

Exercise walk-through

Linear Regression Models ■ 2.6

eXercise

You must be able to

- use a **least-squares regression line** 最小二乘回归线 $\hat{y} = a + bx$
- interpret the **slope** b and the **y-intercept** a in context
- use the model to **predict** a response for a given explanatory value

Method — The regression line

$\hat{y} = a + bx$, where:

- the **slope** b is the predicted change in $\hat{y}$ for each one-unit increase in x ;
- the **y-intercept** a is the predicted $\hat{y}$ when $x = 0$.

Method — Prediction

Substitute the explanatory value into the model. For $\hat{y} = 2 + 3x$ at $x = 4$:
 $\hat{y} = 2 + 12 = 14$, and the slope 3 means $\hat{y}$ rises by 3 per unit of x .

Practice 2.1 ■ 1 mark

In $\hat{y} = a + bx$, state what b represents.

Solution 2.1

Worked steps

the predicted change in $\hat{y}$ for each one-unit increase in x **B1**.

Practice 2.2 ■ 2 marks

For $\hat{y} = 5 + 2x$, predict y when $x = 10$.

Solution 2.2

Worked steps

$$\hat{y} = 5 + 2(10) = 25 \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

State what the y -intercept a represents.

Solution 2.3

Worked steps

the predicted value of $\hat{y}$ when $x = 0$ **B1**.

Exam-style 3.1 ■ 1 mark

In a regression line $\hat{y} = a + bx$, the slope is

A a

B b

C x

D $\hat{y}$

Solution 3.1

Method: The regression line

A a

B b



C x

D $\hat{y}$

Worked steps

B.

Exam-style 3.2 ■ 1 mark

To predict a response value, you

- A** subtract a
- B** substitute the explanatory value into the model
- C** use the median
- D** ignore x

Solution 3.2

- A subtract a
- B substitute the explanatory value into the model 
- C use the median
- D ignore x

Worked steps

B.

Exam-style 3.3 ■ 2 marks

A model $\hat{y} = 20 + 4x$ predicts a test score from hours studied.

- (a) Predict the score for $x = 6$ hours.
- (b) Interpret the slope in context.

Solution 3.3

Method: Prediction

Worked steps

(a) $\hat{y} = 20 + 4(6) = 44$ **M1** **A1**. (b) each extra hour studied adds about 4 points to the predicted score **B1**.