

Exercise walk-through

C9.5

Scatter diagrams

IGCSE Mathematics

You must be able to

- Plot paired observations and identify correlation
- Draw a balanced by-eye best-fit line
- Distinguish interpolation, extrapolation and a causal claim

1

The method

Method — Key knowledge: Scatter diagrams

A scatter diagram plots paired observations with small crosses; do not join consecutive points. Positive correlation rises overall, negative falls, zero has no clear pattern. Draw a single ruled line of best fit by eye across the whole data range, with roughly balanced points on either side. It need not pass through the origin or a data point. Use it to estimate within the observed range; extrapolation outside is less reliable. Correlation does not establish cause.

Exercises 2.1-2.3

2.1 Name the correlation when points tend to fall from left to right. [2]

2.2 Explain why scatter points should not be joined in order. [2]

2.3 A best-fit line is $y = 2x + 10$. Estimate y at $x = 7$. [2]

Exercises 2.1-2.3

2.1 Name the correlation when points tend to fall from left to right. [2]

2.1

- The variables move oppositely: **negative correlation**.

2.2 Explain why scatter points should not be joined in order. [2]

2.2

- **Each point is a separate paired observation**; connecting them suggests a sequence the data may not have.

2.3 A best-fit line is $y = 2x + 10$. Estimate y at $x = 7$. [2]

2.3

- $y = 2(7) + 10 = \mathbf{24}$, a line-based estimate.

Exercise 2.4

2.4 Observations cover $2 \leq x \leq 8$. Which estimate is usually safer: $x = 5$ or $x = 20$?
Explain. [2]

3 Exam-style questions

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3 Exam-style questions

2.4

- $x = 5$ is within the data; $x = 20$ extrapolates and the trend may change.

Exercise 3.1 (a)

3.1 Apply the scatter diagrams methods below. Show working and include units where appropriate.

(a) Plot crosses for $(1, 12)$, $(2, 15)$, $(3, 19)$, $(4, 20)$, $(5, 24)$ and state the correlation. [2]

Exercise 3.1 (a)

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(a) Plot crosses for $(1, 12)$, $(2, 15)$, $(3, 19)$, $(4, 20)$, $(5, 24)$ and state the correlation. [2]

(a)

- **Five correctly plotted crosses; positive correlation.**

Exercise 3.1 (b)

3.1 Apply the scatter diagrams methods below. Show working and include units where appropriate.

(b) Draw a line of best fit and estimate y at $x = 3.5$.

[2]

Exercise 3.1 (b)

3.1 Apply the scatter diagrams methods below. Show working and include units where appropriate.

(b) Draw a line of best fit and estimate y at $x = 3.5$. [2]

(b)

- A reasonable line is $y = 3x + 9$, so $y = 19.5$. Accept **about 19 to 21** from a sensible balanced line.

Exercise 3.1 (c)

3.1 Apply the scatter diagrams methods below. Show working and include units where appropriate.

(c) Explain why this diagram does not show that increasing x causes y to increase. [2]

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(c) Explain why this diagram does not show that increasing x causes y to increase. [2]

(c)

- **Another variable may affect both quantities; the diagram shows association only.**

Exercise 3.2 (a)

3.2 A scatter diagram records room temperatures from 15°C to 25°C and drink sales. A by-eye best-fit line is $s = 4T - 20$, where T is temperature and s is sales.

(a) Use the line to estimate sales at 22°C . Find the temperature corresponding to an estimate of 60 sales. [3]

Exercise 3.2 (a)

3.2 A scatter diagram records room temperatures from 15°C to 25°C and drink sales. A by-eye best-fit line is $s = 4T - 20$, where T is temperature and s is sales.

(a) Use the line to estimate sales at 22°C . Find the temperature corresponding to an estimate of 60 sales. [3]

(a)

- Substitute $T = 22$: $s = 4(22) - 20 = \mathbf{68}$.
- For 60 sales, $60 = 4T - 20$, so $T = \mathbf{20^{\circ}\text{C}}$.

Exercise 3.2 (b)

3.2 A scatter diagram records room temperatures from 15°C to 25°C and drink sales. A by-eye best-fit line is $s = 4T - 20$, where T is temperature and s is sales.

(b) Evaluate a prediction at 35°C and the claim that raising the room temperature must increase sales. Give reasons using the data range and meaning of correlation. [3]

Exercise 3.2 (b)

3.2 A scatter diagram records room temperatures from 15°C to 25°C and drink sales. A by-eye best-fit line is $s = 4T - 20$, where T is temperature and s is sales.

(b) Evaluate a prediction at 35°C and the claim that raising the room temperature must increase sales. Give reasons using the data range and meaning of correlation. [3]

(b)

- The line predicts $s = 4(35) - 20 = \mathbf{120}$, but 35°C is outside the observed range, so this is extrapolation.
- A relationship can change outside that range.
- Correlation does not prove causation; other factors, such as visitor numbers, may affect both variables.