



# Scatter diagrams and correlation

About 50 minutes   Calculator allowed   41 marks

Date \_\_\_\_\_

## A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

**A1** Needed today [2 marks]   **A2** From chapter 5 [2 marks]

$M(-3, 1)$  is the midpoint of  $A(0, 4)$  and  $B$ . Find the coordinates of  $B$ .

Answer .....

In a histogram of the journey times, in minutes, of some commuters, the class  $10 < t \leq 25$  has frequency 10 and is drawn as a bar 3 cm tall. The class  $25 < t \leq 55$  has frequency 32. How tall should its bar be?

Answer .....

**A3** Last lesson [2 marks]   **A4** Maths skill [2 marks]

A gym's new members in Q2 of three years were 71, 92, 108. The trend values for those quarters were 78, 94, 111, and the mean of all twelve quarters was 91. Work out the mean seasonal variation for Q2, to 1 decimal place.

Answer .....

7 numbers have a mean of 13. 6 of the numbers are 2, 10, 28, 8, 6, 8. Find the other number.

Answer .....

## B Examples, then your turn

Your teacher works through each example with you. Then try the one beside it.

### EXAMPLE 1

A gardener records the amount of fertiliser each plant is given and the height it grows to. Which is the explanatory variable? Which axis should it go on?

**Hint** Ask which one is changed, and which one is expected to change because of it.

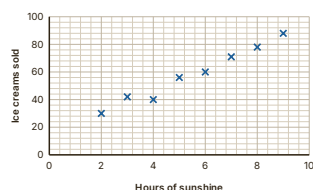
**B1** A family records the outside temperature each day and the amount of gas used to heat their house that day. Write down the explanatory variable and give a reason. Which axis of a scatter diagram should it go on?

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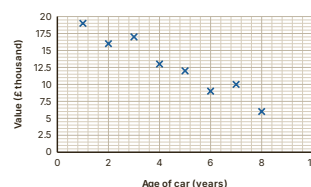
### EXAMPLE 2

The scatter diagram shows the hours of sunshine and the number of ice creams sold at a beach kiosk on 8 days. Describe the correlation and interpret it in context.



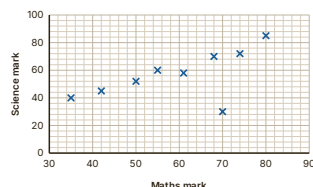
**Hint** Say the type of correlation, then say what it means using the words in the question.

**B2** The scatter diagram shows the age and the value of 8 cars of the same model. Describe the correlation and interpret it in context.



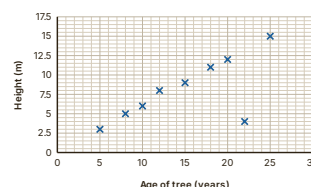
### EXAMPLE 3

The scatter diagram shows the maths and science marks of 9 students. One student's marks do not fit the pattern. Write down this student's marks and give a possible reason.



**Hint** Look for the point far from the others. Read across and up to the axes.

**B3** The scatter diagram shows the age and the height of 9 trees. Write down the age and the height of the tree that does not fit the pattern. Give a possible reason.



**EXAMPLE 4**

For children aged 5 to 11 there is positive correlation between shoe size and reading score. Explain why this does not mean that bigger feet make a child read better.

**Hint** Think of something that makes both of them go up.

- B4** In a survey of 12 towns, there is strong positive correlation between the number of cafés in a town and the number of road accidents each year. A councillor says that the cafés cause the accidents. Explain why the councillor may be wrong.

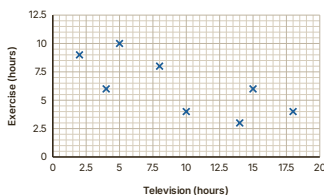
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## **c** Practice

- C1** The scatter diagram shows the hours of television watched and of exercise taken by 8 people last week. Two more people watched 7 and 12 hours and exercised for 5 and 7 hours. Plot these two points. Describe the strength and the type of correlation for all 10 people. [4 marks]

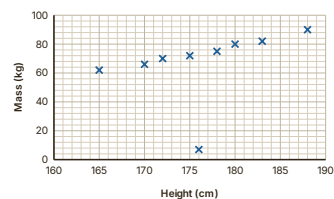


Answer ..... correlation

- C3** Write down the type of correlation you would expect for each pair: positive, negative or none. (i) The hours a waiter works and his pay. (ii) The outside temperature and the number of coats a shop sells. (iii) A person's house number and their age. [3 marks]

Answer (i) ..... (ii) ..... (iii) .....

- C2** Amy recorded the height and the mass of 9 men. She thinks the point at 176 cm should be removed. Is she right? Give a reason. [2 marks]




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- C4** A vet records the age and the mass of 20 dogs of one breed. Give two reasons why a scatter diagram is a suitable way to show these data. [2 marks]

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## D Exam-style questions

- D1** Jo wants to find out if students who spend more time on social media sleep for fewer hours. This is her plan. [4 marks]

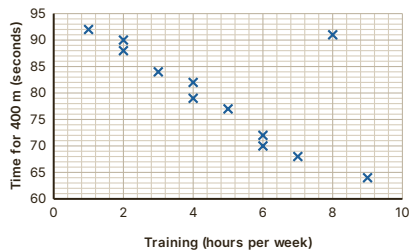
Step 1: ask the 8 students in her friendship group how many hours they spent on social media yesterday and how many hours they slept last night.

Step 2: draw a scatter diagram with hours of sleep on the horizontal axis.

Step 3: if the points show negative correlation, conclude that social media makes students sleep less.

Assess Jo's plan. Comment on each part of it.

- D2** A coach records the number of hours 12 students train each week and the time each student takes to run 400 m.



- (a) Describe the correlation. Interpret it in the context of the question. [2 marks]
- (b) One student does not fit the pattern. Write down this student's hours of training and time. The coach decides not to remove this result. Give a reason why. [2 marks]
- (c) Work out the percentage of these students who ran 400 m in less than 75 seconds. Give your answer to 1 decimal place. [2 marks]

Answer .....

Total for D2: 6 marks

## E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

**E1** The table shows the population, the number of libraries and the number of cafés in six towns. The numbers of libraries and cafés show strong positive correlation. Nadia says, "Libraries bring cafés to a town." [4 marks]

Work out the number of libraries and the number of cafés for every 10 000 people in each town. Use your answers to comment on Nadia's claim.

| Town       | A      | B      | C      | D      | E      | F       |
|------------|--------|--------|--------|--------|--------|---------|
| Population | 10 000 | 20 000 | 40 000 | 60 000 | 90 000 | 120 000 |
| Libraries  | 1      | 5      | 6      | 6      | 18     | 12      |
| Cafés      | 3      | 6      | 24     | 30     | 63     | 60      |

### Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Divide each count by the number of 10 000s of people in that town.
- Hint 2** Town B has 2 lots of 10 000 people, so  $5 \div 2 = 2.5$  libraries for every 10 000 people.
- Hint 3** Libraries per 10 000: 1, 2.5, 1.5, 1, 2, 1. Cafés per 10 000: 3, 3, 6, 5, 7, 5. Do these go up together?

### How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can describe correlation in context. ☐ ☐ ☒
- I can choose the explanatory variable and spot a point that does not fit. ☐ ☐ ☒
- I can explain why correlation does not show cause. ☐ ☐ ☒