Fitting, predicting and interpreting models

6 questions | 13 marks

Equivalent correct methods earn the corresponding marks.

1. Fit a line to $(0, 12), (3, 27), (6, 42)$. [2 marks]

Each 3-unit input step adds 15, so gradient is 5.

Answer: $y = 12 + 5x$.

2. A prediction is 80 and the observation is 77. Find the residual. [2 marks]

$77 - 80 = -3$.

Answer: -3.

3. Fit $P = Ab^n$ to $P(0) = 200$ and $P(2) = 288$. [2 marks]

$b^2 = \frac{288}{200} = 1.44$; use positive factor 1.2.

Answer: $P = 200(1.2)^n$.

4. For $y = 7 + 4x$, observations at $x = 1, 2, 3$ are 12,14,20. Find residuals. [2 marks]

Predictions are 11,15,19.

Subtract each prediction from its matching observation.

Answer: 1, -1, 1.

5. Does accurate fitting between times 2 and 8 alone justify a prediction at 80? [2 marks]

80 is far beyond the observed range.

The process may change; local fit does not establish long-range validity.

Answer: No.

6. An exponential quantity is 60 at time 1 and 135 at time 3. Find its positive factor and value at zero. [3 marks]

The two-step ratio is 2.25, so $b = 1.5$.

Initial value $= \frac{60}{1.5} = 40$.

Answer: Factor 1.5; initial value 40.