

9.5 Carrying Out a Test for the Slope of a Regression Model

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS linear 线性 • regression 回归

Objective

Build the skills to answer exam questions on **carrying out a test for the slope**.

You must be able to:

- compute the slope t statistic and find the **p-value**
- compare it to α and reach a decision
- state a conclusion about the linear relationship in context

1 Worked examples

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

■ The procedure

1. State $H_0 : \beta = 0$ and H_a ; check conditions.
2. Compute $t = \frac{b}{SE(b)}$ with $df = n - 2$.
3. Find the **p-value** from the t -distribution.
4. Compare to α : a **small** p-value $\rightarrow$ **reject** $H_0 \rightarrow$ there is a linear relationship.

■ A worked test

A regression gives slope $b = 2.5$ with $SE(b) = 1.0$ from $n = 12$ points. Then

$$t = \frac{2.5}{1.0} = 2.5, \quad df = 12 - 2 = 10,$$

a p-value $\approx 0.03 < 0.05$ – reject $H_0 : \beta = 0$, so a linear relationship exists.

2 Practice

2.1 State the steps to carry out a slope test. [2]

2.2 State what a small p-value indicates about the slope. [1]

2.3 A slope test gives a p-value of 0.001 at $\alpha = 0.05$. State the decision. [1]

3 Exam-style questions

3.1 A slope test with a small p-value suggests [1]

- **A** no relationship
- **B** a real linear relationship
- **C** bias
- **D** a curved pattern

3.2 A slope test rejects H_0 when the p-value is [1]

- **A** above α
- **B** below α
- **C** exactly zero
- **D** exactly one

3.3 A slope test gives $t = 3.0$, $df = 20$, p-value 0.007 at $\alpha = 0.05$.

- (a) State the decision. [1]
(b) State whether there is a linear relationship. [1]
(c) State the conclusion in context. [1]

Solutions

2.1 state hypotheses and check conditions; compute t ; find the p-value; compare to α and conclude.

2.2 the slope is significantly different from 0 — a real linear relationship.

2.3 reject H_0 ($0.001 < 0.05$).

3.1 B.

3.2 B.

3.3 (a) reject H_0 . (b) yes. (c) there is convincing evidence of a linear relationship between the variables.