

Stage 1 

Creating graphs

Introduction

Chemists may receive information in the form of tables of data. Being able to plot this data on a suitable graph can provide useful information about the relationship between the variables.

Learning objectives

1. Translate information between graphs and tables.
2. Design suitable scales for the axes on a graph.
3. Plot coordinates accurately onto a graph.
4. Draw an appropriate line of best fit.

Which axis to plot?

In chemistry, the **independent variable** is usually plotted on the **x-axis**. This is the variable which the scientist decides to change. In a table of data, the independent variable data usually increases or decreases in equal intervals.

In chemistry the **dependent variable** is what the scientist measures. This is plotted on the **y-axis**.

Look at the experimental descriptions below and decide which variable will go on the *x*- and *y*-axes.

- a) Investigate how the length of magnesium ribbon (mm) affects the volume of hydrogen gas produced (cm³).
- b) Find out how the time taken for a tablet to completely dissolve changes in different water temperatures (°C).
- c) Investigate how the concentration of hydrochloric acid (mol/dm³) affects the volume of gas (cm³) produced when it reacts with calcium.

Which axis to plot? Answer

- a) Independent variable is the length of the magnesium ribbon – x -axis
Dependent variable is the volume of hydrogen gas – y -axis
- b) Independent variable is the water temperature – x -axis
Dependent variable is the time taken for the tablet to dissolve – y -axis
- c) Independent variable is the concentration of acid – x -axis
Dependent variable is the volume of hydrogen gas – y -axis



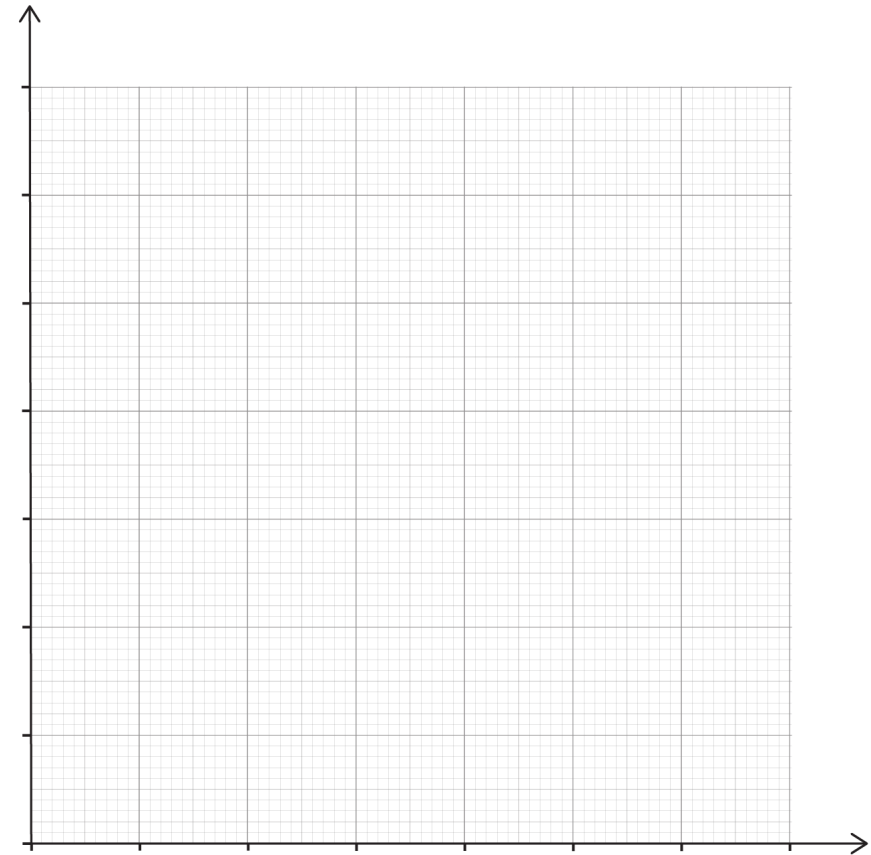
Select an appropriate scale

A

25	2
32	4
37	7
39	8
48	14

B

2	1.9
4	2.3
6	2.7
8	3.3
10	3.8
14	3.4



- Find the range for both axes.
- Suggest suitable scale intervals to plot the data onto this graph paper.

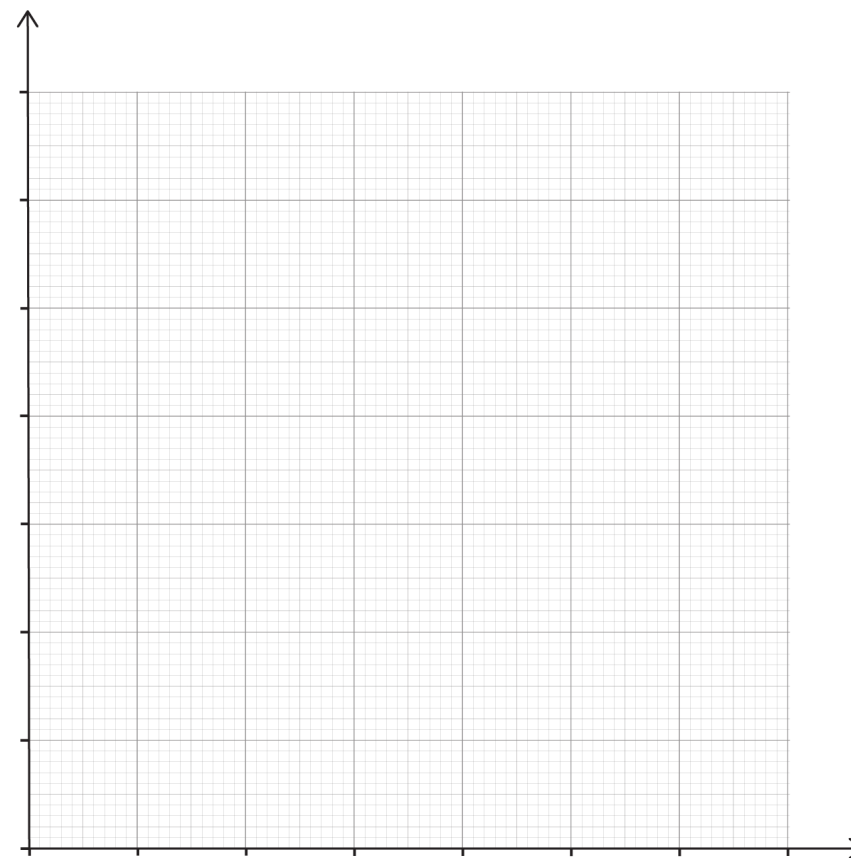
Select an appropriate scale – answers

A

- x-axis: start at 20 and go up in intervals of 5 up to 50. Each small square = 1 unit
- y-axis: start at 0 and go up in intervals of 2 up to 16. Each small square = 0.4 units

B

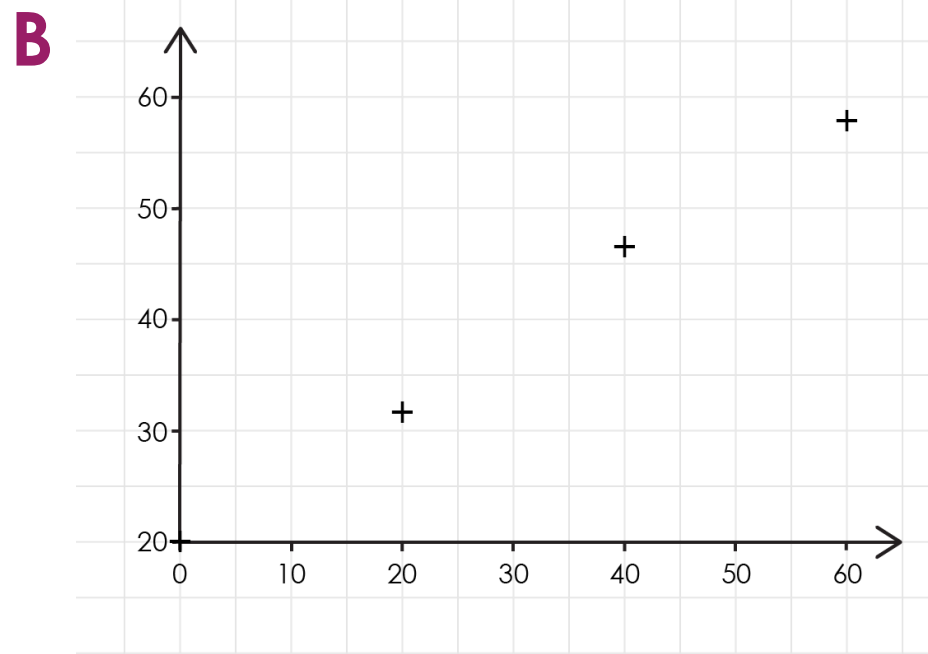
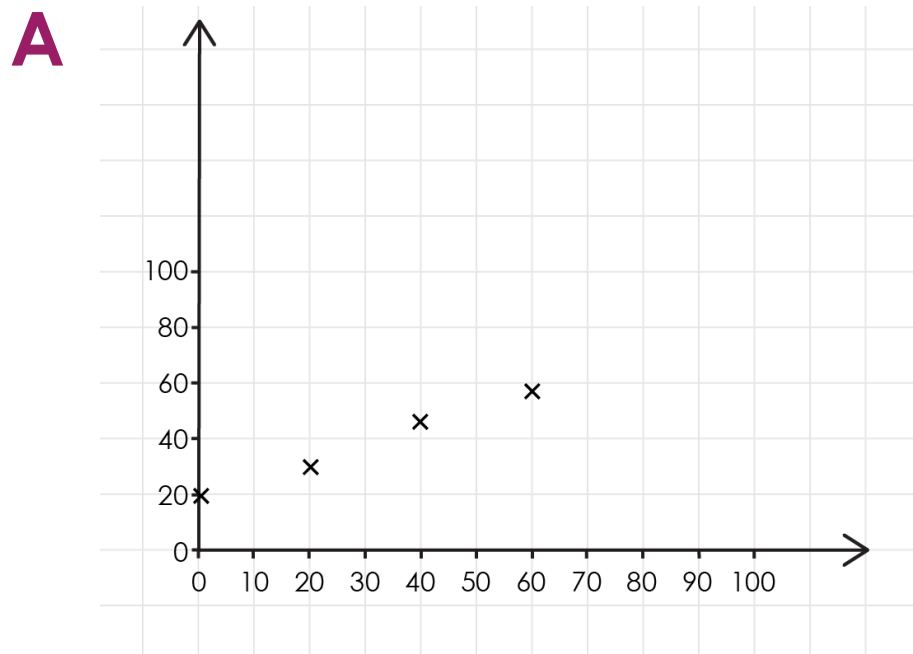
- x-axis: start at 0 (or 2) and go up in intervals of 2 up to 16. Each small square is 0.4 unit
- y-axis: start at 0 and go up in intervals of 0.5 up to a maximum of 4.0. Each small square = 0.1 unit.



Suitable scales

Two learners (A and B) have plotted the **same data**.

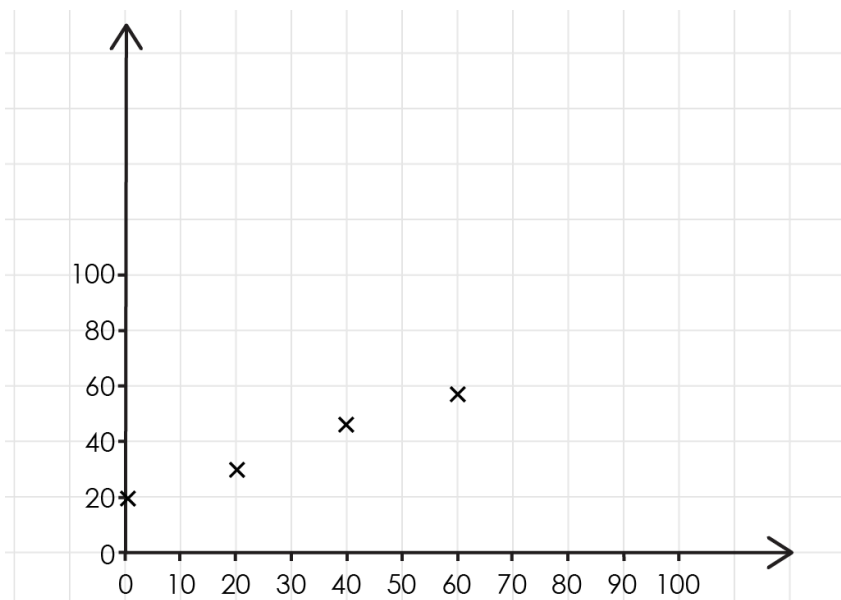
- a) Which scales are better?
- b) Explain why.
- c) How could these scales be improved?



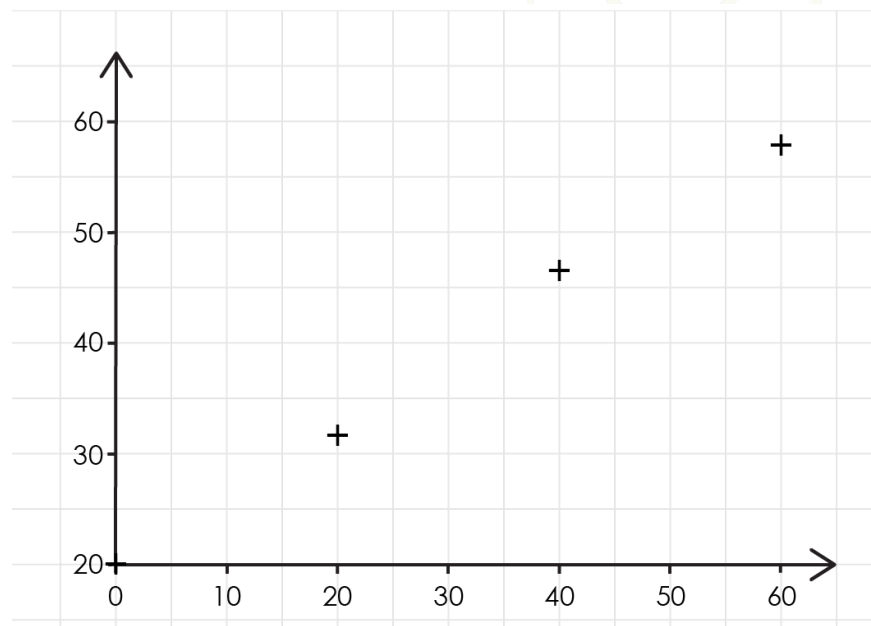
Suitable scales – answers

- a) The scale on learner B's graph is better.
- b) The scale is better because they make full use of the graph paper so that the pattern is easier to see and the values easier to plot.
- c) The scale could be improved by using one more square x-axis to make sure that the coordinates do not fall off the edge.

A



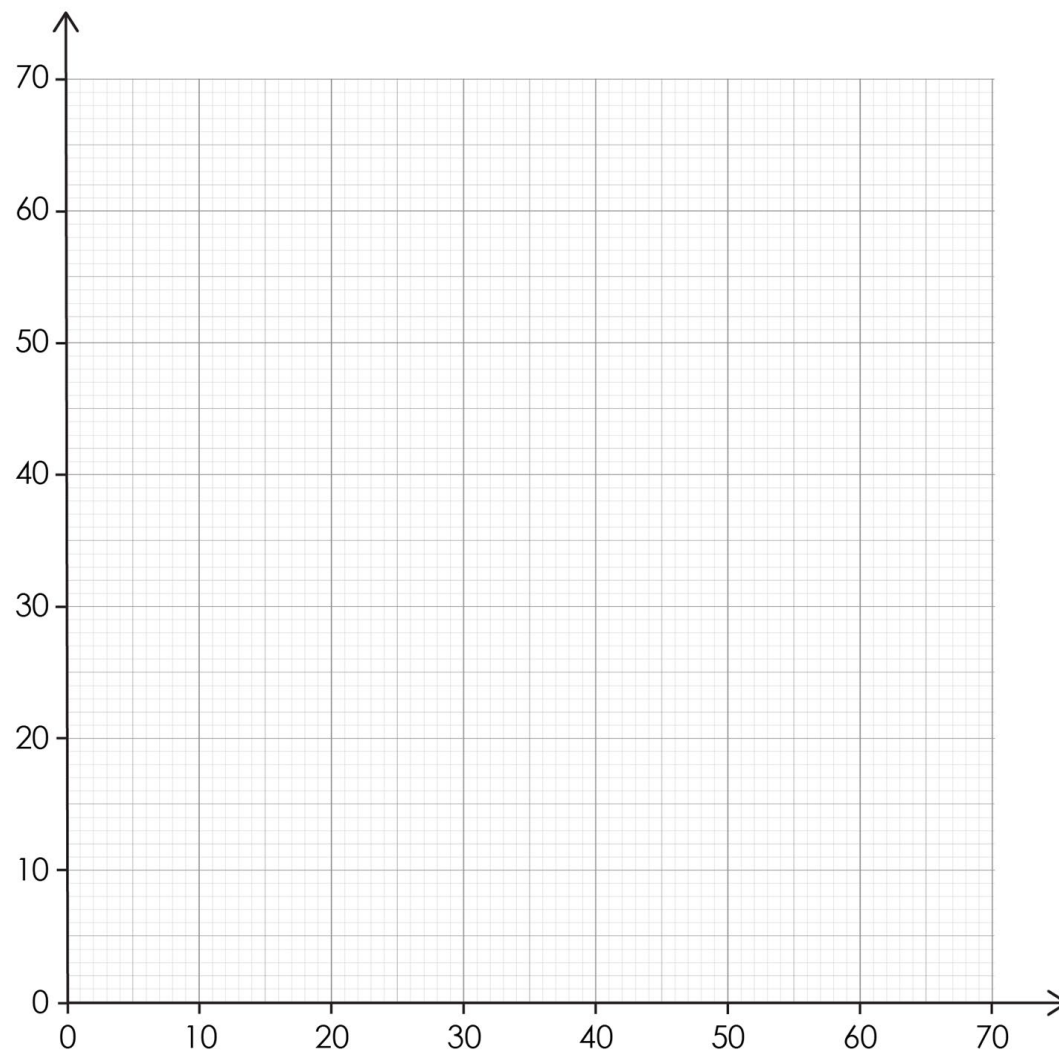
B



Plotting the points

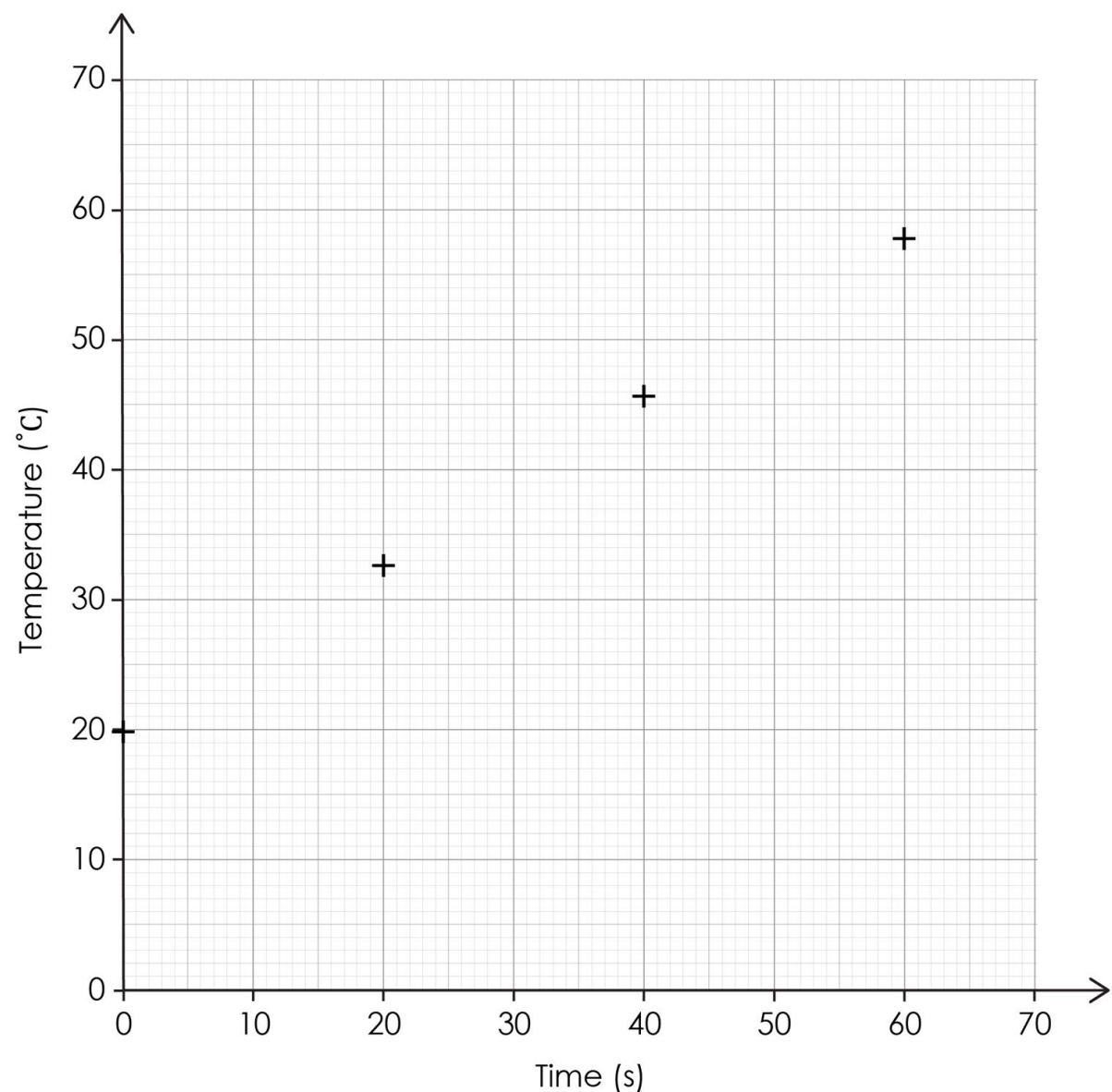
Time (s)	Temperature ($^{\circ}\text{C}$).
0	20
20	33
40	46
60	58

- a) Label the axes on the graph.
- b) What is the coordinate pair for 40 seconds?
- c) Plot the coordinate pairs.
- d) Explain why it is important to use a sharp pencil.





Plotting the points – answers



Line of best fit

A learner has drawn a line of best fit on this graph.

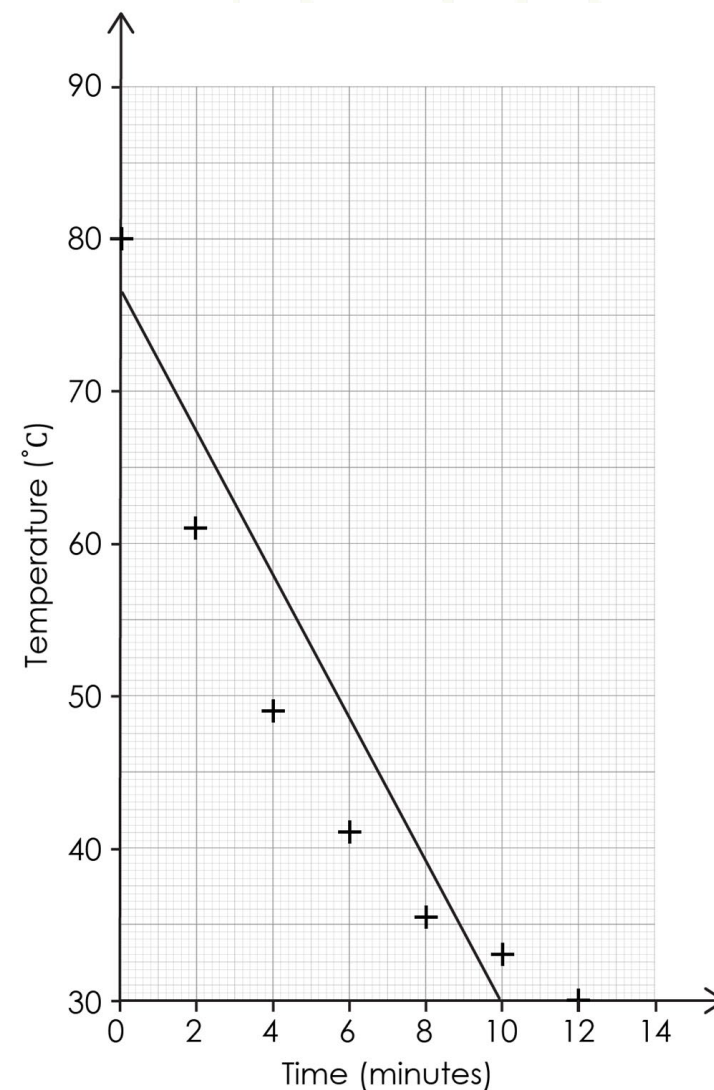
The line of best fit is balanced as there are three points above the line and four below it. So, it is correct.

Learner A

The line of best fit for this data should be a curve.

Learner B

Look at **both** statements and explain whether you agree with the learner or not.





Line of best fit – answer

Learner A is correct with the statement about balancing the points either side of the line of best fit.

However, the data shows that the relationship is not linear. The line of best fit should be a curve, so **Learner B is correct**.

