

Precalculus
**Graph Transformations Across Function Families | 7-Topic
Precalculus Bundle**

7-topic bundle | 672 problems | Four activity formats

Included topics

The following pages list all 7 included resources in the suggested order, with a link to each product. Each resource retains its complete preview.

In every topic

Answer Bank Challenge	24 tasks
Grid Rounds	24 tasks
Match & Move	24 cards
Error Analysis & Strategy	24 tasks
Quick Answer Key and Full Worked Solutions	included
Teacher / Parent Use Guide and Terms of Use	included

Product previews

The following preview pages show the cover, all four activity formats, and worked examples for each included resource, in the listed order.

56 PDFs and 7 READMEs; 584 buyer PDF pages across the 7 products.

Preview pages are not included in the buyer page count. Check the list against resources you already own.

Sets & Steps

Math Practice & Worked Solutions

Precalculus

Included topics

7-topic bundle | 672 problems | Four activity formats

01 Function Translations

[View individual product and its full preview](#)

02 Function Reflections, Stretches, and Compressions

[View individual product and its full preview](#)

03 Combined Function Transformations

[View individual product and its full preview](#)

04 Exponential Parameters and Reference Points

[View individual product and its full preview](#)

05 Logarithmic Transformations and Applications

[View individual product and its full preview](#)

06 Interpreting Sinusoidal Transformations

[View individual product and its full preview](#)

07 Tangent Function Transformations

[View individual product and its full preview](#)

7 included resources | Complete resource previews follow this guide.

Published by Tusils LLC.

AP Precalculus
Function Translations

Function Translations | APPC-U01-P16

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
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04	Error Analysis & Strategy	24 tasks
05	Quick Answer Key	96 answers
06	Full Worked Solutions	96 solutions
07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for translation candidate and failure evidence, identify and correct mismatched row, corrected conclusions, translated rows plus rule, new formula and zero-time value and translated contextual model with units.

8 PDFs and a README; 79 buyer pages.

AP Precalculus

Function Translations

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.

From the table, evaluate $g(-7)$ and $g(4)$ for $g(x) = f(x + 5) + 2$.

Complete response required: ordered pair of exact values.

u	$f(u)$
-8	-4
-2	6
3	0
9	11

Bank label: _____

Write g in terms of f when the graph of f is translated 4 units left and 2 units down. Explain the sign used inside f .

Bank label: _____

If $g(x) = f(x - 2) - 4$, use the table to find $g(4)$.

Complete response required: exact value.

x	$f(x)$
-3	12
2	-5
7	1

Bank label: _____

To determine $g(-3)$ for $g(x) = f(x + 8) - 2$, which source-table row is needed? If that row is $(5, 14)$, compute $g(-3)$.

Bank label: _____

AP Precalculus

Function Translations

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.

A graph consists of closed line segments joining $(-4, 1)$ to $(-1, 5)$ to $(2, -2)$. Translate the graph 2 units left and 3 units up. Give the image of every listed vertex and retain the connections.



-4	1
-1	5
2	-2

AP Precalculus

Function Translations

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.

Incoming: Rows $(-13, 3)$, $(-7, -3)$, $(0, -11)$, and $(6, 2)$.

First set $p(x) = f(x) - 9$, then set $q(x) = p(x + 4)$. Collapse the two steps into one formula involving f and describe the two-coordinate displacement.

Your response: _____

Incoming: Rows $(-11, 2)$, $(-6, 8)$, $(2, -1)$; $g(x) = f(x + 7) + 2$.

Using only the displayed table for f , evaluate every determined value among $g(-4)$, $g(1)$, $g(5)$, and $g(0)$ when $g(x) = f(x + 1) - 3$. Identify any value that cannot be found.

Complete response required: determined values and unsupported query.

u	$f(u)$
-7	2
-3	9
2	-1
6	4

Your response: _____

Incoming: New y -intercept $(0, -4)$; old y -intercept maps to $(-7, 7)$.

The same translation, left 3 and up 4, is applied three times. Replace the repeated action by one vector and one rule g in terms of f .

Your response: _____

Incoming: $h = 3$, $k = -6$, so $g(x) = f(x - 3) - 6$.

Move the graph of f right 2 and up 10. Write g in terms of f and map the source point $(8, -3)$.

Your response: _____

AP Precalculus

Function Translations

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.

The table gives exact values of f . If $g(x) = f(x + 2) - 1$, use the displayed data to find $g(0)$. A student claims $g(0) = f(0) - 1 = -3$. Diagnose the horizontal-input error using the exact table, and give the complete corrected result. Complete response required: exact value.

x	$f(x)$
-3	7
0	-2
2	5
5	1

Only the displayed values of f are known. For $g(x) = f(x - 3) - 1$, find every x supported by the table for which $g(x) = 5$. Do not assume f is one-to-one or extend the table. A student claims the supported answers are the source inputs -4 and 2 without any horizontal change. Diagnose the horizontal-input error using the exact table, and give the complete corrected result.

Complete response required: all displayed-data solutions.

u	$f(u)$
-4	6
-1	2
2	6
3	-3
7	2

Function Translations

Full Worked Solutions - excerpt

Worked example

Problem. Move the graph of f right 2 and up 10. Write g in terms of f and map the source point $(8, -3)$.

Answer. $g(x) = f(x - 2) + 10$; $(8, -3)$ maps to $(10, 7)$.

Explanation and check.

A right shift uses $x - 2$ inside, while an upward shift adds 10 outside. Adding $(2, 10)$ to the point gives $(10, 7)$.

Worked example

Problem. The complete solution of $f(u) > 4$ is $(-7, -1)$ union $(3, 8]$. If $g(x) = f(x + 2) - 9$, solve $g(x) > -5$.

Answer. $(-9, -3)$ union $(1, 6]$.

Explanation and check.

The target inequality becomes $f(x + 2) > 4$. Thus $x + 2$ must lie in the given source set; subtract 2 from every endpoint and preserve all inequality memberships.

AP Precalculus
Function Reflections, Stretches, and Compressions

Function Reflections, Stretches, and Compressions | APPC-U01-P17

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for supported conclusion and limitation, a and possible b, a and all b, forced and unidentifiable factors, description and a,b and explanation.

8 PDFs and a README; 71 buyer pages.

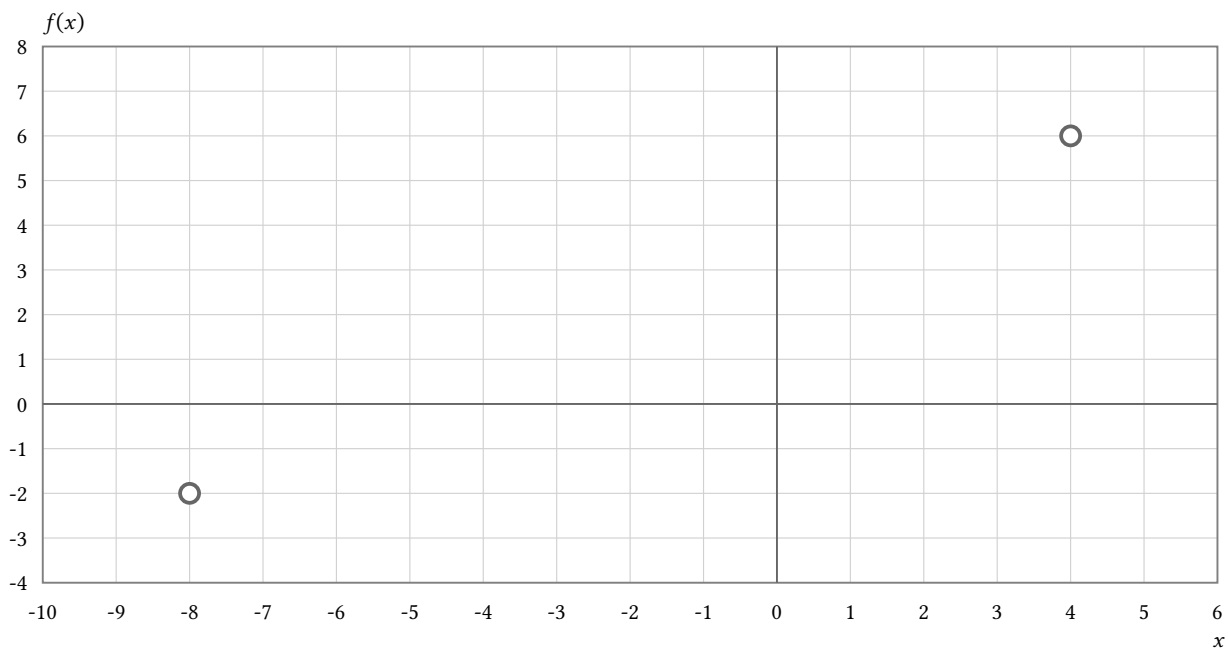
AP Precalculus

Function Reflections, Stretches, and Compressions

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.

A curve runs between open endpoints $(-8, -2)$ and $(4, 6)$. Where are its open endpoints under $g(x) = -f(\frac{x}{2})$?



Bank label: _____

1

AP Precalculus

**Function Reflections, Stretches,
and Compressions**

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.

For $g(x) = f(-3x)$, choose: horizontal stretch by 3, or horizontal compression by $\frac{1}{3}$ with y -axis reflection. Justify by point mapping. Diagnose this student claim: Multiplying the input by -3 stretches the graph horizontally by 3. Use the actual rule and supplied data to give the corrected conclusion and justify the input/output mapping.

Besides naming two axis reflections, what single rigid motion describes $g(x) = -f(-x)$? Diagnose this student claim: The two axis reflections cancel, leaving every point fixed. Use the actual rule and supplied data to give the corrected conclusion and justify the input/output mapping.

Can one fixed pair a, b map $(1, 2), (-2, 5), (4, -1)$ to $(3, 8), (-6, 15), (12, -4)$, respectively, under $g(x) = af(bx)$? Diagnose this student claim: The matching horizontal ratios alone establish one common pair a, b . Use the actual rule and supplied data to give the corrected conclusion and justify the input/output mapping.

Function Reflections, Stretches, and Compressions

Full Worked Solutions - excerpt

Worked example

Problem. Function f has domain $(-2, 6)$ and constant range $\{4\}$. Find both sets for $g(x) = -5f(2x)$.

Answer. Domain $(-1, 3)$; range $\{-20\}$.

Explanation and check.

Divide source inputs by 2 and multiply the sole output by -5 .

Worked example

Problem. If f has domain $[2, 10]$ and range $[-4, 6]$, find the domain and range of $g(x) = 3f(2x)$.

Answer. Domain $[1, 5]$; range $[-12, 18]$.

Explanation and check.

Require $2x$ in $[2, 10]$, giving x in $[1, 5]$. Multiplying outputs by 3 gives $[-12, 18]$.

AP Precalculus

Combined Function Transformations

Combined Function Transformations | APPC-U01-P18

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for determinate or not, g from f , two maps, coordinate rules, equivalence and equivalence proof.

8 PDFs and a README; 70 buyer pages.

AP Precalculus

Combined Function Transformations

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.

Normalize $g(x) = 3f(6x + 15) - 2$ and state h. Bank label: _____	Normalize the inside of $g(x) = (\frac{3}{2})f(-0.4x - 2) + 1$ and state b, h. Bank label: _____
Double all x-coordinates of f, then shift the current graph left 3. Write $g(x)$. Bank label: _____	Function f has domain $[-3, 9)$ and range $(0, 8]$. Find both sets for $g(x) = (\frac{1}{2})f(\frac{x-7}{4}) - 3$. Bank label: _____

AP Precalculus

Combined Function Transformations

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.

Incoming: $(3, 0)$ Under (u, v) to $(h + \frac{u}{b}, k + av)$ with $a, b > 0$, source points $(0, 1), (4, 3)$ map to $(2, -1), (4, 5)$. Find a, b, h, k. Complete response required: a, b, h, k. <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 25%;">2</td><td style="width: 25%;">-1</td><td style="width: 25%;">0</td><td style="width: 25%;">1</td></tr> <tr> <td>4</td><td>5</td><td>4</td><td>3</td></tr> </table> Your response: _____	2	-1	0	1	4	5	4	3	Incoming: Domain $[-20, -8]$ union $\{-2\}$ union $(8, 16]$; range $[-8, 4]$ union $(16, \infty)$. The graph of f has vertical asymptote $x = -2$. Find the corresponding vertical asymptote of $g(x) = 3f(2(x - 5)) + 4$. Your response: _____								
2	-1	0	1														
4	5	4	3														
Incoming: $y = 3$. Under (u, v) to $(h + \frac{u}{b}, k + av)$ with $a, b > 0$, $(-3, 2), (5, 6)$ map to $(1, 7), (3, 15)$. Find a, b, h, k. Complete response required: a, b, h, k. <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 25%;">1</td><td style="width: 25%;">7</td><td style="width: 25%;">-3</td><td style="width: 25%;">2</td></tr> <tr> <td>3</td><td>15</td><td>5</td><td>6</td></tr> </table> Your response: _____	1	7	-3	2	3	15	5	6	Incoming: $a = 2, b = -3, h = 5, k = -2$. Under an affine graph map, $(0, 0)$ maps to $(-2, 5)$ and $(6, 4)$ maps to $(1, -3)$. Find a, b, h, k. Complete response required: a, b, h, k. <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 25%;">-2</td><td style="width: 25%;">5</td><td style="width: 25%;">0</td><td style="width: 25%;">0</td></tr> <tr> <td>1</td><td>-3</td><td>6</td><td>4</td></tr> </table> Your response: _____	-2	5	0	0	1	-3	6	4
1	7	-3	2														
3	15	5	6														
-2	5	0	0														
1	-3	6	4														
Incoming: $a = -2, b = 2, h = -2, k = 5$. Rewrite $g(x) = 2f(3(x + 1)) + 5$ if $f(u) = 4$ for $u < 2$ and $f(u) = u - 1$ for $u \geq 2$. Your response: _____	Incoming: $g(x) = 13$ for $x < -\frac{1}{3}$; $g(x) = 6x + 9$ for $x \geq -\frac{1}{3}$. Under an affine graph map, $(0, 2), (10, -3)$ map to $(4, 1), (9, 11)$. Find a, b, h, k. Complete response required: a, b, h, k. <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 25%;">4</td><td style="width: 25%;">1</td><td style="width: 25%;">0</td><td style="width: 25%;">2</td></tr> <tr> <td>9</td><td>11</td><td>10</td><td>-3</td></tr> </table> Your response: _____	4	1	0	2	9	11	10	-3								
4	1	0	2														
9	11	10	-3														

AP Precalculus

Combined Function Transformations

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.

Shift f down 2, reflect the current graph across the x -axis, then triple outputs. Write $g(x)$. A student reports $g(x) = -3f(x) - 6$. Locate the sign or order-of-operations error, write the corrected intermediate calculation or coordinate map, and give the correct complete result.

Shift f left 2, triple current x -coordinates, reflect across the y -axis, then shift right 1. Write $g(x)$. A student reports $g(x) = f(\frac{-x-5}{3})$. Locate the sign or order-of-operations error, write the corrected intermediate calculation or coordinate map, and give the correct complete result.

Double outputs of f , reflect the current graph across the x -axis, then shift up 7. Write $g(x)$. A student reports $g(x) = -2f(x) - 7$. Locate the sign or order-of-operations error, write the corrected intermediate calculation or coordinate map, and give the correct complete result.

Halve x -coordinates of f , shift the current graph right 4, then reflect across the y -axis. Write $g(x)$. A student reports $g(x) = f(-2x + 8)$. Locate the sign or order-of-operations error, write the corrected intermediate calculation or coordinate map, and give the correct complete result.

Combined Function Transformations

Full Worked Solutions - excerpt

Worked example

Problem. For nonzero q , normalize $g(x)=A f(qx-r)+K$ as $A f(q(x-h))+K$.

Answer. $h=r/q$, so $g(x)=A f(q(x-r/q))+K$.

Explanation and check.

Expand $q(x-r/q)=qx-r$.

Worked example

Problem. Function $f(d)$ gives euros d days after Jan 1. Define $g(w)$ for cents w weeks after Jan 8, using 110 cents per euro.

Answer. $g(w) = 110f(7 + 7w)$.

Explanation and check.

Jan 8 is day 7, and each new unit adds 7 days.

AP Precalculus
Exponential Parameters and Reference Points

Exponential Parameters and Reference Points | APPC-U02-P03

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
03	Match & Move	24 cards
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08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for adjusted ratios and limitation, adjusted sequences and conclusion, actual constant, base sign and consequence, degenerate class and failed condition and domain failures.

8 PDFs and a README; 57 buyer pages.

AP Precalculus

Exponential Parameters and Reference Points

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.

Classify $h(x) = 4(1^{x-7}) - 2$ and give its actual value for every 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: _____	Does $f(x) = (\frac{1}{2})(\frac{5}{4})^x$ define a real nonconstant exponential on all real inputs? Explain. 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 $f(x) = -8(6^x)$ a real nonconstant exponential on all real x? Explain. 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: _____	For $N(t) = 40(0.9^{t-6}) + 12$, what happens at day 6, and what does 40 measure there? 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: _____
Translate the base 0.875 in $q(x) = 90(0.875^x)$ into a percent change per unit 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: _____	For which real p is $g(x) = 7(5 - 2p)^x$ a real nonconstant exponential on all real inputs? 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: _____

AP Precalculus

Exponential Parameters and Reference Points

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 For $f(x) = 9(2^x) + 4$, find $f(0)$ and interpret the coefficient 9 relative to the baseline. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____	Incoming: $f(0) = 13$; the coefficient 9 is the displacement $13 - 4$ from baseline 4. For $g(x) = -11(3^x)$, find $g(0)$ and interpret the coefficient. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____
Incoming: $g(0) = -11$; the coefficient is the zero-input output. Is $q(x) = 7((2 - \sqrt{3})^x)$ a valid real nonconstant exponential for all real x? Justify the base bounds. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____	Incoming: Yes. Since $1 < \sqrt{3} < 2$, the base $2 - \sqrt{3}$ lies strictly between 0 and 1 and is not 1. For $f(x) = 4(3^x) - 10$, state the constant ratio involving displacement from the baseline. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____
Incoming: $\frac{f(x+1)+10}{f(x)+10} = 3$. For $D(t) = 22(0.75^{t-3}) - 5$, find $D(3)$ and express $D(0)$. What does 22 represent? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____	Incoming: $D(3) = 17$ and $D(0) = 22(\frac{4}{3})^3 - 5$; 22 is displacement above baseline -5 at day 3. Compare $f(x) = 12(0.6^x)$ and $g(x) = 6(0.6^x)$. How does the coefficient change affect every output? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Your response: _____

AP Precalculus

Exponential Parameters and Reference Points

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.

Compare $f(x) = 8(1.2^{x-2}) + 5$ and $g(x) = 8(0.7^{x-2}) + 5$. Give their shared reference point and describe their directions to its right. Student work: Both pass through $(3, 13)$. To the right, f 's displacement grows while g 's displacement decays. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

A table of integer inputs makes $u(x) = 5(-2)^x$ look defined. Why is it not a real exponential on all real inputs? Student work: Fractional inputs such as $x = \frac{1}{2}$ produce nonreal values, so integer evidence does satisfy the all-real domain requirement. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

Interpret factors 1.12 and 0.12 as percent changes of a positive quantity. Distinguish percent of the prior value from percent increase or decrease. Student work: Factor 1.12 means 112% remains and a 12% increase. Factor 0.12 means 12% remains and an 87% decrease. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

For $f(x) = 3(4^x) - 2$, compare raw output ratios and baseline-adjusted ratios at $x = 0, 1, 2$. Student work: Outputs 1, 10, 46 have raw ratios 10 and 4.6. Adding 2 gives displacements 3, 12, 47 with ratio 4. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

Exponential Parameters and Reference Points

Full Worked Solutions - excerpt

Worked example

Problem. For $h(x) = 5(4^{x-1}) - 3$, compute $h(1)$ and $h(0)$. Which quantity is represented directly by the coefficient 5?

Answer. $h(1) = 2$ and $h(0) = -\frac{7}{4}$. The coefficient 5 is the displacement $h(1) - (-3)$, not either displayed output by itself.

Explanation and check.

At $x = 1$ the factor is 1, then the baseline -3 must still be added.

Worked example

Problem. For which real c is $h(x) = (c - 5)(2^x)$ a nonconstant exponential?

Answer. All real c except $c = 5$.

Explanation and check.

The base is already valid; only the coefficient must be nonzero.

AP Precalculus

Logarithmic Transformations and Applications

Logarithmic Transformations and Applications | APPC-U02-P20

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
03	Match & Move	24 cards
04	Error Analysis & Strategy	24 tasks
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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.

AP Precalculus

Logarithmic Transformations and Applications

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: $k = 6$ and $a = -4$, so $g(x) = -4 \log_2(-x - 3) + 6$; 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: 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: $(x, y) \rightarrow (x + 4, y - 2)$; Parent asymptote: $x = 0$

Context/domain: $x > 4$

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

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: _____

AP Precalculus

Logarithmic Transformations and Applications

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

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.

AP Precalculus
Interpreting Sinusoidal Transformations

Interpreting Sinusoidal Transformations | APPC-U03-P13

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
03	Match & Move	24 cards
04	Error Analysis & Strategy	24 tasks
05	Quick Answer Key	96 answers
06	Full Worked Solutions	96 solutions
07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for changed and invariant physical features, relevant common-scale comparison, first misleading claim and corrected quantitative statement, phase event and initial-value qualification, contextual attained range and boundary status and parameter meanings and derived features.

8 PDFs and a README; 85 buyer pages.

AP Precalculus

Interpreting Sinusoidal Transformations

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.

Rewrite the supplied model in the requested input/output units or datum. Convert the input coordinate inside the argument and the output coordinate outside it, then verify one named physical event in both systems. conversion: $u = \frac{t}{60}$ minutes and $R = \frac{Q}{100}$ meters; input unit before: seconds; named event: cosine maximum; original model: $Q(t) = 230 + 40 \cos(2\pi \frac{t-90}{300})$; output unit before: centimeters. _____ Bank label: _____	Interpret every relevant coefficient of the supplied model in complete contextual sentences. Normalize an expanded argument before reading phase, distinguish signed coefficient from amplitude, and attach output or time units correctly. argument form: factored argument; input unit: hours; output unit: degrees; supplied formula: $Q(t) = 11 + 3 \cos(2\pi \frac{t-3}{16})$; valid window: 0, 64. _____ Bank label: _____
Rewrite the supplied model in the requested input/output units or datum. Convert the input coordinate inside the argument and the output coordinate outside it, then verify one named physical event in both systems. conversion: $R = \frac{Q}{100}$ meters; input unit before: seconds; named event: cosine maximum; original model: $Q(t) = 210 + 40 \cos(2\pi \frac{t-30}{360})$; output unit before: centimeters. _____ Bank label: _____	Interpret every relevant coefficient of the supplied model in complete contextual sentences. Normalize an expanded argument before reading phase, distinguish signed coefficient from amplitude, and attach output or time units correctly. argument form: factored argument; input unit: hours; output unit: degrees; supplied formula: $Q(t) = 9 + 5 \cos(2\pi \frac{t-4}{8})$; valid window: 0, 32. _____ Bank label: _____

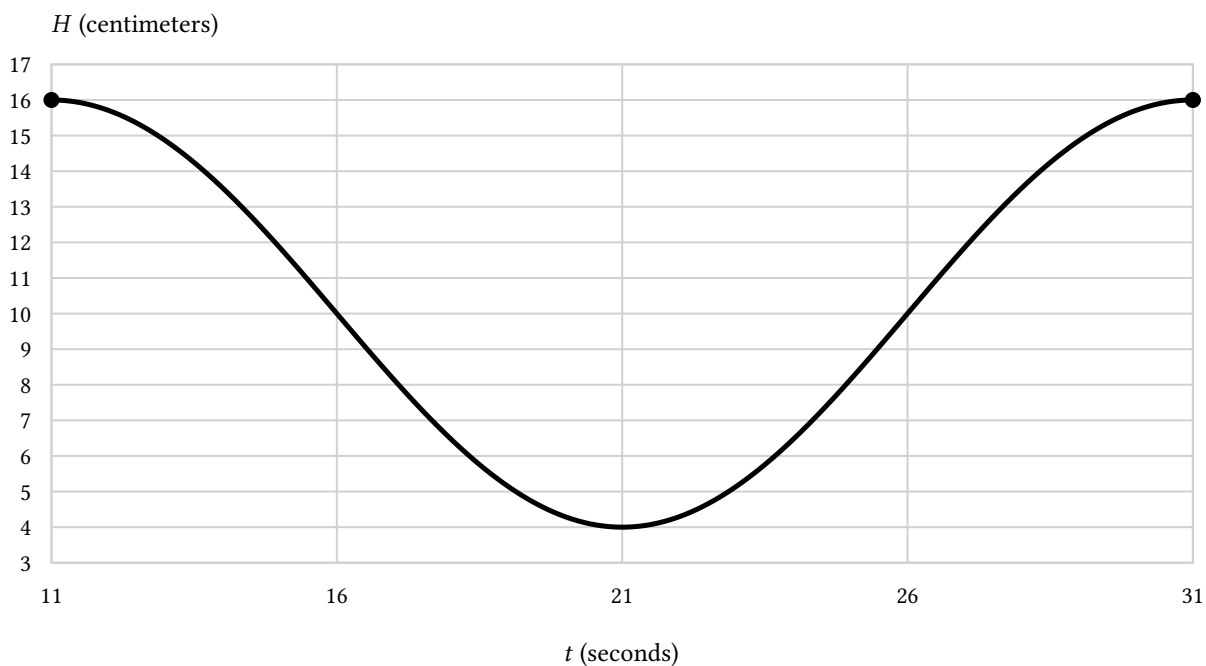
AP Precalculus

Interpreting Sinusoidal Transformations

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.

Interpret the supplied graph only on its physical operating window. State the attainable output interval, midline meaning, and whether displayed boundaries are attained; do not substitute the full mathematical range when the window clips an extremum.



AP Precalculus

Interpreting Sinusoidal Transformations

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 Compare the supplied original and changed models. Explain the physical consequence of the one parameter category that changed and explicitly name the range, recurrence, or event features that remain invariant. changed formula: $P_2(t) = 7 + 4 \sin(2\pi \frac{t-7}{16})$; only changed category: period; original formula: $P(t) = 7 + 4 \sin(2\pi \frac{t-7}{8})$; output unit: units; time unit: hours. Your response: _____	Incoming: period doubles from 8 to 16 time units, so recurrence halves; range and the anchor at $t = \frac{7}{2}$ stay fixed. Rewrite the supplied model in the requested input/output units or datum. Convert the input coordinate inside the argument and the output coordinate outside it, then verify one named physical event in both systems. conversion: new datum is 52 cm above the old datum, so $R = Q - 52$; input unit before: seconds; named event: cosine maximum; original model: $Q(t) = 220 + 60 \cos(2\pi \frac{t-60}{240})$; output unit before: centimeters. Your response: _____
Incoming: $R(t) = 168 + 60 \cos(2\pi \frac{t-60}{240})$; event times are unchanged while every height label decreases by 52 cm. Interpret every relevant coefficient of the supplied model in complete contextual sentences. Normalize an expanded argument before reading phase, distinguish signed coefficient from amplitude, and attach output or time units correctly. argument form: factored argument; input unit: hours; output unit: meters; supplied formula: $Q(t) = 10 + 4 \sin(2\pi \frac{t+\frac{3}{2}}{10})$; valid window: 0, 40. Your response: _____	Incoming: amplitude 4 meters; midline 10 meters; period 10 hours; frequency $\frac{1}{10}$ cycle per hour; $h = -\frac{3}{2}$ hours labels an upward midline crossing. Compare the two supplied contextual models on a common unit scale. Address only the feature relevant to the stated practical measure—range, recurrence, baseline, or phase equivalence—and identify what cannot distinguish the models. common units: input: hours; output: units; formula pair: $A(t) = 6 + 5 \sin(2\pi \frac{t-\frac{3}{2}}{12})$, $B(t) = 8 + 5 \sin(2\pi \frac{t-\frac{3}{2}}{12})$; practical measure: same-period. Your response: _____
Incoming: same period 12 hours and same spread 10, but B's baseline and range are 2 units higher. Compare the supplied original and changed models. Explain the physical consequence of the one parameter category that changed and explicitly name the range, recurrence, or event features that remain invariant. changed formula: $P_2(\tau) = 8 + 5 \sin(2\pi \frac{\tau}{10})$; only changed category: clock; original formula: $P(t) = 8 + 5 \sin(2\pi \frac{t-4}{10})$; output unit: units; time unit: hours. Your response: _____	Incoming: with $t = \tau + 4$, the same physical anchor is labeled $\tau = 0$ rather than $t = 4$; range and physical period are unchanged. Rewrite the supplied model in the requested input/output units or datum. Convert the input coordinate inside the argument and the output coordinate outside it, then verify one named physical event in both systems. conversion: $u = \frac{t}{60}$ minutes; input unit before: seconds; named event: cosine maximum; original model: $Q(t) = 200 + 40 \cos(2\pi \frac{t}{360})$; output unit before: centimeters. Your response: _____

AP Precalculus**Interpreting Sinusoidal Transformations****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.

Test the student's contextual parameter statement against the supplied model. Identify the first misleading claim and replace it with a quantitatively correct statement including units or window limits where relevant. context units: stated in formula or prompt; student statement: The period is 4π .; supplied model: $Q(t) = 4 + 3 \sin(4\pi(t - 2))$. Identify the error or first invalid step, give the corrected result, and state a brief mathematical reason.

Interpreting Sinusoidal Transformations

Full Worked Solutions - excerpt

Worked example

Problem. Compare the two supplied contextual models on a common unit scale. Address only the feature relevant to the stated practical measure—range, recurrence, baseline, or phase equivalence—and identify what cannot distinguish the models. common units: input: hours; output: units; formula pair: $A(t) = 5 + 2 \sin(2\pi \frac{t+2}{8})$, $B(t) = 5 + 2 \sin(2\pi \frac{t+2}{16})$; practical measure: same-range.

Answer. same range $[3, 7]$, but B recurs every 16 rather than 8 hours.

Explanation and check.

Normalize the ranges, periods, and reference families. The decisive result is: same range $[3, 7]$, but B recurs every 16 rather than 8 hours.

Worked example

Problem. Compare the two supplied contextual models on a common unit scale. Address only the feature relevant to the stated practical measure—range, recurrence, baseline, or phase equivalence—and identify what cannot distinguish the models. common units: input: hours; output: units; formula pair: $A(t) = 5 + 4 \sin(2\pi \frac{t-1}{10})$, $B(t) = 5 + 4 \sin(2\pi \frac{t-1}{20})$; practical measure: same-range.

Answer. same range $[1, 9]$, but B recurs every 20 rather than 10 hours.

Explanation and check.

Normalize the ranges, periods, and reference families. The decisive result is: same range $[1, 9]$, but B recurs every 20 rather than 10 hours.

AP Precalculus
Tangent Function Transformations

Tangent Function Transformations | APPC-U03-P15

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
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08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for compatible pattern or precise contradiction, invariants, center outputs, and orientation, period, zero family, and asymptote family, failed relation and corrected feature statement, invalid claim or first invalid step, corrected conclusion, brief mathematical reason, and the requested underlying result and included zeros and asymptote locations.

8 PDFs and a README; 151 buyer pages.

AP Precalculus

Tangent Function Transformations

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.

List every zero and every vertical-asymptote location inside the specified window. Solve integer bounds for the two families separately and honor each open or closed display endpoint exactly.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition	Supplied value
Given vertical-asymptote family	$x = \frac{\pi}{2} + k(\frac{\pi}{2})$
Required window	$(-3\frac{\pi}{4}, 5\frac{\pi}{4}]$
Given zero family	$x = \frac{\pi}{4} + k(\frac{\pi}{2})$

Bank label: _____

AP Precalculus

Tangent Function Transformations

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

Compare the two supplied tangent models without solving a general tangent equation. State what happens to period, asymptotes, branch-center outputs, former zeros, and branch orientation after the vertical translation, with special attention to the required evidence focus. The supplied models are $f(x) = 3 \tan(\frac{1}{2}(x))$ and $g(x) = 3 \tan(\frac{1}{2}(x)) + 1$. The branch-center family is $x = 0 + k(2\pi)$. The required evidence focus is to state exactly which invariants come from the inner map.

Solve the problem and show enough exact work for the requested result.

Condition	Supplied value
Given branch-center input family	$x = 0 + k(2\pi)$
Required evidence focus	state exactly which invariants come from the inner map
Given output translation	1

AP Precalculus

Tangent Function Transformations

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.

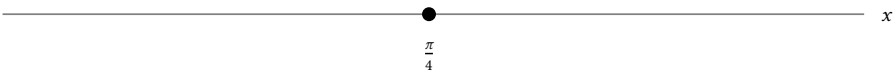
Incoming: zeros are $-15\frac{\pi}{4}, -7\frac{\pi}{4}, \frac{\pi}{4}, 9\frac{\pi}{4}, 17\frac{\pi}{4}$; asymptote locations are $-19\frac{\pi}{4}, -11\frac{\pi}{4}, -3\frac{\pi}{4}, 5\frac{\pi}{4}, 13\frac{\pi}{4}, 21\frac{\pi}{4}$.

Recover the horizontal period and a phase-anchor class from the graph evidence. Decide whether the asymptote spacing is one period or several, and state exactly what sign ambiguity remains; use orientation only when it is supplied.

Observed asymptote locations



Marked branch-center input



Feature	Exact x-location(s)
Observed asymptote locations	$-\frac{\pi}{4}, 3\frac{\pi}{4}$
Marked branch-center input	$\frac{\pi}{4}$

Condition	Supplied value
Given adjacency information	certified consecutive
Given branch direction	not supplied
Given outer coefficient	not orientation-resolving

Your response: _____

AP Precalculus

Tangent Function Transformations**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.

A student claims: “Omit $x = -7\frac{\pi}{3}$ and $x = 7\frac{\pi}{6}$ because boundary locations can never appear in requested zero or asymptote lists.” Diagnose the first invalid step or assumption, give the corrected conclusion, and justify the correction. Then complete or verify the underlying task: Use this route: audit both endpoint flags. Enumerate zeros from $x = -\frac{\pi}{3} + k(\pi)$ and poles from $x = \frac{\pi}{6} + k(\pi)$ inside $[-7\frac{\pi}{3}, 7\frac{\pi}{6}]$, honoring every endpoint.

Identify the stated incorrect claim or first invalid step, give the corrected result, and state a brief mathematical reason.

Condition	Supplied value
Given vertical-asymptote family	$x = \frac{\pi}{6} + k(\pi)$
Required window	$[-7\frac{\pi}{3}, 7\frac{\pi}{6}]$
Given zero family	$x = -\frac{\pi}{3} + k(\pi)$

Tangent Function Transformations

Full Worked Solutions - excerpt

Worked example

Problem. Find the first invalid relation in the worked tangent-feature calculation, repair only that relation, and verify the correction with one representative zero, asymptote, or spacing check.

Identify the error or first invalid step, give the corrected result, and state a brief mathematical reason.

Condition	Supplied value
Step to examine	calls every branch center an x -intercept after adding $d = 4$

Answer. centers have output 4 and need not be x -intercepts.

Explanation and check.

Check the tangent-specific period π , the separate inner-angle conditions for zeros and poles, and the role of any vertical offset. Preserve steps that remain valid after the single correction. At an old center, the inner angle is 0 and $\tan(0) = 0$. After the stated translation by 4, the output there is 4, not 0. This direct substitution verifies that the old center is not an x -intercept.

Worked example

Problem. Find the first invalid relation in the worked tangent-feature calculation, repair only that relation, and verify the correction with one representative zero, asymptote, or spacing check.

Compare the stated objects or approaches and justify the conclusion with exact evidence.

Condition	Supplied value
Step to examine	reports $T = -\frac{\pi}{3}$ for $b = -3$

Answer. period is positive $\frac{\pi}{3}$.

Explanation and check.

Check the tangent-specific period π , the separate inner-angle conditions for zeros and poles, and the role of any vertical offset. Preserve steps that remain valid after the single correction. With $b = -3$ and $T = \frac{\pi}{3}$, the inner-angle change is $-3(\frac{\pi}{3}) = -\pi$. Tangent has the same value after that change, while T is positive. The claimed negative value is not a period length.