

AP Precalculus

Exponential Features and Concavity

Exponential Features and Concavity | APPC-U02-P04

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for monotonicity and concavity, monotonicity, concavity, rate trend, monotonicity, concavity, slope trend, concavity and differences, differences and concavity and differences, direction, concavity.

8 PDFs and a README; 99 buyer pages.

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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.

State the range and horizontal asymptote of $f(x) = -3(2^x)$. 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. _____ Bank label: _____	Find the absolute minimum and maximum of $f(x) = 4(\frac{1}{2})^x$ on $[1, 3]$. 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. _____ Bank label: _____
Is $f(x) = 6(1.2^x) + 3$ increasing or decreasing? Describe the exponential displacement from 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. _____ Bank label: _____	State the range of $g(x) = 8(\frac{1}{3})^x$ and its limit as $x \rightarrow \infty$. 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. _____ Bank label: _____
Compare $f(x) = 3(1.4^x)$ and $g(x) = 12(1.4^x)$ for all real x. 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. _____ Bank label: _____	A nonconstant $f(x) = a(2^{cx}) + k$ stays below $y = k$ and decreases. What signs must a and c have? 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. _____ 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.

A known exponential has exact outputs 3, 6, 12, 24 at $x = 0, 1, 2, 3$. Use first differences to describe its concavity.

Precision: Given values are exact

x	f(x)
0	3
1	6
2	12
3	24

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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 Is $h(x) = -10(0.8^x) - 2$ increasing or decreasing, and how does it approach its baseline? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____	Incoming: It increases toward -2 from below. On $[2, \infty)$, determine the minimum and whether a maximum exists for $f(x) = 3(2^x) - 5$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____
Incoming: Minimum 7 at $x = 2$; no maximum. Find the range and both tail limits of $g(x) = 10 - 7(0.2^x)$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____	Incoming: Range $(-\infty, 10)$; $g(x) \rightarrow -\infty$ as $x \rightarrow -\infty$ and $g(x) \rightarrow 10$ from below as $x \rightarrow \infty$. Describe the monotonicity and concavity of $f(x) = 5(1.5^x) - 20$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____
Incoming: It is increasing and concave up. Find the effective one-unit factor and monotonicity of $f(x) = 10(2^{-3x}) + 1$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____	Incoming: The effective factor is $\frac{1}{8}$, so f decreases toward 1 from above. Find the absolute extrema of $f(x) = 5 - 2(\frac{1}{2})^x$ on $[-1, 2]$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____

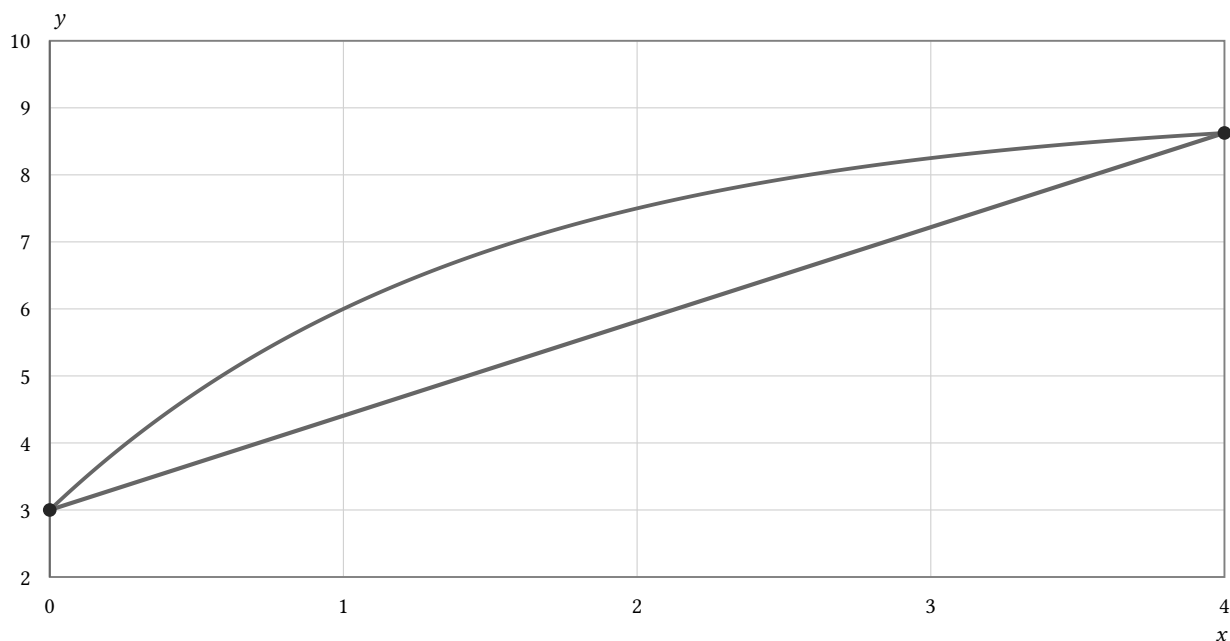
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Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

For $f(x) = 9 - 6(0.5^x)$, a chord joins $x = 0$ and $x = 4$. Does the chord overestimate or underestimate interior values? Explain. Student work: It underestimates them because f is concave up and lies above its chord in the interior. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.



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Full Worked Solutions - excerpt

Worked example

Problem. A calculator rounds $f(12)$ to 0 for $f(x) = 0.1^x$. Explain why this does not mean the graph reaches its asymptote.

Answer. $f(12) = 10^{-12} > 0$. The value may round to 0, but no finite input makes a positive-base exponential equal 0.

Explanation and check.

Display precision is not exact attainment.

Worked example

Problem. Find where $f(x) = 2^x + 5$ and $g(x) = 3(2^x) - 1$ intersect, then state which is larger on each side.

Answer. Equality gives $2^x = 3$, so $x = \log \text{ base } 2 \text{ of } 3$. Before that $f > g$; after that $g > f$.

Explanation and check.

Different baselines and amplitudes create one order reversal.