Sets & Steps
Math Practice & Worked Solutions

AP Precalculus
Logarithmic Transformations and Applications

Logarithmic Transformations and Applications | APPC-U02-P20

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for asymptotes and formulas, formulas and asymptotes, ordered results, resulting rules and relation, two expressions and offset and two formulas and asymptotes.

8 PDFs and a README; 71 buyer pages.

The following pages use the same questions, given data, and notation as the final files. Question/card serial numbers and internal IDs are omitted in this preview only. Table values and matching responses are retained. Full answer keys are not included.

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AP Precalculus

Logarithmic Transformations and Applications

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.

Describe the two vertical transformations and the unchanged asymptote. 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.

Given: $x > 0$

Parent: $f(x) = \log_3(x)$; Rule: $g(x) = -\log_3(x) + 2$

Bank label: ______

Evaluate the model at the given trial count and classify the prediction. 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.

Given: $2 \le n \le 40$ trials

Input: 27; Model: $R(n) = 15 + 6 \cdot \log_3(n)$; Output units: successful responses

Bank label: ______

Identify the row that prevents fitting the requested logarithmic regression to the full 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.

Context/domain: raw predictor must be positive

0	3.1
1	4.0
3	5.2
9	6.4

Bank label: ______

Map the three points and state what happens to the asymptote. 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.

Given: $x > 0$

Axes: unit linear scales; Map: $(x, y) \to (x, 2y + 1)$; Parent asymptote: $x = 0$

Context/domain: $x > 0$

1	0
2	1
4	2

Bank label: ______

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Name: ____________ **Date:** ____________ **Class:** ____________

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.

Describe the transformation from f to g and locate the new vertical asymptote.

Given: $x > 3$

Parent: $f(x) = \log_2(x)$; Rule: $g(x) = \log_2(x-3)+4$

Use the documented logarithmic fit to predict the held-out score and compute observed minus predicted.

Given: $x > 0$ hours

Documented fit: $y = 2 + 1.5 \cdot \ln(x)$; Held out row: $(4, 4.2)$; Output units: score points; Rounding: nearest hundredth

Context/domain: $x > 0$ hours

1	2.1
2	3.0
3	3.7
6	4.6

Construct a model that is zero at $x = 2$ and gains 3 whenever input doubles.

Map the three anchors and the vertical asymptote.

Given: $x > 2$

Axes: unit linear scales; Map: $(x, y) \to (x+2, y-1)$; Parent asymptote: $x = 0$

Context/domain: $x > 2$

1	0
2	1
0.5	−1

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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

Determine whether the model supplies the requested prediction. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Given: $q > 10$ minutes, calibrated for $12 \leq q \leq 50$

Input: 10; Model: $W(q) = 7{+}\ln(q-10)$; Output units: watts

Your response: ______________________

Incoming: A gives $\log_3(3(x-6))$ with asymptote 6; B gives $\log_3(3x-6)$ with asymptote 2.

Map the full defining set to the translated graph. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Given: $x > 4$

Axes: unit linear scales; Map: $(x, y) \to (x+4, y-2)$; Parent asymptote: $x = 0$

Context/domain: $x > 4$

1	0
3	1
$\frac{1}{3}$	-1

Your response: ______________________

Incoming: k = 6 and $a = -4$, so $g(x) = -4{\cdot}\log_2(-x-3) + 6$; the branch increases.

Predict the held-out mass and report its residual with units. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Given: $x > 0$ days

Documented fit: $y = 12 + 2.5\ln(x)$; Held out row: $(3, 14.5)$; Output units: grams; Rounding: nearest tenth

Context/domain: $x > 0$ days

1	12.1
2	13.8
5	15.9
9	17.4

Your response: ______________________

Incoming: Prediction about $5.8g$; residual about $0.3g$, so the model underpredicts.

Write a logarithmic rule satisfying the zero and fivefold-change conditions. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Given: $x > 0$

Input ratio: 5; Normalization: use base 5; Output increment: 2; Zero input: 3

Your response: ______________________

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Name: ____________ **Date:** ____________ **Class:** ____________

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.

Decide whether the requested prediction exists and explain why. Student work: No real prediction exists at $x = 10$ because the logarithm argument is 0; the model requires $x \geq 10$. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

error hunt

Given: $x > 10$ seconds, calibrated for $12 \leq x \leq 100$

Input: 10; Model: $V(x) = 8 + 3 \cdot \log_2 (x - 10)$; Output units: meters per second

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Decide whether a fitted residual can be computed for the held-out row. 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.

error hunt

Given: $x > 0$ hours

Documented fit: $y = 6 + 1.4 \ln(x)$; Held out row: $(0, 5.5)$; Output units: points

Context/domain: $x > 0$ hours

1	6.1
2	7.0
5	8.3

Logarithmic Transformations and Applications

Full Worked Solutions - excerpt

Worked example

Problem. Build a log curve through $(6, 0)$ whose output drops 4 whenever input triples.

Answer. A suitable rule is y = $-4 \cdot \log_3\left(\frac{x}{6}\right)$.

Explanation and check.

The normalized argument is 1 at $x = 6$; tripling x raises the logarithm by 1, so scale -4 creates the stated drop.

Worked example

Problem. Construct a model that is zero at $x = 2$ and gains 3 whenever input doubles.

Answer. One normalized model is y = $3 \cdot \log_2\left(\frac{x}{2}\right)$.

Explanation and check.

The ratio $\frac{x}{2}$ anchors the zero, and $\log_2$ gains 1 per doubling, so the output scale is 3.