PreCalculus Name: Period: Date:

Warm Up 9/10

<u>Lesson 2-4: Transformation of Functions I</u>

Objective

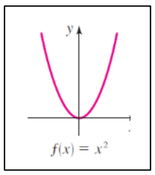
Students will…

- Be able to understand the basic idea of transformation of functions.
- Explore and apply the properties of vertical and horizontal <u>shifts</u>**.**

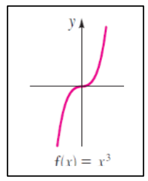
"Parent" Functions

We have seen and studied some of the standard functions and their graphs. For example.

$f(x) = x^2$



$f(x) = x^3$



Transformation of Functions

Now, consider our problem from the warm up. Let's go ahead and compare the two functions: $f(x) = x^2$ and $g(x) = x^2 + 2$

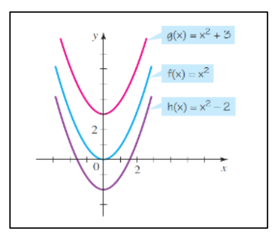
Transformation: Vertical Shift

As observed, the difference between $f(x)$ and $g(x)$ was that $g(x)$ was simply $f(x)$ vertically ________________ **<u>2 units</u>**. This can be generalized by the following:

$y =$ shifts the graph of $y = f(x)$ upward(+) or downward(-) c units, for $c > 0$.

Ex. Use the graph of $f(x) = x^2$ to sketch the graph of,

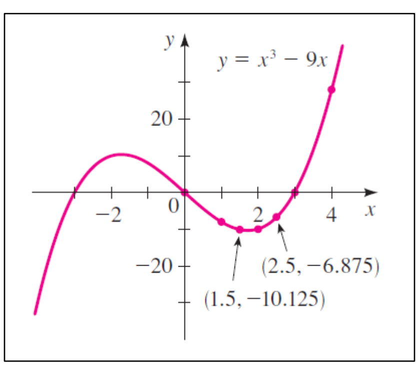
$g(x) = x^2 + 3$ and $h(x) = x^2 - 2$



Examples

Use the graph of $f(x) = x^3 - 9x$ shown below to sketch the graph of

$g(x) = x^3 - 9x + 10$ and $h(x) = x^3 - 9x - 20$



Transformation: Horizontal Shift

Similar to vertical shift, we also have a **horizontal shift**. Let's compare the three functions: $f(x) = x^2$, $g(x) = (x+2)^2$, $h(x) = (x-1)^2$

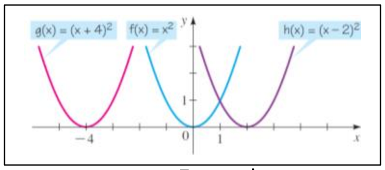
Transformation: Horizontal Shift

So the horizontal shift can also be generalized.

$y =$ shifts the graph of $y = f(x)$ to the right(+) or left(-) c units, for $c > 0$. Note the **opposite** signs!

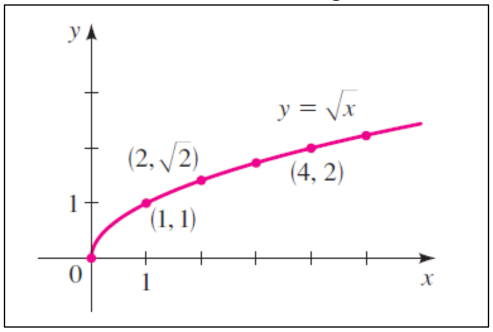
Ex. Use the graph of $f(x) = x^2$ to sketch the graph of,

$g(x) = (x+4)^2$ and $h(x) = (x-2)^2$



Examples

Use the graph of $f(x) = \sqrt{x}$ shown below to sketch the graph of $g(x) = \sqrt{x-3}$ and $h(x) = \sqrt{x-3} + 4$



Example

Describe the shift of the function: $g(x) = (x+11)^2 - 2$ from its "parent" function, $f(x) = x^2$

Describe the shift of the function $h(x) = (x-6)^5 + 1$ from its "parent" function, $f(x) = x^5$

Describe the shift of the function $p(x) = \sqrt{x+5} - 4$ from its "parent" function, $f(x) = \sqrt{x}$

Homework 9/10

TB pg. 190 #1-3, 7, 11, 13, 19 (a, b, d), 27, 28, 33, 37, 39