

Exercise walk-through

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

eXercise

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

Method — 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.

Method — A worked test

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

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

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

Practice 2.1 ■ 2 marks

State the steps to carry out a slope test.

Solution 2.1

Method: A worked test

Worked steps

state hypotheses and check conditions; compute t ; find the p-value; compare to α and conclude **B1** **B1** *for two steps; for the full procedure.*

Practice 2.2 ■ 1 mark

State what a small p-value indicates about the slope.

Solution 2.2

Worked steps

the slope is significantly different from 0 — a real linear relationship **B1**.

Practice 2.3 ■ 1 mark

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

Solution 2.3

Method: A worked test

Worked steps

reject H_0 ($0.001 < 0.05$) **B1**.

Exam-style 3.1 ■ 1 mark

A slope test with a small p-value suggests

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

Solution 3.1

Method: A worked test

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

Worked steps

B.

Exam-style 3.2 ■ 1 mark

A slope test rejects H_0 when the p-value is

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

Solution 3.2

Method: A worked test

A above α

B below α



C exactly zero

D exactly one

Worked steps

B.

Exam-style 3.3 ■ 1 mark

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

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

Solution 3.3

Method: A worked test

Worked steps

(a) reject H_0 **B1**. (b) yes **B1**. (c) there is convincing evidence of a linear relationship between the variables **B1**.