculate the area of this square.



$\text{Area} = l \times b$

$\text{Area} = 7 \times 7$

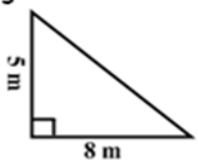
$\text{Area} = 49\ \text{mm}^2$

Area of Triangles

To calculate the area of a triangle we use the formula

$$\text{Area} = \tfrac{1}{2} \times \text{Base} \times \text{Height}$$

Example 3 Calculate the area of this right-angled triangle.

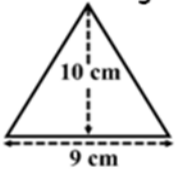


$\text{Area} = \tfrac{1}{2} \times b \times h$

$\text{Area} = \tfrac{1}{2} \times 8 \times 5$

$\text{Area} = 20\ \text{m}^2$

Example 4 Calculate the area of this isosceles triangle.

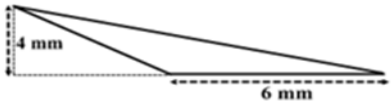


$\text{Area} = \tfrac{1}{2} \times b \times h$

$\text{Area} = \tfrac{1}{2} \times 9 \times 10$

$\text{Area} = 45\ \text{cm}^2$

Example 5 Calculate the area of scalene triangle.



$\text{Area} = \tfrac{1}{2} \times b \times h$

$\text{Area} = \tfrac{1}{2} \times 6 \times 4$

$\text{Area} = 12\ \text{mm}^2$

Area of Circles

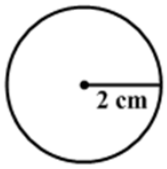
To calculate the area of a circle we use the formula

$$\text{Area} = \pi r^2$$

$\pi = 3{\cdot}14$

r = circle radius

Example 6 Calculate the area of this circle.



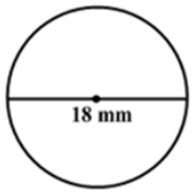
$\text{Area} = \pi \times r^2$

$\text{Area} = 3{\cdot}14 \times 2 \times 2$

$\text{Area} = 12{\cdot}56\ \text{cm}^2$

Example 7 Calculate the area of this circle.

diameter = 18 mm, so radius = 9 mm



$\text{Area} = \pi \times r^2$

$\text{Area} = 3{\cdot}14 \times 9 \times 9$

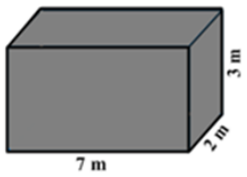
$\text{Area} = 254{\cdot}34\ \text{mm}^2$

Volume of Cuboids

To calculate the volume of a cuboid we use the formula

$$\text{Volume} = \text{Length} \times \text{Breadth} \times \text{Height}$$

Example 1 Calculate the volume of this cuboid.

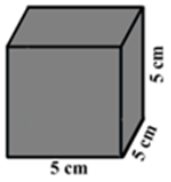


$\text{Volume} = l \times b \times h$

$\text{Volume} = 7 \times 2 \times 3$

$\text{Volume} = 42\ \text{m}^3$

Example 2 Calculate the volume of this cube.



$\text{Volume} = l \times b \times h$

$\text{Volume} = 5 \times 5 \times 5$

$\text{Volume} = 125\ \text{cm}^3$