

# Exercise walk-through

## Least Squares Regression ■ 2.8

eXercise

## You must be able to

- explain that the **least-squares line** minimises the sum of the **squared residuals**
- interpret the **coefficient of determination** 決定系数  $r^2$
- interpret the **standard deviation of the residuals**  $s$

## Method — Least squares

The **least-squares line** is the line that makes the **sum of the squared residuals** as small as possible.

## Method — $r^2$ and $s$

- $r^2$  — the proportion of the variation in  $y$  that the model **explains** (between 0 and 1). It is the square of the correlation  $r$ .
- $s$  — the standard deviation of the residuals, i.e. the **typical prediction error**.

## Practice 2.1 ■ 1 mark

State what the least-squares line minimises.

## Solution 2.1

Method: Least squares

### Worked steps

the sum of the squared residuals **B1**.

## Practice 2.2 ■ 1 mark

State what  $r^2$  represents.

## Solution 2.2

### Worked steps

the proportion of the variation in  $y$  explained by the model **B1**.

## Practice 2.3 ■ 2 marks

If  $r = 0.8$ , find  $r^2$ .

## Solution 2.3

## Worked steps

$$r^2 = 0.8^2 = 0.64 \quad \text{M1} \quad \text{A1}.$$

## Exam-style 3.1 ■ 1 mark

The least-squares line minimises the sum of the

- A** residuals
- B** squared residuals
- C**  $x$ -values
- D** predictions

## Solution 3.1

Method: Least squares

- A residuals
- B squared residuals**
- C x-values
- D predictions



### Worked steps

B.

## Exam-style 3.2 ■ 1 mark

An  $r^2$  of 0.64 means

- A** 64% of the variation in  $y$  is explained by the model
- B**  $r = 0.64$
- C** there are 64 outliers
- D** there is no relationship

## Solution 3.2

**A** 64% of the variation in  $y$  is explained by the model



**B**  $r = 0.64$

**C** there are 64 outliers

**D** there is no relationship

**Worked steps**

**A.**

## Exam-style 3.3 ■ 2 marks

A regression has  $r = 0.9$ .

- (a) Find  $r^2$ .
- (b) Interpret  $r^2$  in context (the variation in  $y$ ).

## Solution 3.3

### Worked steps

(a)  $r^2 = 0.9^2 = 0.81$  **M1** **A1**. (b) about 81% of the variation in  $y$  is explained by the model **B1**.