

Pre-Calculus 12 Translations

Recall: Transformations of the form $y = a(x - h)^2 + k$

$a =$ vertical stretch/compressions

$h =$ horizontal translation (right or left) $(x-h) \rightarrow$ right
 $(x+h) \rightarrow$ left

$k =$ vertical translation (up or down) $+k \rightarrow$ up
 $-k \rightarrow$ down

This year's notation

$$y = af(b(x - h)) + k$$

*where b must be factored out

$b =$ horizontal stretch/compression

Translation: a translation is a transformation of a graph in which every point is moved in the same direction. Common terms used are: a shift or a slide.

Recall: Sketch $y = (x - 2)^2 + 1$

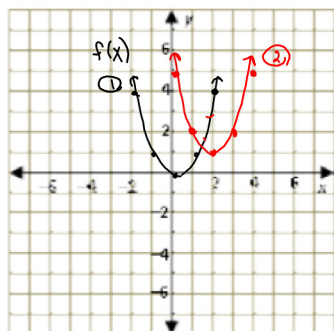
Standard Form:

$$y = a(x - h)^2 + k \quad \textcircled{1} f(x) = x^2$$

$$y = (x - 2)^2 + 1 \quad \textcircled{2} y = f(x - 2) + 1$$

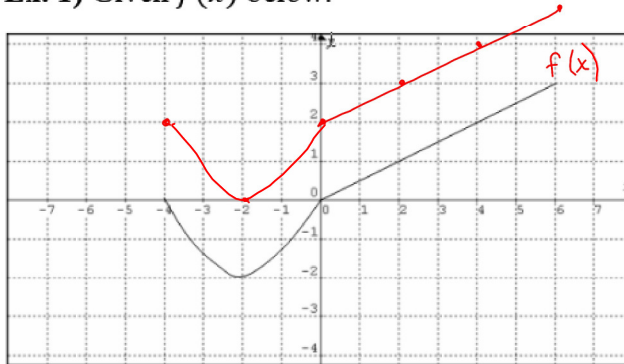
gr. 11 gr. 12

$$\begin{array}{c|c} x & y = x^2 \\ \hline -2 & 4 \\ -1 & 1 \\ 0 & 0 \\ 1 & 1 \\ 2 & 4 \end{array}$$



Vertical Translations (Shifts): $y = f(x) + k$

Ex. 1) Given $f(x)$ below:



Sketch: $y = f(x) + 2$

↑ up 2

The graph of $y = f(x) + k$ consists of the graph of $y = f(x)$ moved through a **vertical translation** of k units.

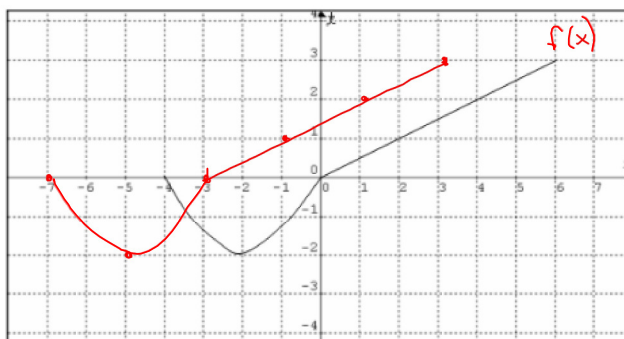
What is the effect of k ?

$k > 0$ $f(x) + k$ the graph moves up k units

$k < 0$ $f(x) - k$ the graph moves down k units

Horizontal Translations (Slides): $y = f(x - h)$

Ex. 2) Given $f(x)$ below:



Sketch: $y = f(x + 3)$

↑ left 3

The graph of $y = f(x - h)$ consists of the graph of $y = f(x)$ moved through a **horizontal translation** of h units.

What is the effect of h ?

$h > 0$ $f(x - h)$ graph moves right h units

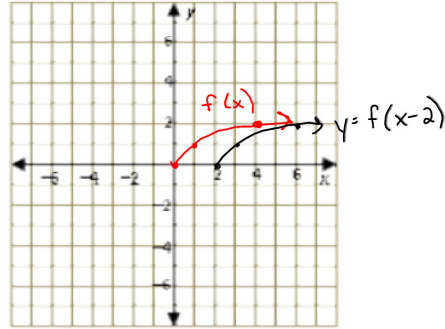
$h < 0$ $f(x + h)$ graph moves left h units

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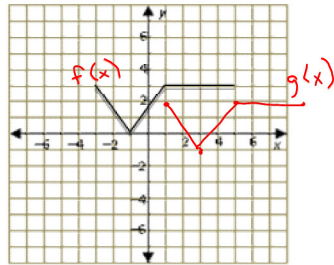
Ex. 3) Given $f(x) = \sqrt{x}$, sketch $y = f(x-2)$

x	y
0	0
1	1
4	2

↑
half-parabola



Ex. 4) Given the graph of $f(x)$, sketch the image graph after a translation 4 units right and 1 unit down. Write the new equation, $g(x)$. State the domain and range of each graph.



$g(x) = f(x-4) - 1$

$D: [-3, 5]$ $g(x)$
 add 4 since $h=4$ → $[1, 9]$

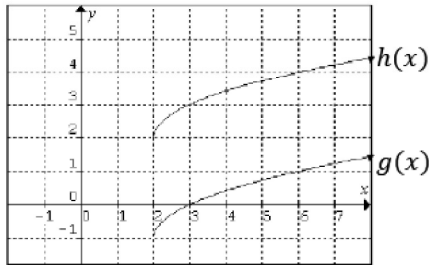
$R: [0, 3]$ subtract 1 since $k=-1$ → $[-1, 2]$

Ex. 5) Describe how the graph of $y = \frac{1}{x^2}$ would need to be translated to create the graph of $y + 4 = \frac{1}{(x+3)^2}$

$y = \frac{1}{(x+3)^2} - 4$

horizontal translation 3 units left
 vertical translation 4 units down

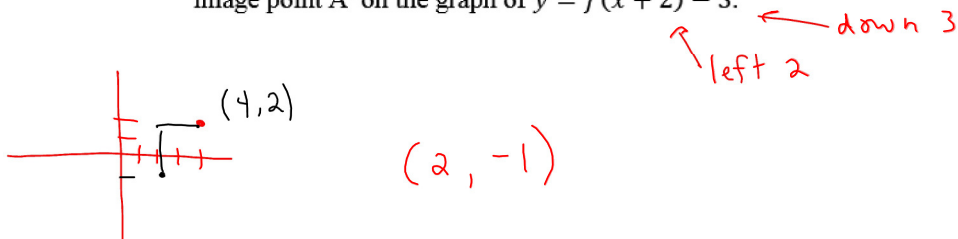
Ex. 6) State the equation for the function $h(x)$ if it was originally $g(x)$.



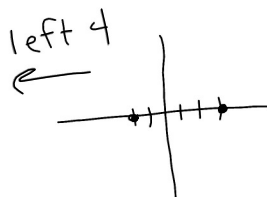
$h(x) = g(x) + 3$ up 3
 $k=3$

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Ex. 7) The point $(4, 2)$ lies on the graph of $y = f(x)$. Determine the coordinates of its image point A' on the graph of $y = f(x + 2) - 3$.



Ex. 8) The x-intercepts of the graph of $f(x) = x^2 - x - 6$ are 3 and -2 . State the x-intercepts of the graph of $g(x) = (x + 4)^2 - (x + 4) - 6$.



-6 and -1

Assign - Translations
PS 34
1 a, c, 2 a, c

Bulawka's Bullets

- ☺ Know your parent graphs
- ☺ Watch your notation
- ☺ Use a sketch to help you determine equations/points if you need