Sets & Steps
Math Practice & Worked Solutions

Precalculus
Function Transformations

3-topic bundle | 288 problems | Four activity formats

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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

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.

24 PDFs and 3 READMEs; 220 buyer PDF pages across the 3 products.

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

This is a fixed collection of the listed products. Purchase includes the existing individual resource files. To open a product's online preview, follow its title link and select View Preview.

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Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Function Translations

Function Translations | APPC-U01-P16

96 problems · Four activity formats

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.

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

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: _____

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: _____

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: _____

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: _____

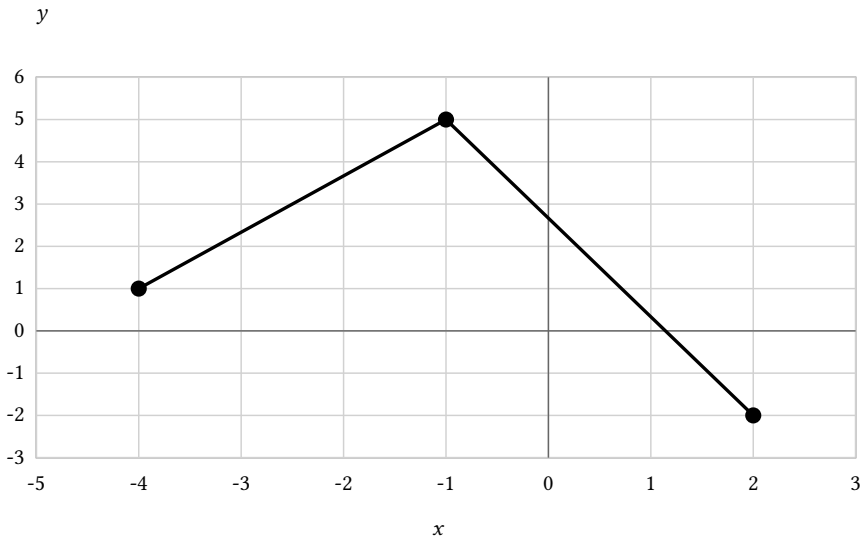
AP Precalculus

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.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Function Reflections, Stretches, and Compressions

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

96 problems · Four activity formats

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.

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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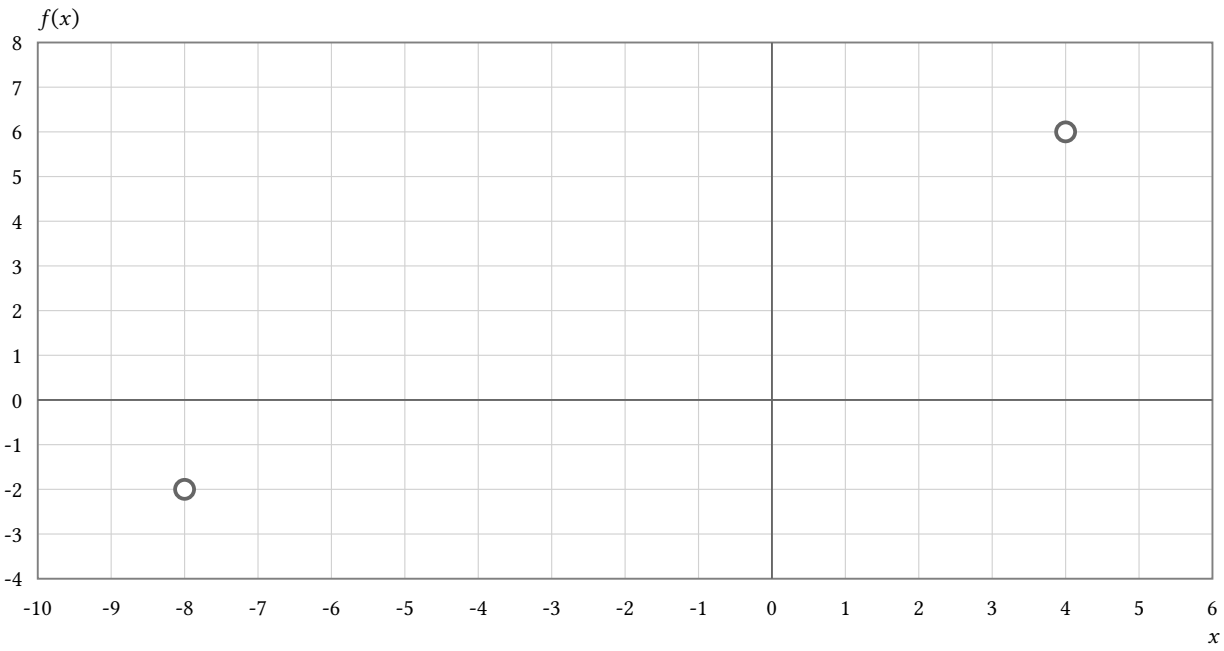
AP Precalculus

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: _____

AP Precalculus

Function Reflections, Stretches, and Compressions

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.

The table lists exact values of f. If $g(x) = 2f(-\frac{x}{2})$, find $g(6)$.

Required output: exact value

x	f(x)
-6	4
-3	-5
1	7
4	0

The domain of f is $[-6, 3)$ and its range is $(-2, 8]$. Determine the domain and range of $g(x) = -4f(-2x)$.

AP Precalculus

Function Reflections, Stretches, and Compressions

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

A table row for f is $(6, -4)$. Find its corresponding row for $g(x) = -5f(-2x)$.

Given f-table row

x	f(x)
6	-4

Your response: _____

Incoming: $[-3, 20]$

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

Your response: _____

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 $[-12, 18]$.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Combined Function Transformations

Combined Function Transformations | APPC-U01-P18

96 problems · Four activity formats

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.

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

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:** _____

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.

Starting from f, shift the graph right 3 units and then double every x-coordinate. Write the final rule $g(x)$.	Function f has vertex (0,-2) and domain [-4,4]. Construct g(x)=a f(b(x-h))+k with a>0,b>0 so the vertex becomes (3,5) and domain becomes [1,5].
Let $f(u) = u + 1$ for $u < 0$ and $f(u) = u^2$ for $u \geq 0$. Write $g(x) = 2f(3(x - 4)) - 5$ as a piecewise function of x.	Normalize $g(x) = -4f(-2x - 6) + 1$ and give a, b, h, k and the coordinate map.

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.

2	-1	0	1
4	5	4	3

Your response: _____

Incoming: Domain $[-20, -8)$ union $\{-2\}$ union $(8, 16]$; range $[-8, 4]$ union (16,infinity).

The graph of f has vertical asymptote $x = -2$. Find the corresponding vertical asymptote of $g(x) = 3f(2(x - 5)) + 4$.

Your response: _____

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.

1	7	-3	2
3	15	5	6

Your response: _____

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.

-2	5	0	0
1	-3	6	4

Your response: _____

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.

4	1	0	2
9	11	10	-3

Your response: _____

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.