S30 TABLES

Tables are used to record data. When this data records the numbers of times results happen, it is a **frequency table** or **frequency diagram**.

You should always design a table when planning an investigation because it helps you to think about:

- what variables to choose
- the range of measurements to use
- the intervals to have between measurements
- how to make your measurements.

Tables are used to present small sets of data because they let you sort the data into different orders (e.g. increasing number, alphabetically). This helps you to spot patterns.

There is a standard way of setting out a table.

the variable you select values for (the **independent variable**)

the variable you measure (the **dependent variable**)

Time (mins)	Temperature of water (°C)
0	24.0
1	31.1
2	38.7
3	46.3
4	54.2
5	62.1

interval

range

Figure B: Temperature of 300 cm³ of water heated for different lengths of time.

discrete variable

frequency

Flavour of crisps	Students in 11 F with that favourite	Students in 11 B with that favourite
cheese & onion	6	9
other	1	3
prawn cocktail	2	2
ready salted	7	3
salt & vinegar	11	8
smoky bacon	3	2

Continuous data is often put into groups. You need to make sure that your groups:

- are all the same size (so you can make comparisons)
- do not overlap (otherwise you have more than one choice of group to put a reading into).

Height groups (cm)	4 year olds with that height
90.0 – 94.9	1
95.0 – 99.9	3
100.0 – 104.9	7
105.0 – 109.9	8
110.0 – 114.9	1

Figure A: Frequency tables.

QUESTIONS

Level Booster

★★★ draw tables to help plan investigations

★★ draw tables for continuous data and group continuous data where necessary

★ draw frequency tables for discrete data

1 ★ Look at the crisp-flavour frequency data for class 11F, in Figure A. Draw a frequency table for this data, but order the data by the popularity of the flavours.

2 A survey of rabbits on a hill and their heights above sea level produced this data:
Rabbit A (499 m), B (300 m), C (246 m), D (434 m), E (302 m), F (458 m), G (255 m), H (365 m), I (299 m), J (249 m), K (355 m), L (258 m).

a ★★ Is there is a range of heights in which more rabbits are found? Draw a suitable table to find out.

b ★★★ How does drawing a table make it easier to spot patterns, compared to having a list?

3 Look at Figure B.

a ★ State the choices of range, interval and variables used in the experiment.

b ★★★ What trend can you see?

Links

Learn about variables ▶▶ S13
Learn about other ways of presenting data ▶▶ S38

S31 BAR CHARTS

Bar charts are used to present data.

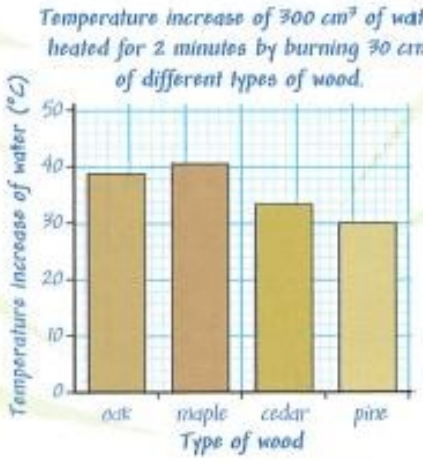
- The **independent variable** is **qualitative** or **quantitative** *and* **discrete.**
- The **dependent variable** is **quantitative**.

Always give your charts a title.

The variable that you measure (dependent variable) goes on the vertical axis. Give the name and units.

Choose a scale so that the bars fill as much of the graph paper as possible. Number the scale and remember that the intervals must be equal.

The variable that you change (independent variable) goes on the horizontal axis. Write in its name.



Gaps are left between the bars to make it easier to read.

Bars are drawn:
- with a ruler
- from each category up to the correct level
- with equal widths

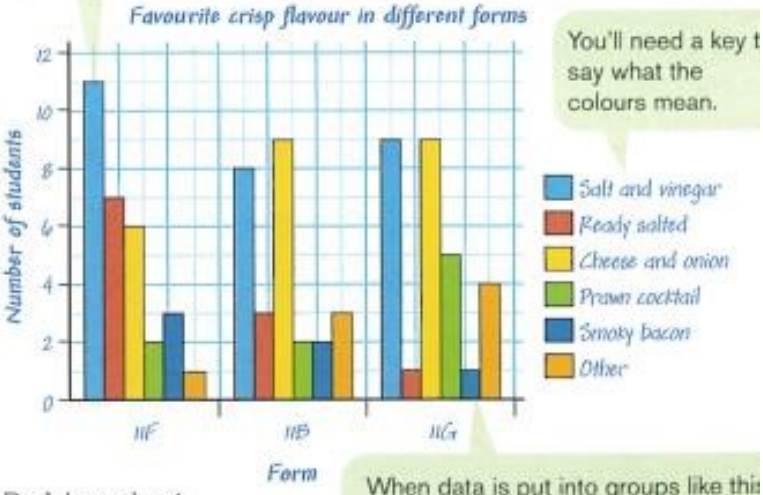
This bar tells you that pine raised the temperature of the water by 30 °C.

Figure A: A bar chart.

Generally the independent variable is plotted on the horizontal axis (*x*-axis). The dependent variable is plotted on the vertical axis (*y* axis). It can be done the other way around but the bars always 'come out of' which ever axis the independent variable is plotted on.

To show how several of the same things change in different groups, you group the bars.

Make the bars for the different things different colours or patterns.



You'll need a key to say what the colours mean.

When data is put into groups like this we don't leave gaps between the bars.

Figure B: A bar chart with bars in groups.

QUESTIONS

Level Booster

★★★ explain how using bar charts allows better spotting of patterns

★★ draw a bar chart

★ read from a bar chart and spot patterns in bar charts

1 Look at Figure A. To the nearest degree, by how much did the following woods raise the temperature of the water:
- **a** ★ pine
- **b** ★ cedar?

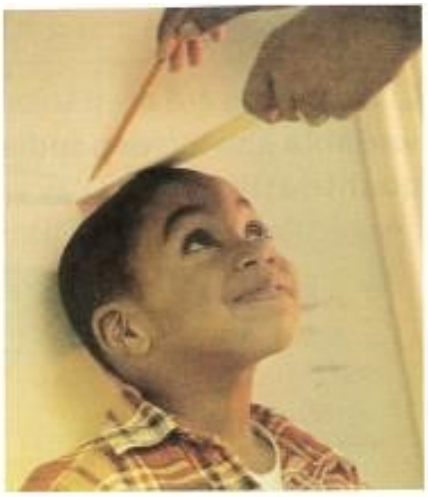
2 ★★ An experiment was done in which the amount of vitamin C in 100 g of different fruits was measured: mango (37 mg), kiwi fruit (59 mg), apple (6 mg), grapefruit (31 mg), banana (11 mg), grape (11 mg), blackberry (6 mg), orange (54 mg). Plot this data on a bar chart.

3 Look at Figure B.
- **a** ★ What is the independent variable in this survey?
- **b** ★★★ What are the two most popular flavours of crisps?
- **c** ★★★ Explain why it is easier to spot these using the bar chart rather than the table in Figure A on page 36 in S30.

Links

Learn about types of data ⏩ **S5**
Learn about variables ⏩ **S13**
Learn about other ways of presenting data ⏩ **S38**

S34 SCATTER GRAPHS



Scatter graphs are used when you want to find a **correlation** (a link) between two numerical variables.

You use a line graph to see how a variable changes, usually with time. You use a scatter graph to try to find evidence that one variable is having an effect on the other.

A **line of best fit** is often drawn through the points on a scatter graph. The line goes through the middle of the points, so that about half the points are on either side of it. You ignore any **anomalous data** (**outliers**) when drawing a line of best fit.

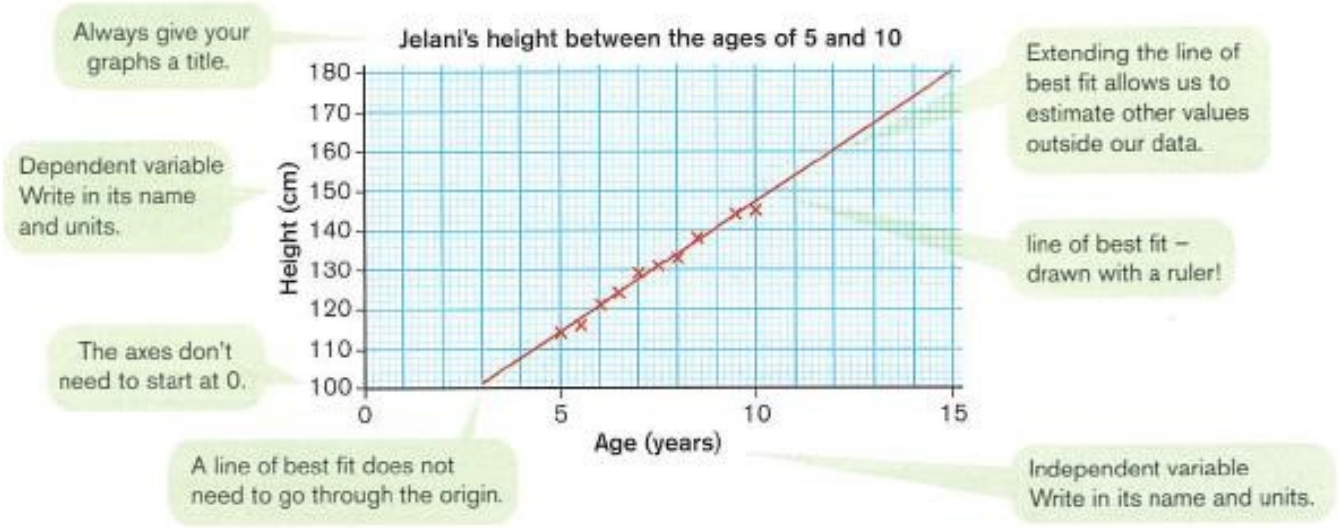


Figure A: This line of best fit shows a correlation between Jelani's height and his age.

QUESTIONS

Level Booster

★★★ decide to draw a scatter graph instead of a line graph and draw a line of best fit

★★ draw a scatter graph

★ read from a scatter graph and identify trends in a scatter graph

1 Look at the scatter graph in Figure A.

a ★What are the independent and dependent variables on this graph?

b ★What intervals is the *y*-axis scale marked up in?

c ★What is the correlation (link) between Jelani's age and his height?

d ★★Estimate Jelani's height at age 12.

2 The table shows the distances of the four inner planets from the Sun, and how long it takes each one to orbit (go around) the Sun.

Planet	Distance from Sun (million km)	Time for one orbit of the Sun (Earth days)
Mercury	58	88
Venus	108	225
Earth	150	365
Mars	228	687

a ★★Plot this data on a scatter graph.

b ★★What correlation (link) can you see?

c ★★★ Draw a line of best fit through the points on your scatter graph.

3 ★★★ Explain why you would use a scatter graph for the data in question **2**, instead of a line graph.

Links

Learn about correlations ▶▶ **S15**
Learn about gradients ▶▶ **S35**
Learn about other ways of presenting data ▶▶ **S38**

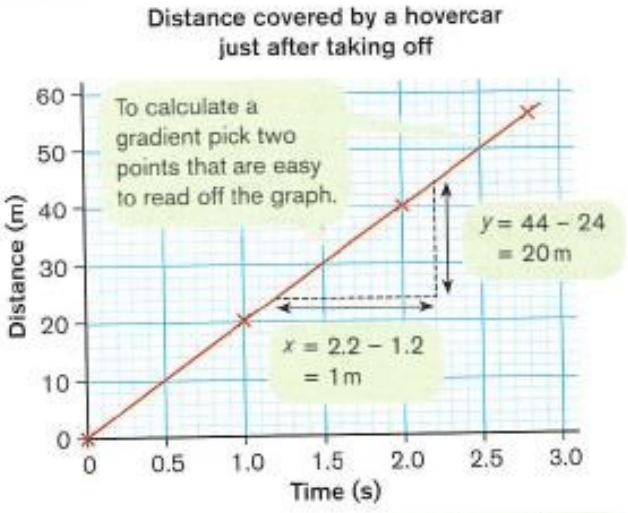
S35 GRADIENTS

Lines on graphs can be used to:

- estimate other values within your data
- estimate other values outside your data
- calculate the **gradient** of a line – the resulting units will be the vertical axis units divided by the horizontal axis units
- see if two variables are directly proportional.

Straight lines that go through the origin show variables that are **directly proportional**. This means that when one variable changes, the other changes in the same way by the same percentage. For example, in Figure A when the distance doubles, the time also doubles.

EXTENSION The equation of a graph showing direct proportion is $y = mx$, where 'm' is the gradient. If the line does not go through the origin, the variables are not directly proportional and the equation is $y = mx + c$, where 'c' is the value at which the line crosses the y-axis.



gradient = y/x
= 20/1
= 20 m/s
So, in this case the gradient is the speed

Figure A: The gradient of a line contains valuable information.

QUESTIONS

Level Booster

★★★ work out the gradient of a line and build equations for lines on graphs

★★ identify variables that are directly proportional

★ recognise that straight-line graphs can be expressed in equations

1 Look Figure A on page 40 in S34.

a ★Estimate Jelani's height at 9 years old and at 12 years old.

b ★★Calculate the gradient of the line.

c ★★What are the units for this gradient?

d ★★ Is age directly proportional to height? Explain your reasoning.

2 Look Figure A on this page.

a ★★ Are the two variables directly proportional? Explain your reasoning.

b ★★★ State the equation for this line, in terms of x and y.

3 Figure B shows the relationship between the Celsius temperature scale and the older Fahrenheit scale.

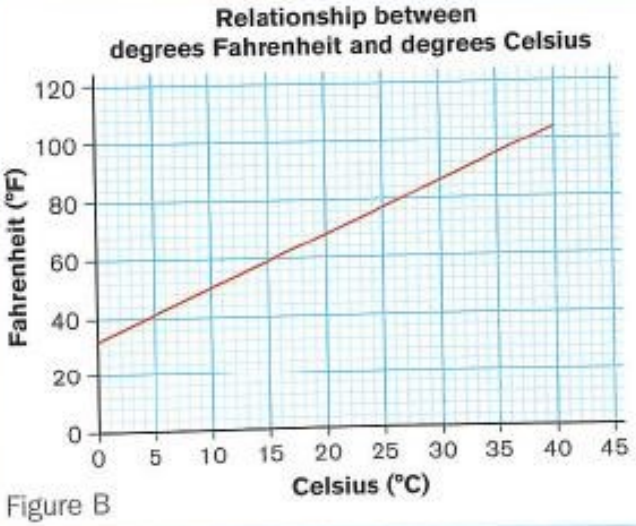


Figure B

a ★★ Are the two variables directly proportional? Explain your reasoning.

b ★★★ State the equation for this line.

Links

Learn about scatter graphs ⏩ S34