Statistics and regression - Practice test 5

Name: _____ Date: _____

10 questions | 54 marks | 70 minutes

Combine full regression analysis, defensible reporting and normal-model decisions.

Use a graphics calculator or appropriate digital tool for labelled tasks.

1. A small study records weekly production hours and output. [5 marks]

Paired measurements

Hours	Output (units)
1	9
2	11
3	12
4	15
5	17
6	20

(a) Draw a scatter plot and describe its form. [3 marks]

(b) State a limitation of the sample for predicting a different factory’s output. [2 marks]

2. Use the production data from Question 1. [8 marks]

Paired measurements

Hours	Output (units)
1	9
2	11
3	12
4	15
5	17
6	20

(a) Find the regression equation. [3 marks]

(b) Find r^2 and interpret it. [3 marks]

(c) Predict output at 4.5 hours. [2 marks]

3. For the production fit, the observation at $x = 3$ has output 12. [5 marks]

(a) Calculate its residual. [3 marks]

(b) What is the sum of residuals for the full least-squares fit before rounding? [2 marks]

4. A separate model has $r^2 = 0.81$ and a negative fitted slope. [5 marks]

(a) Find r. [2 marks]

(b) Explain why a line with $r^2 = 0.81$ can still be a poor model. [3 marks]

5. For $y = 50(1.08)^t$, where t is in years: [5 marks]

(a) Write the natural-log form. [3 marks]

(b) Find the modelled percentage increase over two years. [2 marks]

6. A positive data set is fitted by $\ln(\hat{y}) = 2 + 0.3x$. [6 marks]

(a) Predict y at $x = 2$. [3 marks]

(b) The original response there is 15. Find its original-scale residual. [3 marks]

7. A normal product length has mean 80 mm. Its 90th percentile is 86.4078 mm. [6 marks]

(a) Estimate the standard deviation. [4 marks]

(b) Why must the standard deviation be positive here? [2 marks]

8. Normal task time has mean 24 min and SD 3 min. [5 marks]

(a) Find the probability of finishing between 21 and 27 min. [3 marks]

(b) Find the expected number in that interval among 180 tasks. [2 marks]

9. A study combines two groups. Each group shows no clear within-group association, but the combined scatter plot has two clusters and a positive r. [5 marks]

(a) Why should the combined r be treated cautiously? [3 marks]

(b) Give a better presentation. [2 marks]

10. A manager uses a fitted model as an exact target for every individual. [4 marks]

(a) Explain why the fitted mean tendency is not an exact individual prediction. [2 marks]

(b) List two items that should accompany a published prediction. [2 marks]