



Cambridge O Level Maths



Your notes

Scatter Graphs & Correlation

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Scatter Graphs

Correlation

What is correlation?

- **Correlation** is a way of describing the way two quantities are related to each other
 - You may see this referred to as *linear* correlation
 - The word linear will not appear in an exam question
- Correlation can be one of three types
 - **Positive correlation**
 - This is where one quantity **increases** as the other quantity **increases**
 - Examples
 - As the temperature increases, the sales of cold drinks increase
 - As the age of a tree increases, its height increases
 - **Negative correlation**
 - This is where one quantity **decreases** as the other quantity **increases**
 - Examples
 - The age of a car and its value
 - The amount of daylight hours and the time spent indoors
 - **No correlation**
 - This is where there is no apparent relationship between the two quantities
 - Examples
 - The batting average of a cricketer and the cost of a pint of milk
 - The amount of time spent playing computer games and the weight of an elephant
- Note in some cases, a correlation might not be true all the time
 - For example, a tree will reach an age where it is fully grown and its height no longer increase
- There could also be exceptions to quantities that have correlation
 - For example, an old, but rare, sports car may be worth a lot of money

What does the phrase "correlation doesn't mean causation" mean?

- Correlation only refers to whether two quantities are linked by the way their values increase or decrease
- It does not necessarily mean they are linked in real-life
 - One quantity increasing or decreasing does not **cause** the other quantity to increase or decrease
 - e.g. the volume of cheese eaten by a population and the number of marriages in that population
 - both could be increasing but an increase in the volume of cheese eaten does not **cause** people to get married
- It could be that the two quantities are not linked in real-life but can appear linked due to a third quantity - usually time
 - e.g. the height of a sunflower and the weight of a puppy
 - the height of a sunflower does not **cause** the weight of a puppy to change!
 - but both generally increase with time



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Scatter Graphs

What is a scatter graph?

- **Scatter graphs** are used to quickly see if there is a connection (correlation) between two pieces of data
 - For example a teacher may want to see if there is a link between grades in mathematics tests and grades in physics tests
- You may also come across scatter plots or scatter diagrams
 - these are the same as scatter graphs

What do scatter graphs look like?

- For each data pair, points are plotted
 - they are not joined up!
 - points are 'scattered' around the diagram
- The general shape the points form indicate the type of correlation they are showing



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NEGATIVE CORRELATION

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NO CORRELATION

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How do I draw a scatter graph?

- This is simply a matter of plotting points - usually from a table of values
 - be very careful which way round you are plotting them

- this is particularly important when values are very similar



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Line of Best Fit

What is a line of best fit?

- If a **scatter graph** suggests 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 predict one data value from the other
e.g. we can use the physics grade for a student to predict their maths grade

How do I draw a line of best fit?

- A **line of best fit** can be drawn by eye
 - it does not have to pass through any particular point(s)
 - however, in some cases it would make sense that it is drawn through the origin
e.g. the height and weight of a kitten
 - there should roughly be as many points on one side of the line as the other
 - the spaces between the points and the line should roughly be the same on either side



Examiner Tip

- Watch out for **outliers** on scatter graphs
 - these are rogue results or values that do not follow the general pattern of the data/graph
 - you should ignore these points when judging where to draw your line of best fit
 - you'll usually only see one of these in a question, if any



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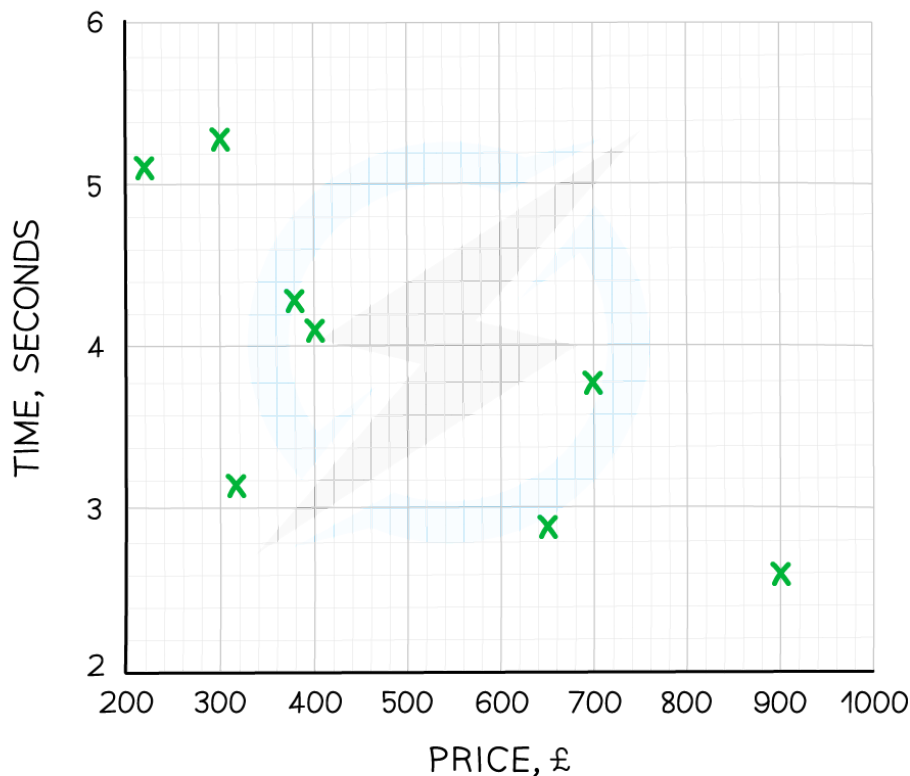
Worked example

Sophie is investigating the price of computers to see if the more they cost, the quicker they are. She tests 8 computers and runs the same program on each, measuring how many seconds each takes to complete the program. 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 graph to show this information.

Draw the points carefully and accurately as to not miss any out.



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(b) Describe the correlation and explain what this means in terms of the question.

As we are asked to explain what the correlation means in terms of the question we need to mention the connection between cost and speed.

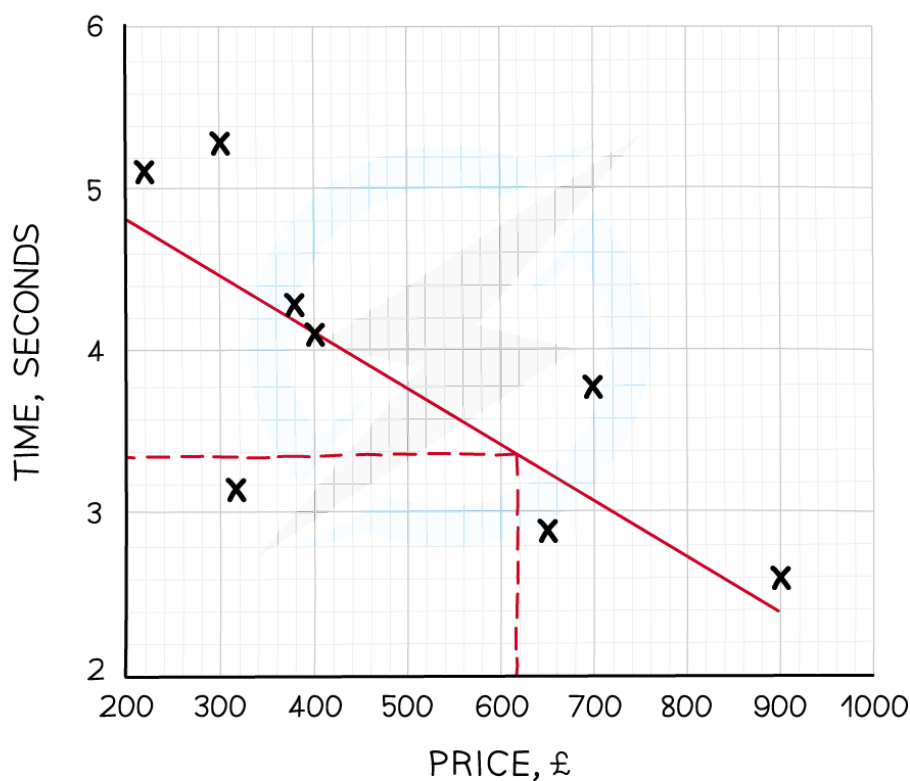


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The graph shows negative correlation
This means that the more a computer costs, the quicker it is at running the program

- (c) Showing your method clearly, estimate the price of a computer that completes the task in 3.5 seconds.

First draw a line of best fit, by eye.



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Draw a horizontal line from 3.5 on the time axis until it hits the line of best fit, then draw a vertical line down to the price axis and take a reading.

The price of a computer taking 3.5 seconds to run the program should cost around £612

Due to possible difficulties of reading an exact value a range of answers will be acceptable