Patterns in data

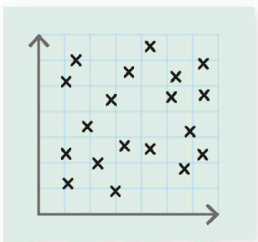
In some experiments, you might look to see if there is a relationship between two variables. In other words, if you change one variable, how does it affect the other?

Key facts

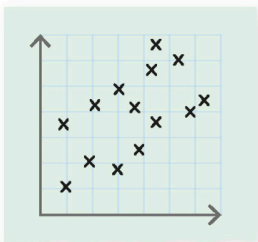
- ✓ **A correlation is when one variable changes as the other variable does.**
- ✓ **A correlation does not show that one change causes the other.**
- ✓ **A relationship between two variables is linear if the points form a straight line when plotted on a graph.**
- ✓ **A relationship is proportional if a straight line goes through the origin.**

Correlation

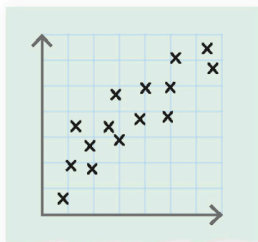
When two variables appear to be linked, we say they are correlated. Plotting a scatter graph of your data is a good way to spot correlations. A correlation between two variables doesn't show that one causes the other. For example, ice cream sales and swimming accidents are positively correlated, but this is because ice cream and swimming are both more popular in hot weather and not because ice cream causes swimming accidents.



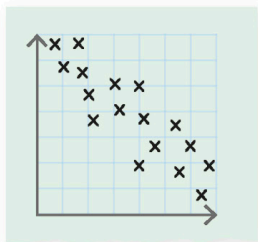
No correlation
The data points are scattered around randomly and show no pattern. There is no correlation between the variables.



Weak correlation
The points look as if they might be grouped around a diagonal line. The large scatter means this is only a weak relationship.



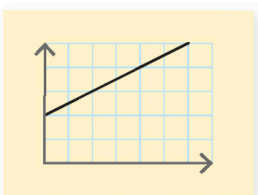
Strong positive correlation
The points form a diagonal line, showing that one variable increases as the other one does.



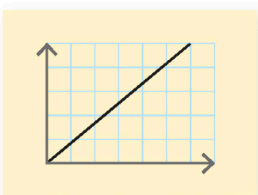
Strong negative correlation
The line formed by these points shows that one variable decreases as the other increases. This is a negative correlation.

Linear and proportional relationships

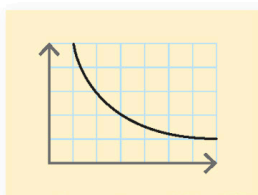
Graphs showing correlation can reveal other interesting patterns in a relationship, depending on their shape.



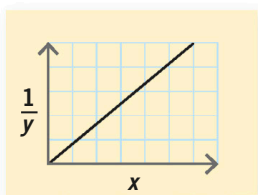
Linear
A correlation where the points form a straight line is described as linear.



Proportional
If the points form a straight line through the origin (where x and y both equal zero), the relationship is described as proportional. This means that if one variable doubles, so does the other.



Inversely proportional
In an inversely proportional relationship, one variable halves when the other doubles. This forms a curved line.

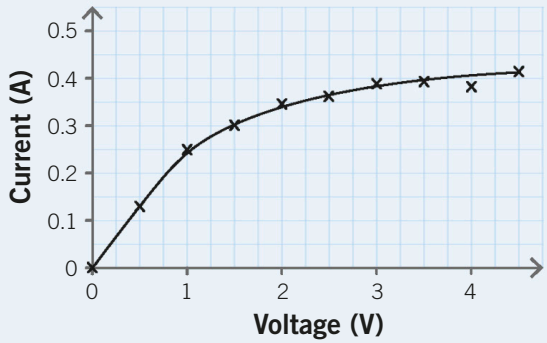


Checking
To check whether a relationship is inversely proportional, plot one variable against the inverse of the other (1 divided by the value). The graph should be a straight line through the origin.

Conclusions

The conclusion of an experiment describes what you found out, interprets the results, and says whether the experiment agrees with the prediction you made.

An electricity experiment
Three students carried out an experiment to test the prediction that the current flowing through a bulb is proportional to the voltage across it. By using an ammeter to measure current in the circuit and a voltmeter to measure voltage across the bulb, they obtained the results shown in the graph. Their conclusions are shown below.



Conclusion 1
"The current does go up when the voltage goes up, so the prediction was correct."

An incorrect conclusion
The description is not detailed, and the graph does not show a proportional relationship, which would produce a straight line.

Conclusion 2
"The current increases as voltage increases, but the graph is a curve. A proportional relationship would produce a straight line, so the prediction was not correct."

A better conclusion
The description has more detail and the final conclusion is correct.

Conclusion 3
"The graph shows that the current increases as the voltage increases. At lower voltages, the relationship could be proportional, as the first few points fall on a straight line. However, at higher voltages, there is a smaller increase in current for every increase in voltage. This shows that the resistance is increasing. The prediction was partially correct, as the current does increase with voltage, but the relationship is not proportional."

An excellent conclusion
The description is much more detailed. The student has used their knowledge of the link between current, resistance, and voltage to suggest what may be causing the change in shape of the graph.