

1.4 Combining Transformations

$$y = af(b(x \pm c)) \pm d \quad \text{OR} \quad a(y \pm d) = f(b(x \pm c))$$

a – Vertical expansion/compression as well as reflection over the x-axis

b – Horizontal expansion/compression as well as a reflection over the y-axis

c – Translate the graph left/right

d – Translate the graph up/down

Ex. strategies for graphing:

	$y = 2f(3(x-4)) + 6$ $a=2 \quad b=3 \quad c=4 \quad d=6$	$\frac{1}{2}(y-6) = f(3(x-4))$
1	$b \rightarrow$ Compress x by (3)	$y = 2f(3(x-4)) + 6$
2	$a \rightarrow$ stretch by (2)	\rightarrow Compress x by (3)
3	$c \rightarrow$ right 4	\rightarrow Stretch y by (2)
4	$d \rightarrow$ up 6	\rightarrow right 4 Up 6

Moving a point: If (4, 6) is on the graph of $y = f(x)$, what point is on the graph

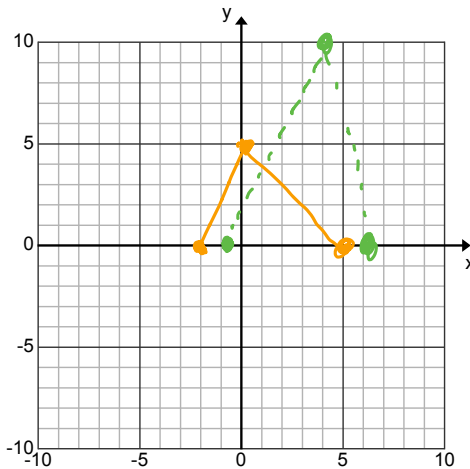
	$y = -f\left(\frac{1}{2}(x+1)\right) + 2$	$-(y-2) = f\left(\frac{1}{2}(x+1)\right)$
1	$a = -1 \quad k = \frac{1}{2} \quad c = -1 \quad d = 2$	$y = -f\left(\frac{x+1}{2}\right) + 2$
2	expansion in X (2) + reflect	reflect over X-axis.
3	over X-axis. Left 1. Up 2.	Expansion in X (2). Left 1
4	$(2(4) - 1, -6 + 2)$ $(7, -4)$	Up 2. $(4, 6) \rightarrow (7, -4)$ map

Moving a graph: Given the graph $y = f(x)$ shown below, sketch a graph of

$$y = 2f(-(x-4))$$

$$(x, y) \rightarrow (-x+4, 2y)$$

$$(-2, 0) \rightarrow (6, 0)$$



$$(0, 5) \rightarrow (4, 10)$$

$$(5, 0) \rightarrow (-1, 0)$$

Dealing with: $y = f(bx \pm c)$

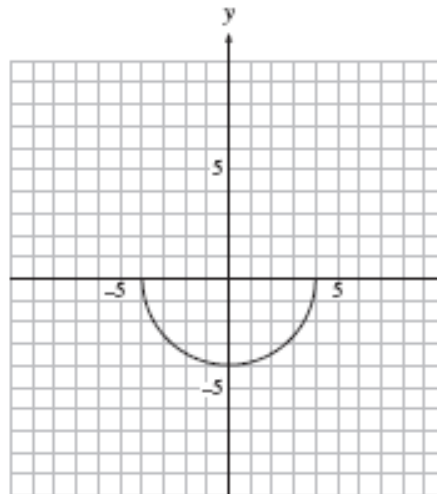
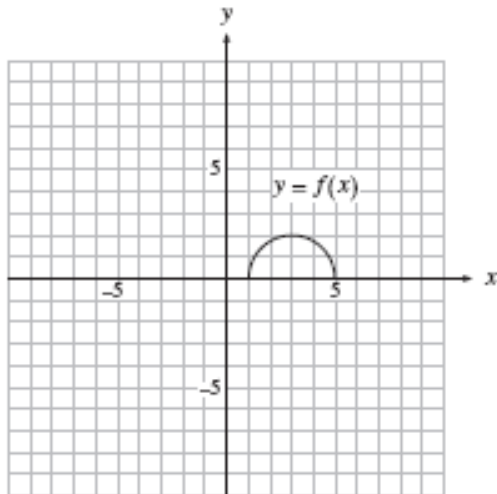
<p>Example 1. Factor $y = f(2x+6)$ $y = f(2(x+3))$</p>	<p>Example 2. $y = f(-2x+12)$ $y = f(-2(x-6))$</p>
<p>Example 3: $y = f\left(\frac{1}{3}x+6\right)$ $y = f\frac{1}{3}(x+18)$</p>	<p>Example 4: $y = f\left(\frac{1}{2}x+6\right)$ $y = f\frac{1}{2}(x+12)$</p>

Dealing with $ay \pm d = f(x)$

<p>Method 1. Factor $2y+6 = f(x)$ $f(x) = 2(y+3)$</p>	<p>Method 2. Make $y =$ $2y+6 = f(x)$ $y = \frac{f(x)-6}{2}$ $= \frac{f(x)}{2} - 3$</p>	<p>Example 1. $-3y-9 = f(x)$ $y = f(x) + 9$ $= -\frac{1}{3}f(x) - 3$</p>
---	--	---

Practice Question

The graph of $y = f(x)$ is shown below on the left. Which equation represents the graph shown on the right?



1) peak
 $y = 2 \rightarrow y = -4$
 $\therefore a = -2$
 2) x stretched
 by 2.
 $\therefore b = \frac{1}{2}$
 3) left 3
 $\therefore c$

A. $y = -f(2x+3)$	B. $y = -2f\left(\frac{1}{2}x+6\right)$
C. $y = -2f\left(\frac{1}{2}x+3\right)$	D. $y = -2f\left(\frac{1}{2}x+6\right)$