

AP Precalculus
Linearizing Exponential Data

Linearizing Exponential Data | APPC-U02-P25

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for corrected line, least integer threshold, ratio and observed value, slope evolution, tail behavior and values and explanation.

8 PDFs and a README; 73 buyer pages.

AP Precalculus

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Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

Linearize the decay model in base 3. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. Use $y = 9(\frac{1}{3})^x$. Use the transformation $Y = \log_3(y)$.

Bank label: _____

Read the original output at the marked height $x = 2$. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. Use these axis scales: scale logarithmic y ; linear x ; x input; y original y on base-10 logarithmic scale. The marked point has $x2$; y label 100. The labeled levels are 1, 10, 100, 1000.

Bank label: _____

Use the fitted table to predict the original output at $x = 4$. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value.

Context/domain: data

x	fitted $Y = \ln(y)$
0	0
2	1
4	2

Bank label: _____

Place the decay observations on a base-2 transformed table. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. Use logarithm base 2. The raw observations are (0, 8), (1, 4), and (2, 2); only these observations are asserted. Construct the transformed output column yourself.

Context/domain: data

x	raw y
0	8
1	4
2	2

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. Give the whole requested response, including any reasoning the question asks for.

Diagnose the parameter error and state the correct factor. The given line is $Y = 1 + 0.3x$. A student claims: The raw growth factor is 0.3. Use the transformation $Y = \log_{10}(y)$. 	Write the transformed line and identify its intercept and slope. Use $y = 4(2^x)$. Use the transformation $Y = \log_2(y)$. 						
Correct the student's reading of the plotted point. Use these axis scales: scale linear-linear transformed plot; x input; $yY = \log_2(y)$. The point are 3, 5. A student reads $y = 5$. 	Express the semi-log line exactly and interpret the two coefficients. Use $y = 5(100^x)$. Use the transformation $Y = \log_{10}(y)$. 						
Compare the initial values and one-input growth factors. Use these axis scales: scale linear-linear transformed plot; x input unit; $yY = \log_{10}(y)$. The lines are (model P; rule $Y = 1 + 0.4x$), (model Q; rule $Y = 2 + 0.4x$). 	Map all three raw observations to the base-4 plot. Context/domain: data <table border="1" data-bbox="824 1360 1469 1455"> <tbody> <tr> <td>0</td> <td>2</td> </tr> <tr> <td>1</td> <td>8</td> </tr> <tr> <td>3</td> <td>128</td> </tr> </tbody> </table> 	0	2	1	8	3	128
0	2						
1	8						
3	128						

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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 Recover the positive raw y-value represented by $Y = -2$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use these axis scales: scale linear in Y; x input; $yY = \log_{10}(y)$. The point are $-1, -2$. Your response: _____	Incoming: Y-values $\log_2(16)=4, \log_2(20), \log_2(28)$; their increments are unequal. Predict y at $x = 2$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The fitted relation is $Y = 1 + 0.5x$ where $Y = \log_{10}(y)$. Evaluate at input 2. The observations cover x in 0, 4. Your response: _____
Incoming: $x = 1$ and common $y = 27$ State the original output at the plotted point (3, 5). Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use these axis scales: scale linear in Y; x stage; $yY = \log_2(y)$. The point are 3, 5. Your response: _____	Incoming: $Y = 4.5$ and $y = 16\sqrt{2}$ Convert the fitted height at $x = 1$ to original units. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The fitted relation is $Y = 3-x$ where $Y = \log_2(y)$. Evaluate at input 1. The observations cover x in 0, 3. Your response: _____
Incoming: The slope is initially negative but approaches 0 as Y approaches $\log_3(9)=2$. What multiplicative change is encoded by moving one labeled vertical interval from 1 to 10? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____	Incoming: $y = 100(\frac{1}{\sqrt{5}})^x$ Translate the half-unit rise into a ratio of original outputs. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use these axis scales: scale linear in Y; x input; $yY = \log_4(y)$. The vertical displacement is 0.5. 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.

Judge the student's claim that equal-looking log increments prove $y = 10(1.5^x)$ exactly. Student work/claim: The displayed fitted equation is an exact identity for every input, including values outside the observed data window. Locate the unsupported exact-fit/extrapolation step, then state the properly qualified model and justify the qualification from the displayed data.

Context/domain: data

x	raw y	Y=log_base(y)
0	10.0	1.0
1	15.1	1.179
2	22.4	1.35
3	34.0	1.531

Construct every admissible transformed row and diagnose the remaining observation. Student work: (0, 1.079) and (3, 2.079) are admissible; $x = 1$ can be plotted because $y = 0$ Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

Context/domain: data

x	raw y	Y=log_base(y)
0	12	1.079
1	0	_____
3	120	2.079

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Full Worked Solutions - excerpt

Worked example

Problem. Write the transformed line and identify its intercept and slope. Use $y = 4(2^x)$. Use the transformation $Y = \log_2(y)$.

Answer. $Y = 2 + x$; intercept 2 and slope 1

Explanation and check.

$\log_2(4) = 2$ and $\log_2(2) = 1$, so logarithms turn the product into $2 + x$.

Worked example

Problem. What multiplicative change is encoded by moving one labeled vertical interval from 1 to 10? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Answer. a factor of 10

Explanation and check.

Consecutive decade levels differ by a ratio of 10 even though their numerical differences are not constant.