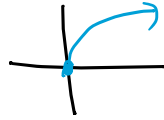
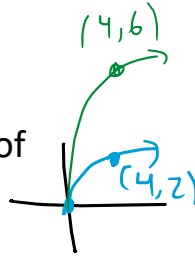


Warm-up!

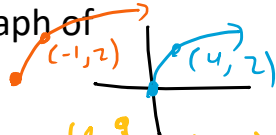
Let $f(x) = \sqrt{x}$



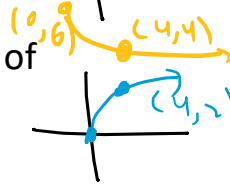
Compared to $f(x)$, do you know what the graph of $g(x) = 3\sqrt{x}$ looks like?



Compared to $f(x)$, do you know what the graph of $g(x) = \sqrt{x+5}$ looks like?



Compared to $f(x)$, do you know what the graph of $g(x) = -\sqrt{x} + 6$ looks like?



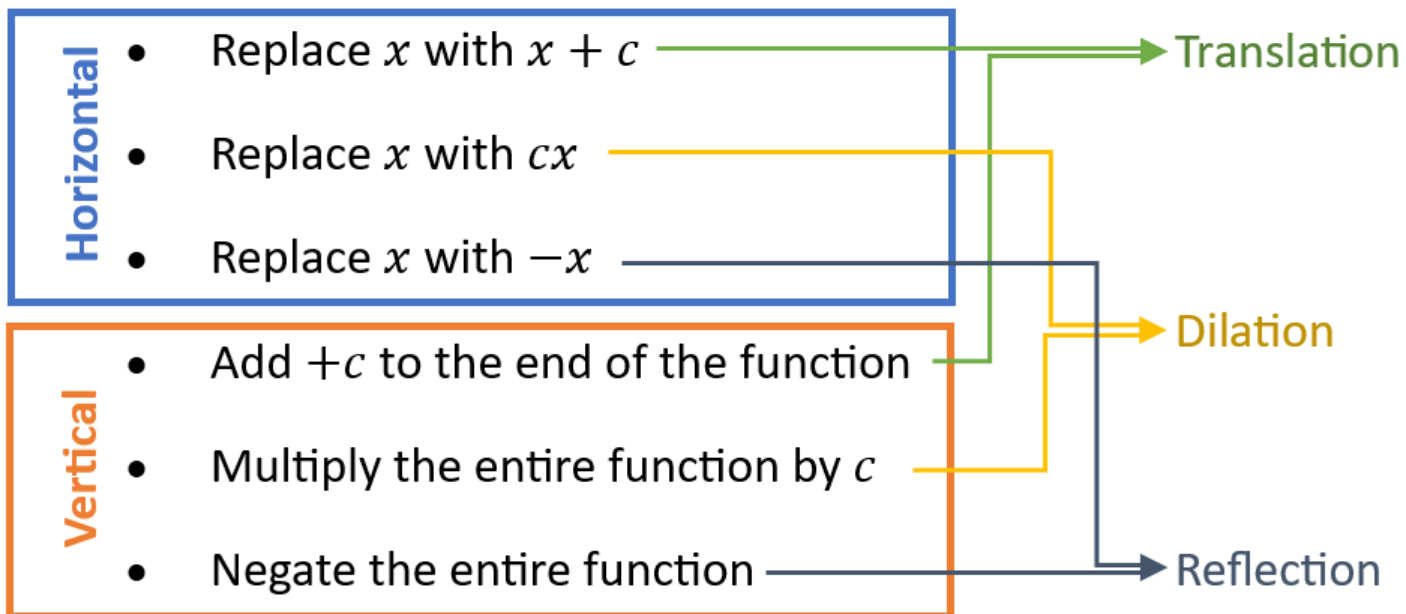
Periodic Graphs Day 1

- (1.12) Transformations Review

Homework: Transformations Refresh

Transformations

There are six basic transformations:



Example 1: Translations

Let $g(x) = f(x + 3) + 5$

If the point $(2,10)$ is on the graph of $f(x)$,
determine the corresponding point on the graph of
 $g(x)$.

Example 2: Dilations

Let $g(x) = 3f(2x)$

If the point $(-10, 12)$ is on the graph of $f(x)$,
determine the corresponding point on the graph of
 $g(x)$.

Example 3: Translation + Dilation

$$\text{Let } g(x) = f\left(\frac{1}{3}x\right) + 6$$

Describe the transformations, in order, that map the graph of $f(x)$ to the graph of $g(x)$.

If the point $(3, -1)$ is on the graph of $f(x)$, find the corresponding point on the graph of $g(x)$.

Example 4

To the function $f(x)$, perform the following transformations in this order: a horizontal dilation by a factor of 3, a vertical dilation by a factor of 2, a horizontal translation by 5 units.

Starting: $f(x)$

After horizontal dilation by a factor of 3:

After vertical dilation by a factor of 2:

After horizontal translation by 5 units:

If the point $(12,6)$ is on the graph of $f(x)$, find the corresponding point on the transformed graph.

Example 5

To the function $f(x)$, perform the following transformations in this order: a vertical translation by -2 units, A horizontal dilation by a factor of $\frac{1}{4}$, a vertical dilation by a factor of 3.

Starting: $f(x)$

After vertical translation by -2 units:

After horizontal dilation by a factor of $\frac{1}{4}$:

After vertical dilation by a factor of 3:

If $f(x)$, has domain $[-20,8]$ and range $[-5,10)$, find the domain and range of the transformed function.

Example 6: Reflections

The graph of $g(x)$ is the image of the graph of $f(x)$ after the following transformations in the following order: Horizontal dilation by a factor of $\frac{1}{3}$, reflection over the x -axis, horizontal translation -2 units

A) Find an equation for $g(x)$ in terms of $f(x)$.

B) If the point $(6,10)$ is on the graph of $f(x)$, find the corresponding point on the graph of $g(x)$.

Example 7

Let $g(x) = f(-x + 4) - 3$

A) Describe the transformations, in order, that map the graph of $f(x)$ to the graph of $g(x)$.

B) If the point $(2,5)$ is on the graph of $f(x)$, find the corresponding point on the graph of $g(x)$.

Example 8

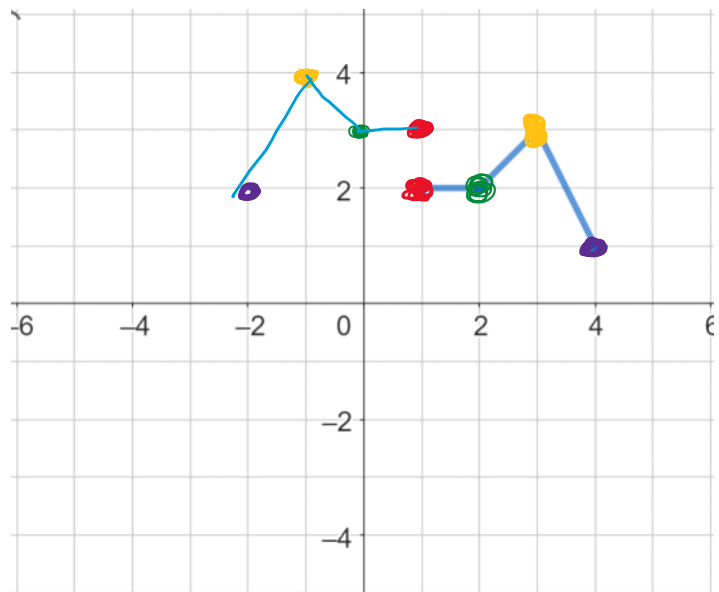
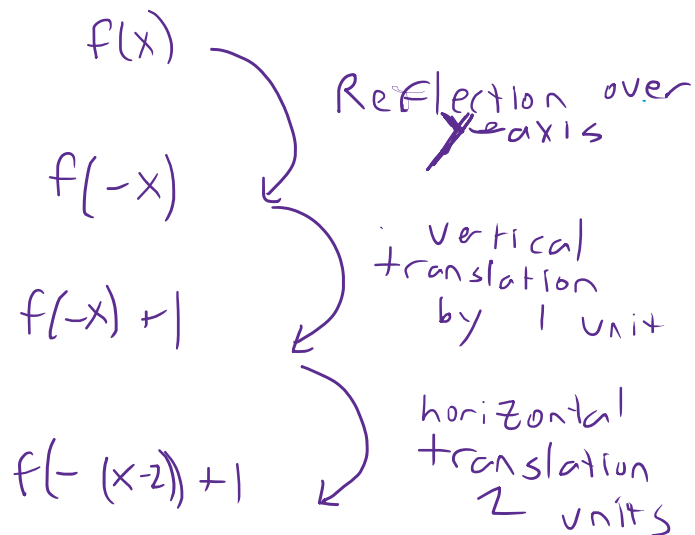
The function f is given by $f(x) = x^2 + 3x$

Find the equation of the function whose graph is the image of the graph of $f(x)$ after the following a reflection over the y -axis followed by a horizontal translation by 2 units.

Example 9

The graph of $y = f(x)$ is shown to the right.

Sketch $g(x) = f(-(x - 2)) + 1$



Example 10

To the function $f(x)$, perform the following transformations in this order: a horizontal dilation by a factor of $\frac{1}{2}$, a vertical translation by -3 units, a reflection over the x -axis.

Starting: $f(x)$

After horizontal dilation by a factor of $\frac{1}{2}$:

After vertical translation by -3 units:

After a reflection over the x -axis:

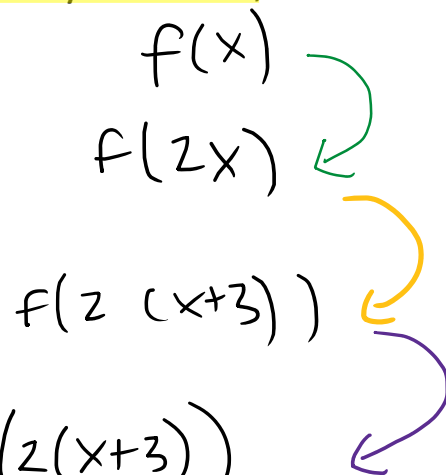
If the domain of $f(x)$ is $[-4,10]$ and the range of $f(x)$ is $[-5,5]$, find the domain and range of the transformed function.

Example 11

$g(x)$ is the result of applying the following transformations, in order, to $f(x)$:
 Horizontal dilation by a factor of $\frac{1}{2}$, horizontal translation by -3 units, vertical
 dilation by a factor of 10.

A) Find an expression for $g(x)$ in terms of $f(x)$

$$g(x) = 10 f(2(x+3))$$



B) The following are values of $f(x)$. Find $g(2)$

x	2	4	6	8	10	12	14	16
$f(x)$	5	6	-1	7	-4	3	0	-2

$$\begin{aligned}
 g(2) &= 10 f(2(2+3)) \\
 &= 10 f(10) \\
 &= 10 \cdot -4 = -40
 \end{aligned}$$

Day 1 Transformations Step By Step Tables



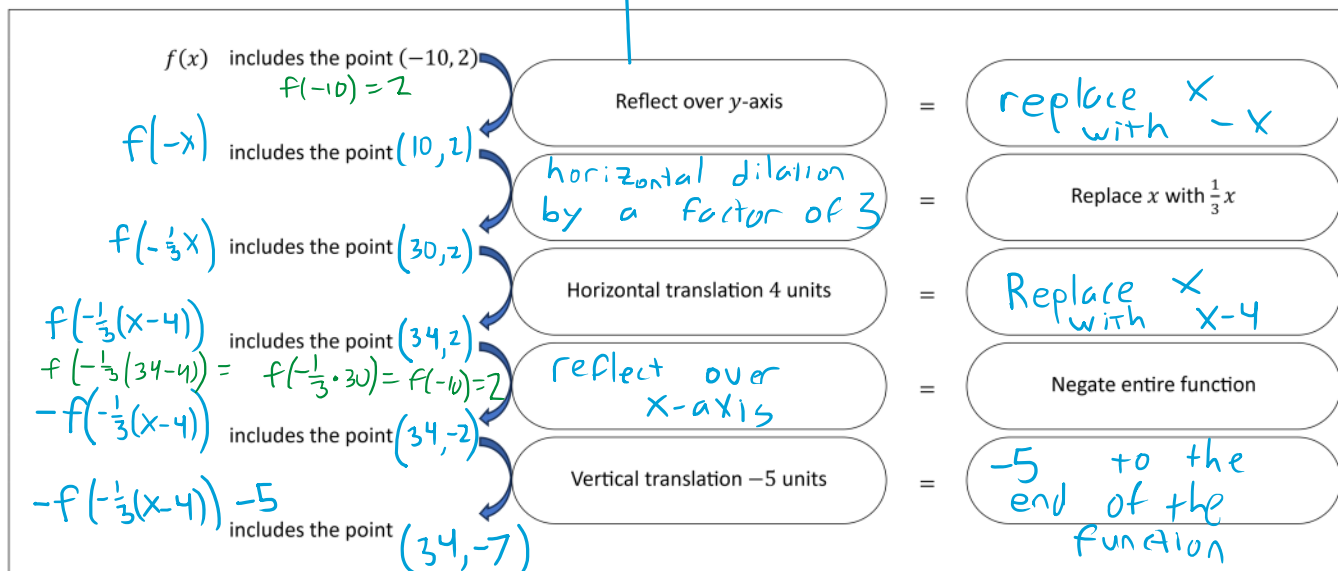
Day 1 Transformations Step By Step Tables

$f(x)$ includes the point $(8, -4)$ $f(8) = -4$	Vertical translation 3 units	=	Add 3 to entire function
$f(x)+3$ includes the point $(8, -1)$ $f(8)+3 = -4+3 = -1$	Horizontal translation 4 units	=	Replace x with $x-4$
$f(x-4)+3$ includes the point $(12, -1)$	Horizontal dilation by a factor of $\frac{1}{2}$	=	Replace x with $2x$
$f(2x-4)+3$ includes the point $(6, -1)$	Vertical dilation by a factor of 5	=	Multiply entire function by 5
$5f(2x-4)+3$ includes the point $(6, -5)$			

$5f(2x-4)+15$ $5f(2 \cdot 6-4)+15 = 5f(8)+15 = 5(-4)+15 = -20+15 = -5$ $f(x)$ includes the point $(2, 15)$ $f(2) = 15$	Vertical dilation by a factor of $\frac{1}{3}$	=	$\times \frac{1}{3}$ to the entire function
$\frac{1}{3}f(x)$ includes the point $(2, 5)$	Horizontal dilation by a factor of 6	=	Replace x with $\frac{1}{6}x$
$\frac{1}{3}f(\frac{1}{6}x)$ includes the point $(12, 5)$	Vertical translation 2 units	=	+2 to the end of the function
$\frac{1}{3}f(\frac{1}{6}x)+2$ includes the point $(12, 7)$	Horizontal translation -1 unit	=	Replace x with $(x+1)$
$\frac{1}{3}f(\frac{1}{6}(x+1))+2$ includes the point $(11, 7)$			

$$\frac{1}{3}f\left(\frac{1}{6}(11+1)\right)+2 = \frac{1}{3}f(2)+2 = \frac{1}{3} \cdot 15+2 = 5+2 = 7$$

$(-10, 2)$



$$-f\left(-\frac{1}{3}(x-4)\right) - 5$$

$(34, -7)$

$f(x)$ includes the point



=

includes the point



=

includes the point



=

$f(-(x+3))+6$ includes the point $(-9,2)$

$f(x)$ includes the point



=

includes the point



=

includes the point



=

$f(-x+3)+6$ includes the point $(-9,2)$

$f(x)$ includes the point (3,1)

Horizontal dilation by a factor of __

=

includes the point (6, 1)

Reflection over the __-axis

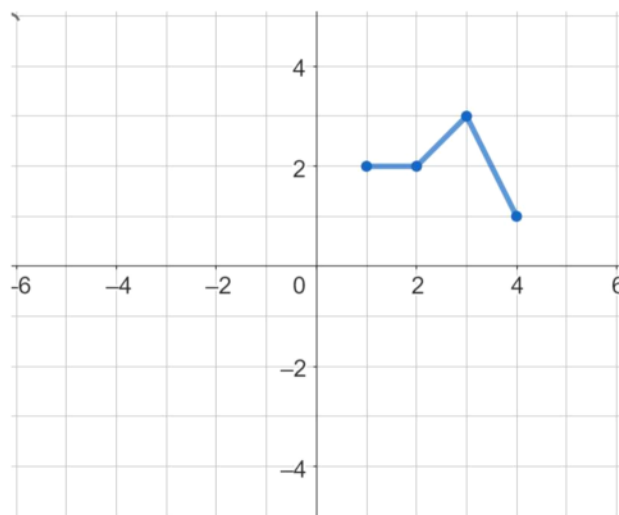
=

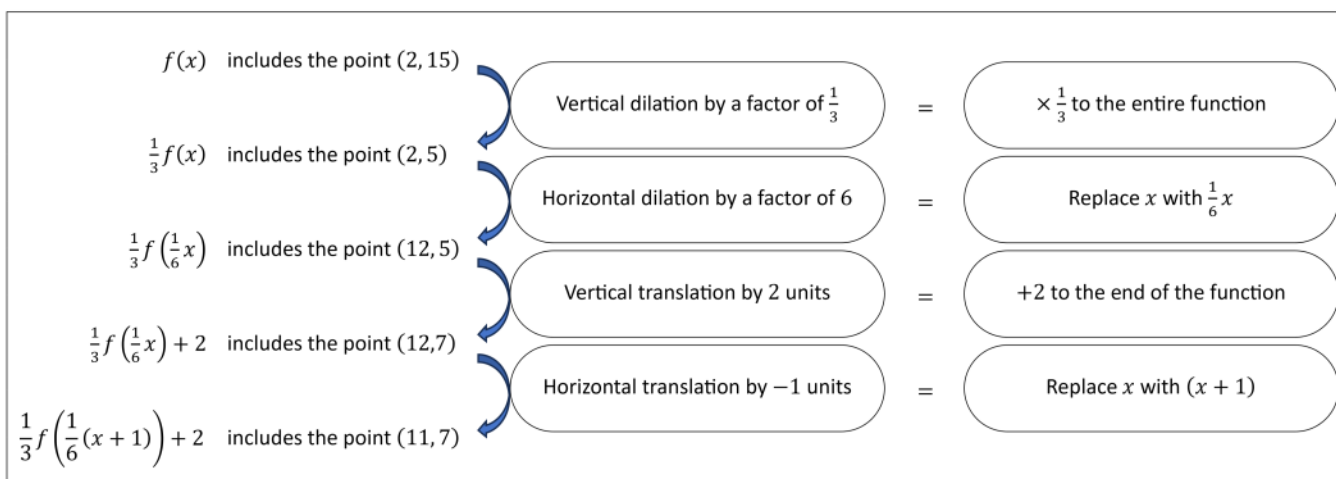
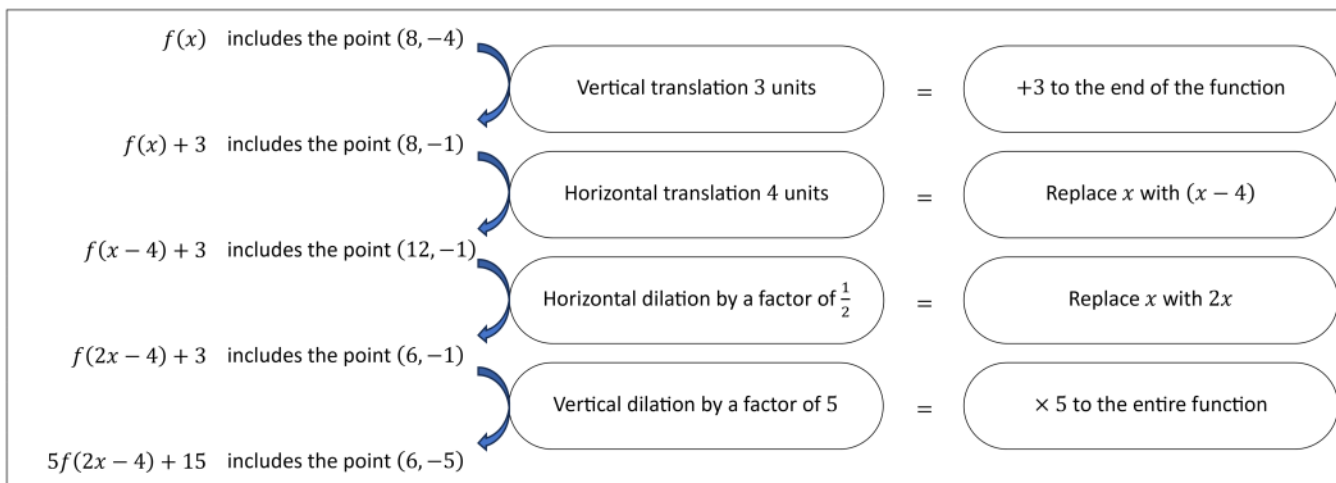
includes the point (6, -1)

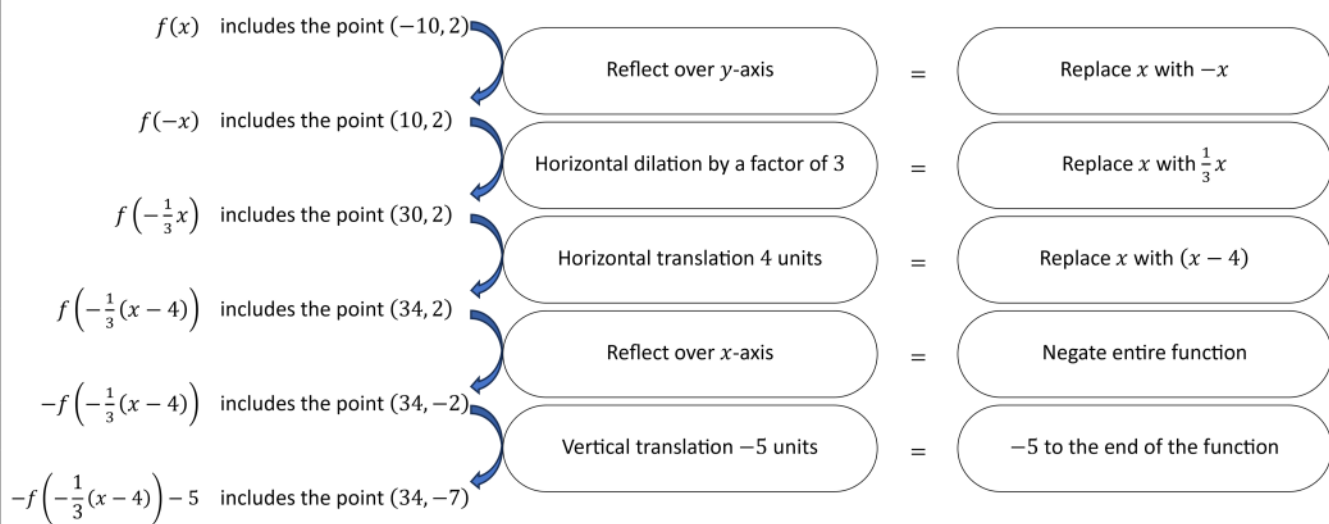
Vertical Translation by 6 units

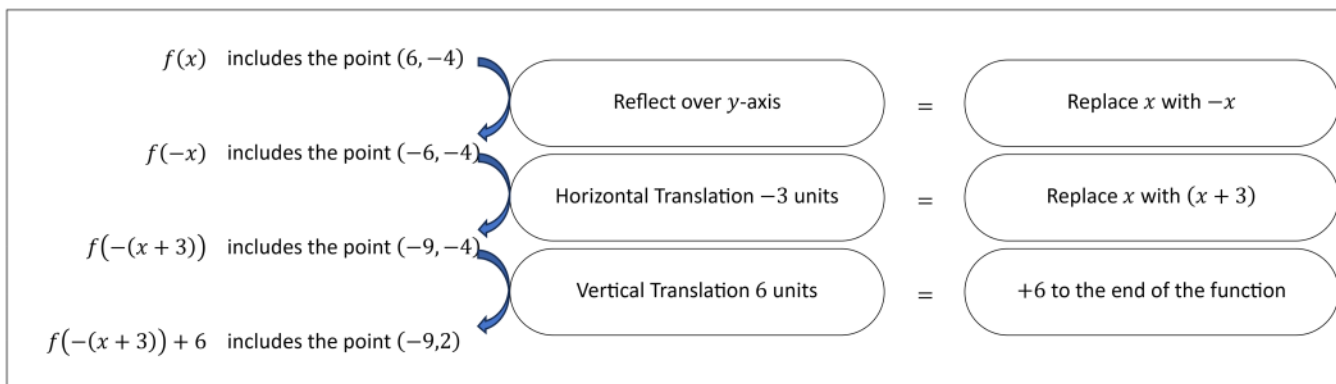
=

includes the point

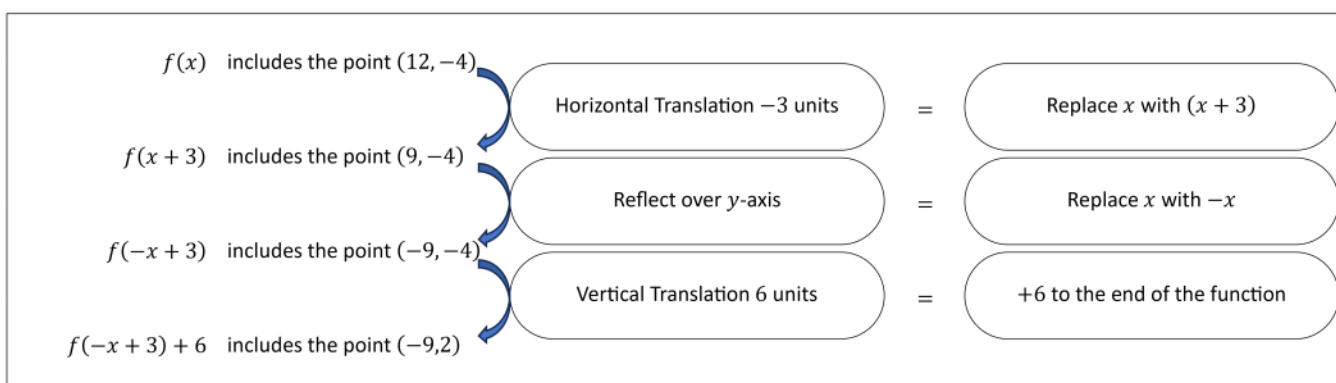




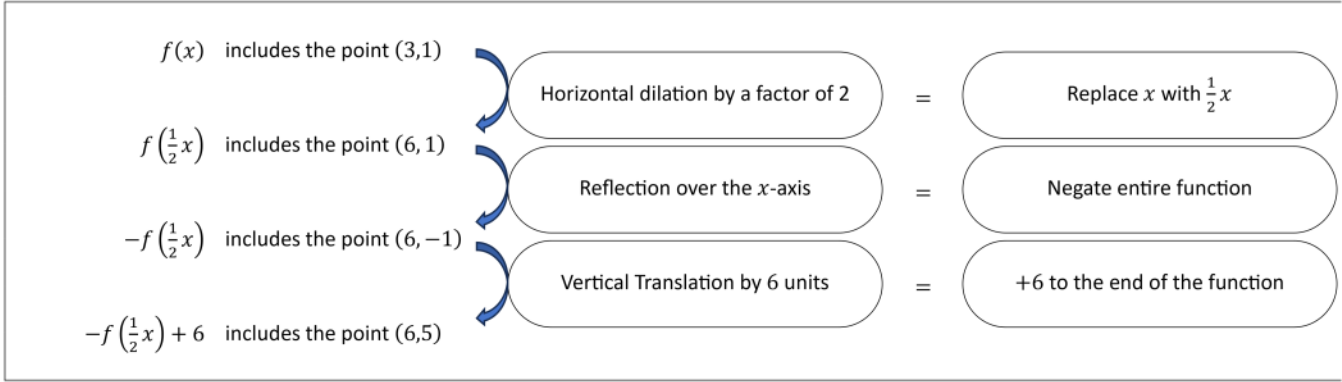




(This is not the only correct order. The vertical translation could happen at any point. The reflection over the y-axis can come after the horizontal translation if we instead did a horizontal translation by $+3$ units, replacing x with $(x - 3)$)



(This is not the only correct order. The vertical translation could happen at any point. The reflection over the y-axis can come before the horizontal translation if we instead did a horizontal translation by $+3$ units, replacing x with $(x - 3)$)



Day 1 Transformations Step By Step Tables



Day 1
Transfor...

$f(x)$ includes the point $(8, -4)$		Vertical translation 3 units	=	
includes the point		Horizontal translation 4 units	=	
includes the point		Horizontal dilation by a factor of $\frac{1}{2}$	=	
includes the point		Vertical dilation by a factor of 5	=	
includes the point				

$f(x)$ includes the point $(2, 15)$			=	$\times \frac{1}{3}$ to the entire function
includes the point			=	Replace x with $\frac{1}{6}x$
includes the point			=	+2 to the end of the function
includes the point			=	Replace x with $(x + 1)$
includes the point				

$f(x)$ includes the point $(-10, 2)$	Reflect over y-axis	=	
includes the point		=	Replace x with $\frac{1}{3}x$
includes the point	Horizontal translation 4 units	=	
includes the point		=	Negate entire function
includes the point	Vertical translation -5 units	=	
includes the point		=	

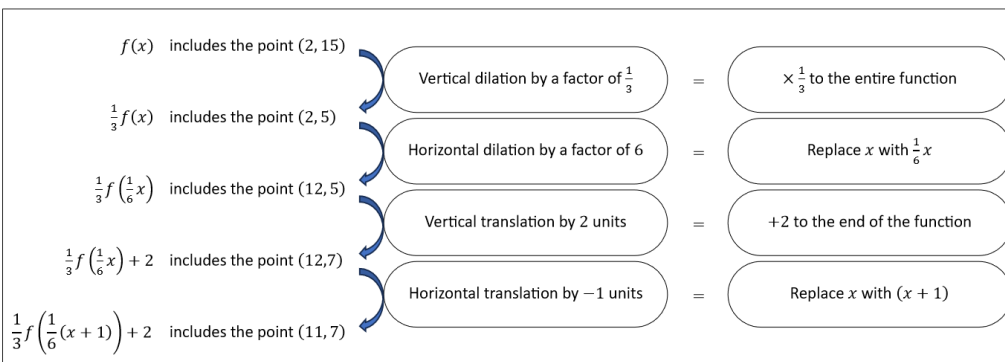
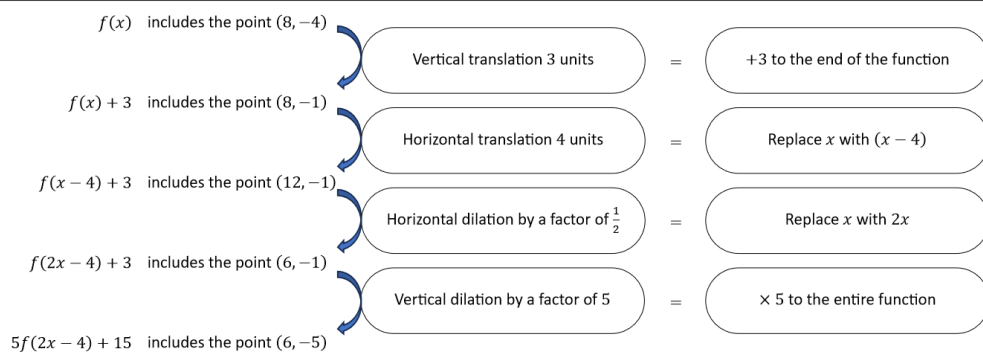
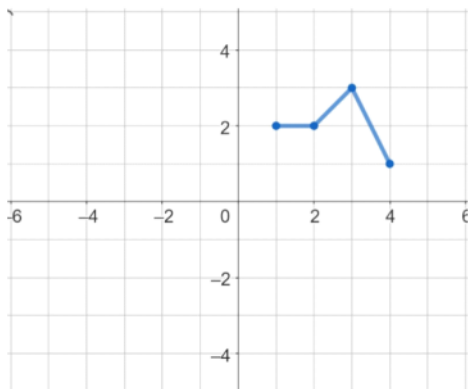
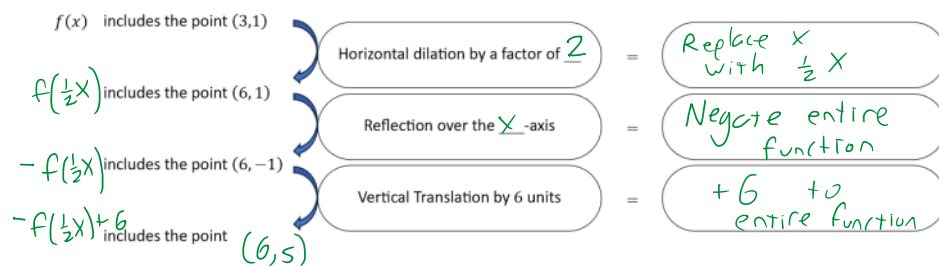
$f(x)$ includes the point $(6, -4)$	Reflect over y-axis	=	Replace x with $(-x)$
$f(-x)$ includes the point $(-6, -4)$	horiz trans -3 units	=	Replace x with $(x+3)$
$f(-(x+3))$ includes the point $(-9, -4)$	vert trans 6 units	=	Add 6 to entire function
$f(-(x+3)) + 6$ includes the point $(-9, 2)$			

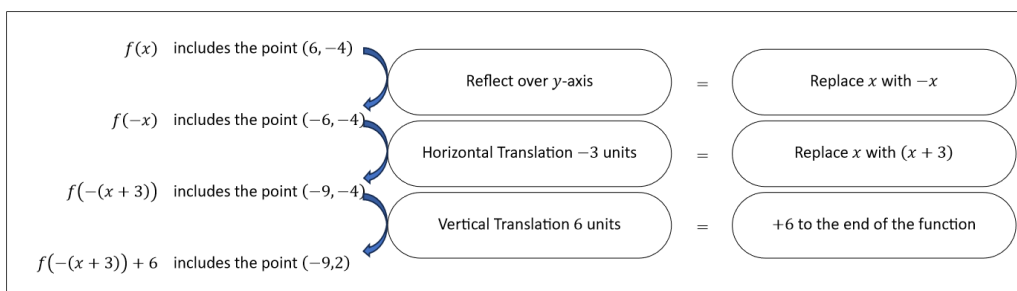
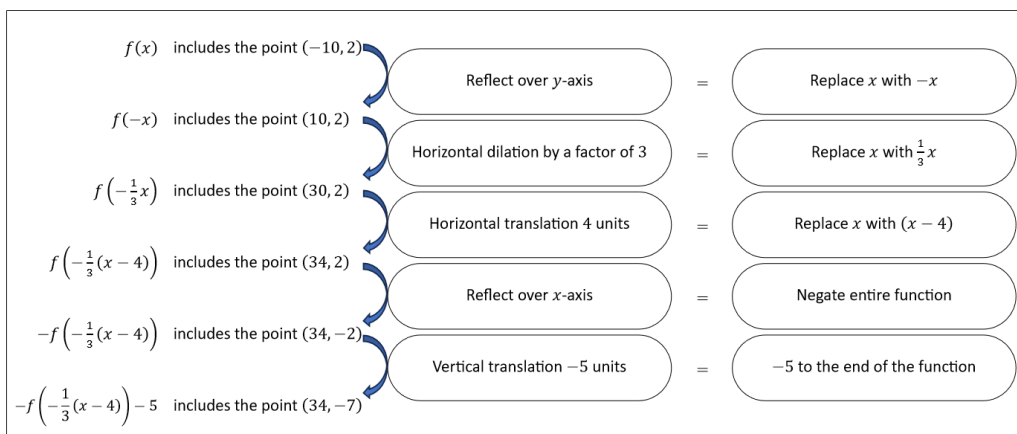
$$f(-(x+3)) + 6 = 2 \rightarrow f(6) = -4$$

$$f(6) + 6 = 2$$

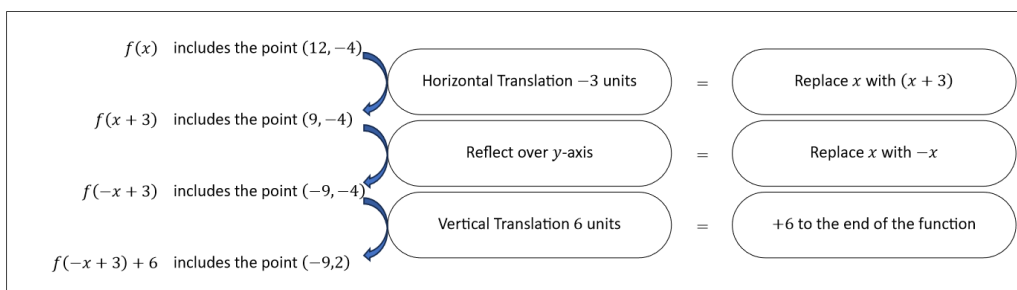
$$af(b(x+h)) + k$$

$f(x)$ includes the point $(12, -4)$	horizontal trans -3 units	=	replace x with $x+3$
$f(x+3)$ includes the point $(9, -4)$	reflect over y-axis	=	Replace x with $-x$
$f(-x+3)$ includes the point $(-9, -4)$	vertical translation 6 units	=	Add 6 to function
$f(-x+3) + 6$ includes the point $(-9, 2)$			





(This is not the only correct order. The vertical translation could happen at any point. The reflection over the y-axis can come after the horizontal translation if we instead did a horizontal translation by $+3$ units, replacing x with $(x - 3)$)



(This is not the only correct order. The vertical translation could happen at any point. The reflection over the y-axis can come before the horizontal translation if we instead did a horizontal translation by $+3$ units, replacing x with $(x - 3)$)

