Exponential regression

6 questions | 18 marks

Equivalent correct methods earn the corresponding marks.

1. Find an exact exponential model for $y = 50, 100, 200$ at $x = 0, 1, 2$. [3 marks]

Successive values have ratio 2.

At $x = 0$ the response is 50.

Answer: $y = 50 \times 2^x$.

2. For $\hat{y} = 120(1.1)^x$, predict the response at $x = 3$. [3 marks]

Calculate 120×1.1^3.

Answer: 159.72.

3. A log fit is $\ln(\hat{y}) = 1.5 + 0.2x$. Find A and b in $\hat{y} = Ab^x$. [3 marks]

Exponentiate the intercept and slope separately.

$A = e^{1.5}$ and $b = e^{0.2}$.

Answer: $A \approx 4.4817, b \approx 1.2214$.

4. Why cannot a zero or negative response be entered directly into a real natural-log regression? [3 marks]

A different justified model or transformation is needed.

Do not silently discard values.

Answer: The real logarithm $\ln(y)$ is defined only for $y > 0$.

5. A model multiplies by 0.96 each week. Find its modelled change over three weeks. [3 marks]

Calculate 0.96^3.

$$\text{Percentage decrease} = 100(1 - 0.884736).$$

Answer: Multiplier 0.884736, so a decrease of about 11.53%.

6. A log-scale regression has $r^2 = 0.94$. State a careful interpretation. [3 marks]

The statistic belongs to the transformed response.

It is not automatically 94% of original y-variation or evidence of causation.

Answer: 94% of the observed variation in $\ln(y)$ is accounted for by its fitted linear relationship with x.