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ANSWER BOOK

# Correlation and regression

Statistics · Year 12–13

7 questions · 20 marks

NAVY EDITION

## SECTION A · Warm-up

- A1** Strong negative correlation: as one variable rises the other falls, and the points hug a downhill straight line closely. The sign gives the direction, the nearness to  $\pm 1$  the strength. [2]
- A2** The gradient: each extra hour of revision is associated with about 0.6 more marks. The intercept: about 3.5 marks predicted with no revision at all. The phrasing earns the marks: 'associated with', not 'causes', and both interpretations must mention hours and marks, not  $x$  and  $y$ . [3]

## SECTION B · Standard

- B1**  $y = 3.5 + 0.6 \times 10 = 9.5$  marks. The prediction is trustworthy because 10 hours sits comfortably inside the observed range: this is interpolation, the regression line's home ground. [3]
- B2** The arithmetic gives  $3.5 + 24 = 27.5$ , but the number deserves no trust: 40 hours lies far outside the 2-to-15-hour window the line was fitted to. This is extrapolation, and nothing in the data says the straight-line pattern continues out there; returns to revision may well flatten. The right answer is the refusal, with the reason. [4]
- B3** It shows the two rise and fall together; it does not show either causes the other. Hot weather drives both: more swimming and more ice cream. A lurking third variable can manufacture a correlation between two things that never touch: correlation is not causation. [3]

## SECTION C · Stretch

- C1** The line was fitted by minimising the vertical distances, treating  $x$  as known and  $y$  as the response. Predicting backwards swaps those roles, and the correct line for that job,  $x$  on  $y$ , is a different line. One direction of prediction per fitted line. [3]
- C2** Essentially no linear relationship: the points form a shapeless cloud around any straight line. It does not rule out a relationship altogether, though: a strong curve can hide behind a near-zero  $r$ , which only measures straightness. [4]