

AP Precalculus
Exponential Regression

Exponential Regression | APPC-U02-P09

96 problems · Four activity formats

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Topic focus
Across 96 tasks this topic asks for metrics and verdict, classification and verdict, metric and verdict, evidence statement, robustness conclusion and validity and weighting implication.
8 PDFs and a README; 88 buyer pages.

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Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

Format and interpret the regression using the reporting rule without rounding b before converting it to a percent.

Given: domain: months; payload: convention: raw-output least squares; report rule: coefficient a to nearest tenth and percent change to nearest tenth percent; technology result: $a: 7.408; b: 0.9631$

Bank label: _____

Write the original-scale model represented by the fitted excess.

Given: domain: hours; payload: baseline: 6; fitted excess: $e = 45(0.65)^t$; relation: $e = y - 6$

Bank label: _____

Interpret the base of this fitted colony model.

Given: domain: days; payload: convention: raw-output least squares; output unit: colonies; technology result: $N(t) = 18.4(1.065)^t$

Bank label: _____

The negative response is a displacement below zero, and technology fit its positive magnitude. Restore the signed model.

Given: domain: seconds; payload: baseline: 0; definition: $m = -y$; magnitude regression: $m(t) = 12.0(0.823)^t$; table: $(0, -12.0); (2, -8.1); (4, -5.5)$

Context/domain: seconds

0	-12.0
2	-8.1
4	-5.5

Bank label: _____

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Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. A value without its unit is not a complete answer.

May all three rows be entered directly into a log-output exponential regression for $y = ab^x$? Explain before fitting.

Context/domain: minutes

0	8.2
2	4.1
4	0.0

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Name: _____ Date: _____ Class: _____

Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

START Convert the two-hour regression factor to an equivalent hourly percent increase. Given: domain: 2-hour blocks; payload: input definition: n counts two-hour blocks; technology result: $Q(n) = 9.3(1.44)^n$ Your response: _____	Incoming: The relative residual magnitudes are at most about 1.2%, but their signs alternate at consecutive days 0 through 7 before another positive residual at day 8. Percentage errors are small; the ordered oscillation is a pattern, so small magnitude alone does not establish an adequate pattern-free model. Compare the week-12 residuals after rounding only the amplitude. Given: domain: weeks; payload: observation: $x: 12; y: 27.4$; predictions: retained: 26.98; rounded: 27.05; residual definition: observed-predicted; retained model: $y = 51.86(0.947)^x$; rounded model: $y = 52(0.947)^x$ Your response: _____
Incoming: The student's 0.011 is a log-scale residual. The required original-scale residual is $39.0 - 38.12 = 0.88$. Find both residuals at the origin. Given: domain: months; payload: input: 0; observed: 20.6; retained model: $y = 20.54(0.92)^x$; rounded model: $y = 21(0.92)^x$ Your response: _____	Incoming: Dividing hours by 24 gives 0, 1, 3, 5 days, so the conversion is consistent. The fitted base is a factor per day, not per hour. A regression models the excess above a known level of 250. Restore the original response and state its long-run level. Given: domain: days; payload: baseline: 250; definition: $e = y - 250$; fitted excess: $e(t) = 84.5(0.91)^t$ Your response: _____

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Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

The numerical regression inputs are years since 2018, although the source table lists calendar years. Is the fit invalid, and how should it be interpreted? A student says recoding calendar years invalidates the fit and it predicts calendar year zero. Diagnose both claims.

The last measured value equals the known baseline. Diagnose the proposed baseline-corrected log regression and give two defensible next steps without silently altering the row. A student enters $\log(0)$ for the baseline-equal reading. Diagnose the operation and explain two defensible next steps.

Context/domain: hours

0	31
2	19
5	12

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Full Worked Solutions - excerpt

Worked example

Problem. The residual magnitudes are modest, but every sign is positive. Interpret this evidence.

Answer. The model underpredicts every observation, showing a one-sided level bias rather than centered residuals. Its calibration should be reconsidered.

Explanation and check.

Observed-minus-predicted is positive whenever prediction is low.

Worked example

Problem. A chamber warms toward 72 degrees Fahrenheit from below. Regression was performed on the positive shortfall $d(t) = 72 - y(t)$, producing $d(t) = 18.6(0.81)^t$. Restore a model for y and describe its approach.

Answer. $y(t) = 72 - 18.6(0.81)^t$; it increases toward 72 from below.

Explanation and check.

The fitted magnitude is the amount below equilibrium, so subtract it from 72; the decaying shortfall makes y rise.