

2.7 Residuals

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS residual • residual plot

Objective

Build the skills to answer exam questions on **residuals**.

You must be able to:

- calculate a **residual** as $y - \hat{y}$ (observed minus predicted)
- construct and interpret a **residual plot**
- use a residual plot to judge whether a **linear model** is appropriate

1 Key knowledge and worked examples

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

■ Residuals

$$\text{residual} = y - \hat{y} = \text{observed} - \text{predicted}.$$

A **positive** residual means the point lies **above** the line.

■ Residual plots

Plot the residuals against x (or $\hat{y}$):

- **random scatter** with no pattern $\rightarrow$ the linear model is appropriate;
- a **clear pattern** (e.g. a curve) $\rightarrow$ a linear model is **not** appropriate.

2 Practice

2.1 Write the formula for a residual.

[1]

2.2 An observed value is 18 and the model predicts 15. Find the residual.

[2]

2.3 State what a residual plot with a clear pattern suggests.

[1]

3 Exam-style questions

3.1 A residual equals

[1]

- ☐ **A** $\hat{y} - y$
B $y - \hat{y}$
C $y + \hat{y}$
D $y \times \hat{y}$

3.2 A residual plot showing random scatter suggests the linear model is

[1]

- ☐ **A** inappropriate
B appropriate
C curved
D wrong

3.3 A prediction is $\hat{y} = 40$, but the actual value is $y = 46$.

(a) Find the residual.

[2]

(b) State whether the point is above or below the line.

[1]