U3D3_T Vertical _ Horizontal Translations

Monday, March 18, 2019 6:44 PM

U3D3_T Vertical _ ...

U3D3 MCR3UI

Vertical and Horizontal Translations of Functions Vertical Translations

How do the graphs of $f(x) = x^2$ and $y = x^2 + 3$ compare?
(Sketch, state domain and range):

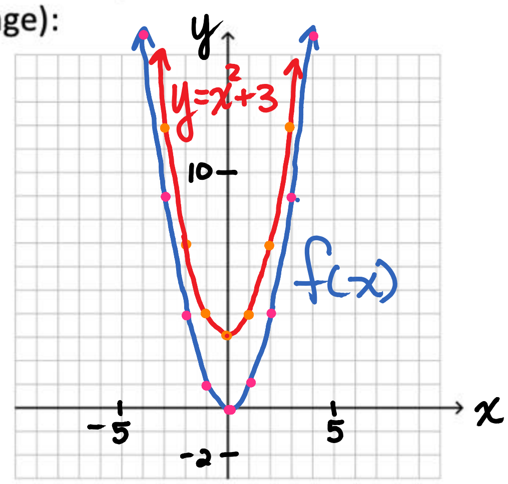
$f(x) = x^2$

x	f(x)
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$y = x^2 + 3$

$y = f(x) + 3$

x	y
-3	12
-2	7
-1	4
0	3
1	4
2	7
3	12



D: { $x \in \mathbb{R}$ }

R: { $y \geq 0$ }

D: { $x \in \mathbb{R}$ }

R: { $y \geq 3$ }

The second graph is a **vertical** translation of 3 units **up** from the first graph. (All y-values in f(x) have been translated **up 3**).

To write the second graph in function notation, we write

$y = f(x) + 3$

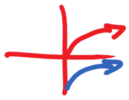
2. Describe the graph of $y = \sqrt{x} - 3$.

The graph of $y = \sqrt{x} - 3$ is a **vertical** translation of 3 units **down** from the graph of $g(x) = \sqrt{x}$.

$y = \sqrt{x} - 3$ is $y = g(x) - 3$ in function notation.

State the Domain and Range of each graph in the description above:

$g(x) = \sqrt{x}$



$y = \sqrt{x} - 3$

D: { $x \geq 0$ } D: { $x \geq 0$ }

R: { $y \geq 0$ } R: { $y \geq -3$ }

The graph of *y = f(x) + k* is congruent to *y = f(x)*.
If *k* > 0, translate the graph of *f(x)* *k*-units up.
If *k* < 0, translate the graph of *f(x)* *k*-units down.

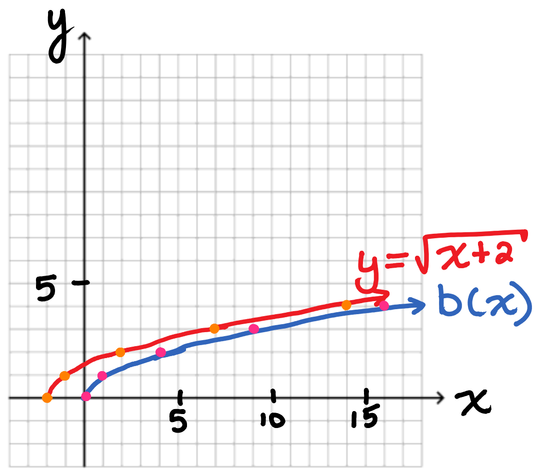
$y = x^2$ $V(0,0)$ $y=(x+2)^2$ $V(-2,0)$

Horizontal Translations

How do the graphs of $b(x) = \sqrt{x}$ and $y = \sqrt{x+2}$ compare? (Sketch, state domain and range)

$b(x) = \sqrt{x}$ $y = \sqrt{x+2}$

x	b(x)	x	y
0	0	-2	0
1	1	-1	1
4	2	2	2
9	3	7	3
16	4	14	4



D: { $x \geq 0$ } D:{ $x \geq -2$ }

R: { $y \geq 0$ } R:{ $y \geq 0$ }

The graph of $y = \sqrt{x+2}$ is a horizontal translation of 2 units to the left of the graph $b(x) = \sqrt{x}$. In function notation, $y = b(x+2)$

The graph of *y = f(x-h)* is congruent to the graph of *y = f(x)*.
If *h* > 0, translate the graph of *f(x)* to the right *h*-units.
If *h* < 0, translate the graph of *f(x)* to the left *h*-units.

***Note:* Remember, for horizontal shifts, it is opposite of what you see in the brackets.**

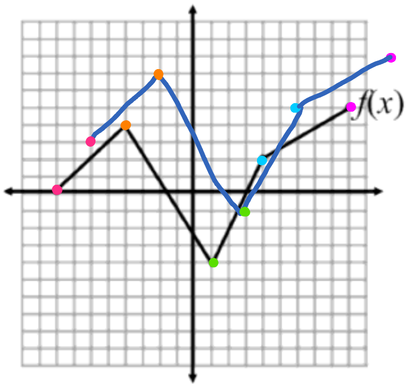
Examples:

1. Describe the graph of $y=(x+4)^2-5$.

parent graph → quaratic function $(y=x^2)$
horizontal translation left 4 units (shift L4)
vertical translation down 5 units (shift D5)

2. For the function shown, $f(x)$,
   i) describe how the graph of $y = f(x - 2) + 3$ can be obtained from the graph of $y = f(x)$

shift right 2
shift up 3



   ii) graph $y = f(x - 2) + 3$

3. Given $j(x) = \frac{1}{x}$. Determine the equation of $y = j(x - 5) + 3$. Describe the graph of the second function.

$$y=\frac{1}{(x-5)}+3$$

parent graph → reciprocal function
shift Right 5 units
shift Up 3 units.

4. Given $h(x) = \sqrt{x}$.

a) Use function notation to describe the graph of $h(x)$, shifted left 11 units and up 5 units.

$$y = h(x+11) + 5$$

b) Write the equation of the translated function described in part (a).

$$y = \sqrt{x+11} + 5$$

5. Given $m(x) = \frac{1}{x+3}$.

a) Write the image equation for the transformation

$y = m(x-7) + 2$.

$y = \frac{1}{(x-7)+3} + 2$

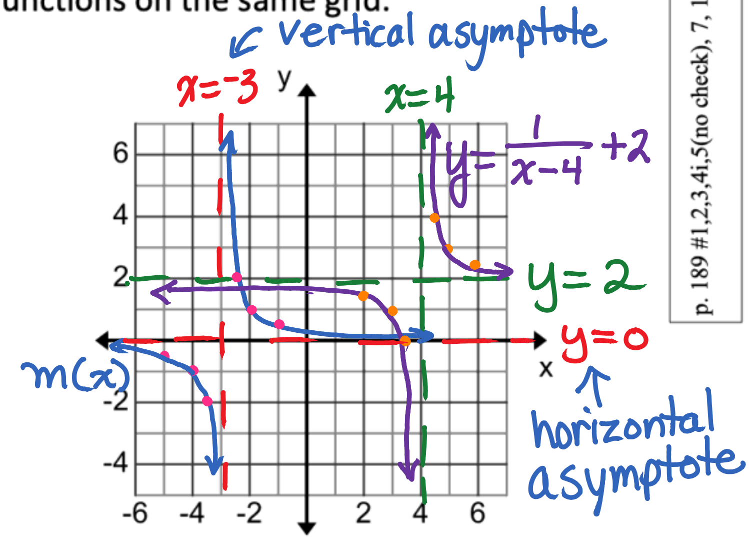
$y = \frac{1}{x-4} + 2$

b) State the Domain and Range of each function.

$m(x)$ D: $\{x \neq -3\}$ R: $\{y \neq 0\}$

y D: $\{x \neq 4\}$ R: $\{y \neq 2\}$

c) Graph both functions on the same grid.



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