

2.8 Least Squares Regression

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS coefficient of determination 决定系数 • residual 残差

Objective

Build the skills to answer exam questions on **least-squares regression**.

You must be able to:

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

1 Worked examples

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

■ Least squares

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

■ 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**.

2 Practice

2.1 State what the least-squares line minimises.

[1]

2.2 State what r^2 represents.

[1]

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

[2]

3 Exam-style questions

3.1 The least-squares line minimises the sum of the [1]

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

3.2 An r^2 of 0.64 means [1]

- **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
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3.3 A regression has $r = 0.9$.

(a) Find r^2 . [2]

(b) Interpret r^2 in context (the variation in y). [1]

Solutions

2.1 the sum of the squared residuals.

2.2 the proportion of the variation in y explained by the model.

2.3 $r^2 = 0.8^2 = 0.64$.

3.1 B.

3.2 A.

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