

2.6 Linear Regression Models

Name: _____ Class: _____ Date: _____ Total: 9 marks

KEY WORDS least-squares regression line 最小二乘回归线 • slope 斜率

Objective

Build the skills to answer exam questions on **linear regression models**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ 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 $x = 0$.

■ 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 .

2 Practice

2.1 In $\hat{y} = a + bx$, state what b represents. [1]

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

2.3 State what the y -intercept a represents. [1]

3 Exam-style questions

3.1 In a regression line $\hat{y} = a + bx$, the slope is [1]

- A a
- B b
- C x
- D $\hat{y}$

3.2 To predict a response value, you [1]

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

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

(a) Predict the score for $x = 6$ hours. [2]

(b) Interpret the slope in context. [1]

Solutions

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

2.2 $\hat{y} = 5 + 2(10) = 25$.

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

3.1 B.

3.2 B.

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