AQA GCSE Maths: Higher

Your notes

Scatter Graphs & Correlation

Contents

Scatter Graphs & Correlation


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Correlation

What is correlation?

- **Correlation** describes how two quantities are related to each other
- **Positive correlation** is when one quantity **increases** and the other quantity **increases**
  - For example, as temperature increases, sales of cold drinks increase
- **Negative correlation** is when one quantity **decreases** while the other quantity **increases**
  - For example, the value of a car decreases as its age increases
- **No (zero) correlation** is where there is no apparent relationship
  - For example, the masses of snails and scores in an exam

What does the phrase "correlation does not imply causation" mean?

- If two quantities **correlate**, it does **not** mean that the first **causes** the second
- For example, each day you record the height of a sunflower and the weight of a puppy
  - As the height of the sunflower **increases**, the weight of the puppy **increases**
    - This is a **positive** correlation
  - But you **cannot claim** that:
    - If you want your puppy to weigh more, make your sunflower taller!
    - Sunflowers grow better when puppies are heavier!
  - Both quantities may be increasing due to another reason
    - In this case, **time**

Scatter Graphs

What are scatter graphs?

- **Scatter graphs** (or **scatter diagrams**) are used to plot **pairs** of data
  - For example, students' Maths grades against their Physics grades

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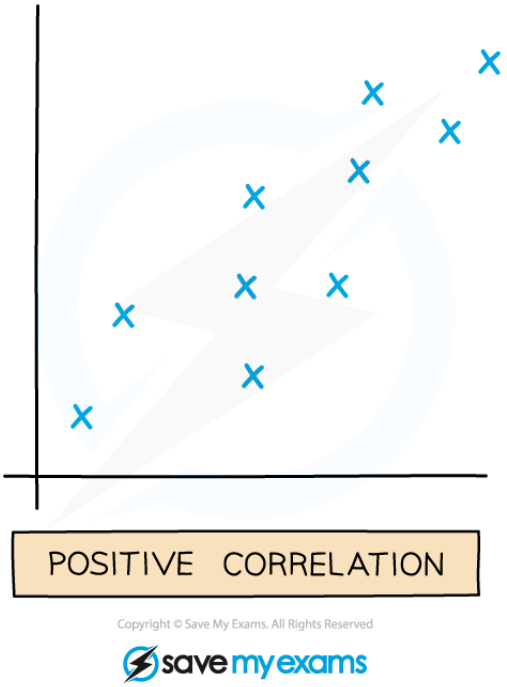
- The vertical and horizontal **axes** represent the two **quantities** being measured
- **Points** are plotted as **crosses**, ×
  - They are **not** joined up
- The general **shape** formed by the points shows the type of **correlation**
  - **Positive** correlation goes from bottom left to top right
    - A positive gradient
  - **Negative** correlation goes from top left to bottom right
    - A negative gradient
  - **No (zero)** correlation looks like a cloud of points
- **Correlations** can be **weak** or **strong**
  - The **stronger** the **correlation**, the **closer to a straight line** the data points lie



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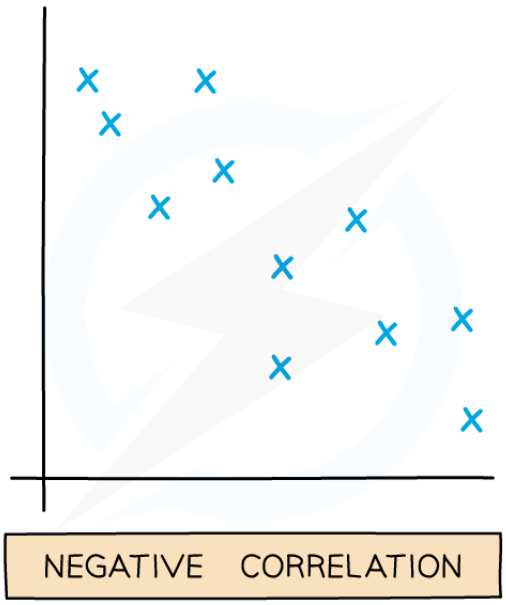

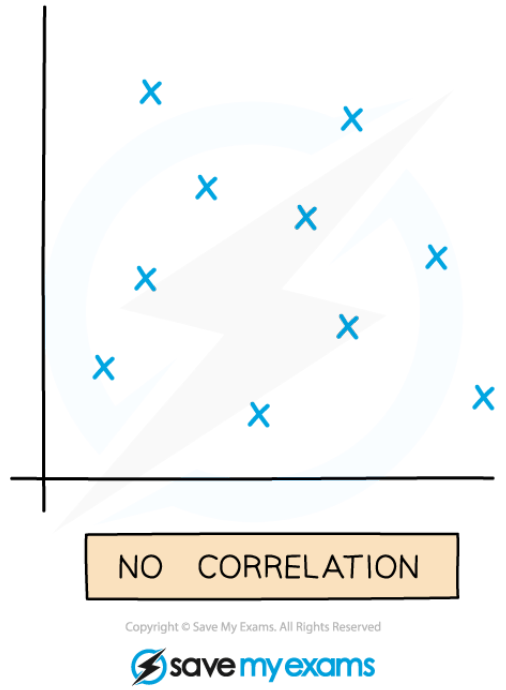

Lines of Best Fit

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Line of Best Fit

What is a line of best fit?

- If a **scatter graph** suggests that there is a positive or negative **correlation**
  - a **line of best fit** can be **drawn** on the scatter graph
    - This can then be used to make **predictions**

How do I draw a line of best fit?

- A **line of best fit** is drawn on **by eye**
  - It is a **single-ruled** straight line
  - It must **extend** across the **full** data set
  - It does **not** need to pass through any particular point(s)
  - There should roughly be as many points on **either side** of the line (along its **whole** length)
- If there is one **extreme value** (outlier) that does not fit the general pattern
  - then **ignore** this point when drawing a line of best fit

How do I use a line of best fit?

- Once the line of best fit is drawn, you can use it to **predict values**
  - E.g. to estimate y when $x = 5$
    - Use the line to read off the y value when x is 5
- It is best to use your line to predict values that lie **within the region** covered by the data points
  - This is called **interpolation**
- Be careful: if you **extend your line too far** away from the data points and try to predict values, those parts of the line are **unreliable**!
  - This is called **extrapolation**

Examiner Tips and Tricks

- Sliding a ruler around a scatter graph can help to find the right position for the line of best fit!

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Worked Example

Sophie wants to know if the price of a computer is related to the speed of the computer.
She tests 8 computers by running the same program on each, measuring how many seconds it takes to finish.
Sophie's results are shown in the table below.

Price (£)	320	300	400	650	250	380	900	700
Time (secs)	3.2	5.4	4.1	2.8	5.1	4.3	2.6	3.7

(a) Draw a scatter diagram, showing the results on the axes below.

Plot each point carefully using crosses

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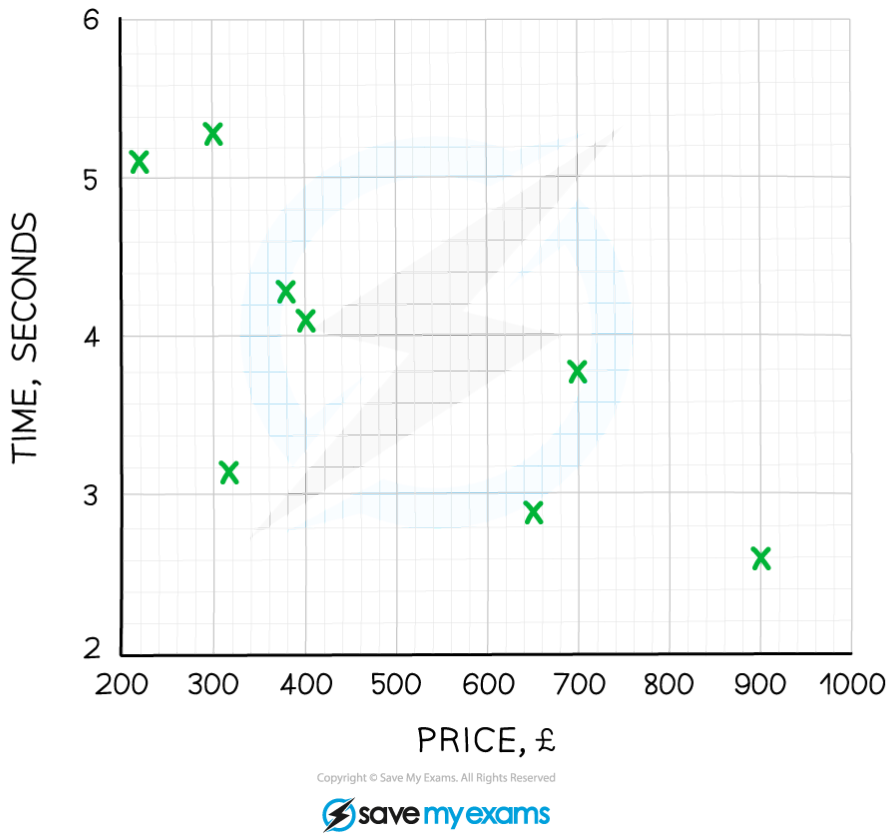

(b) Write down the type of correlation shown and use it to form a suitable conclusion.

The shape formed by the points goes from top left to bottom right (a negative gradient)
This is a negative correlation
As one quantity increases (price), the other decreases (time)

The graph shows a negative correlation
This means that the more a computer costs, the quicker it is at running the program

(c) Use a line of best fit to estimate the price of a computer that completes the task in 3.4 seconds.

First draw a line of best fit, by eye
Then draw a horizontal line from 3.4 seconds to the line of best fit
Draw a vertical line down to read off the price

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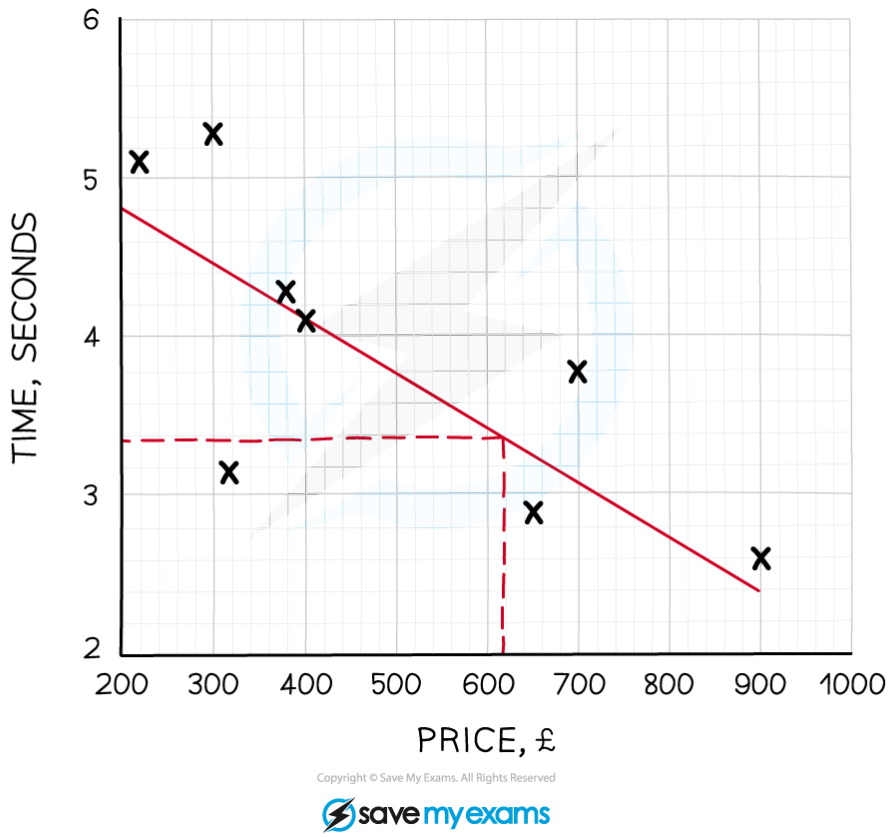

A computer that takes 3.4 seconds to run the program should cost around £620

A range of different answers will be accepted, depending on the line of best fit