Warm Up 9/12

Determine whether f is even, odd, or neither.

~~odd~~

a. $f(x) = 2x^5 - 3x^2 + 2$

$f(-x) = 2(-x)^5 - 3(-x)^2 + 2$

$= -2x^5 - 3x^2 + 2$

$= -(2x^5 + 3x^2 - 2)$

Neither

$-(f(x))$

Neither

~~even~~

b. $f(x) = \frac{1}{x+2}$

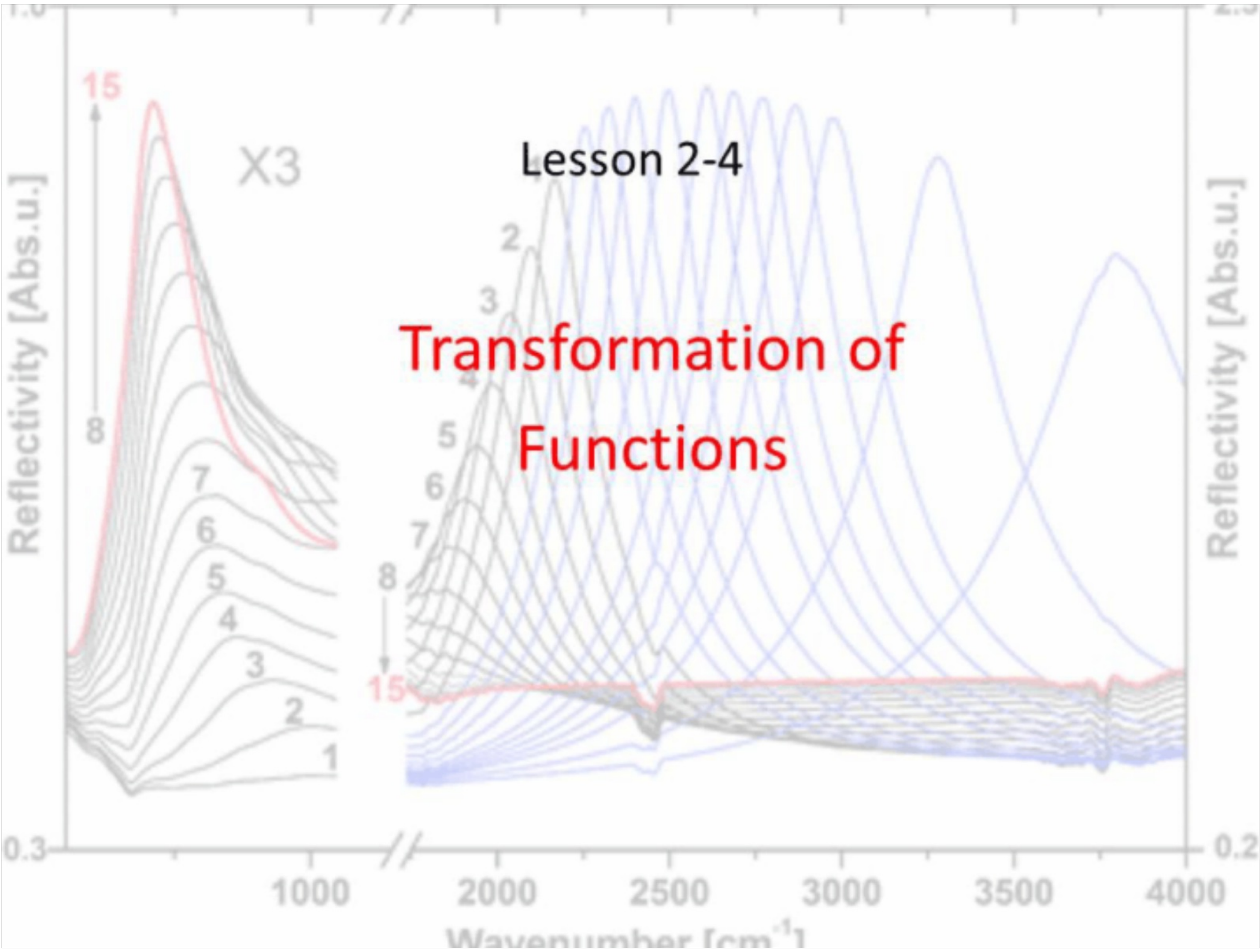
$f(-x) = \frac{1}{-x+2} \neq -\frac{1}{x+2}$

$= \frac{1}{-(x-2)} = -\frac{1}{x-2}$

Neither

Lesson 2-4

Transformation of Functions



Objective

Students will…

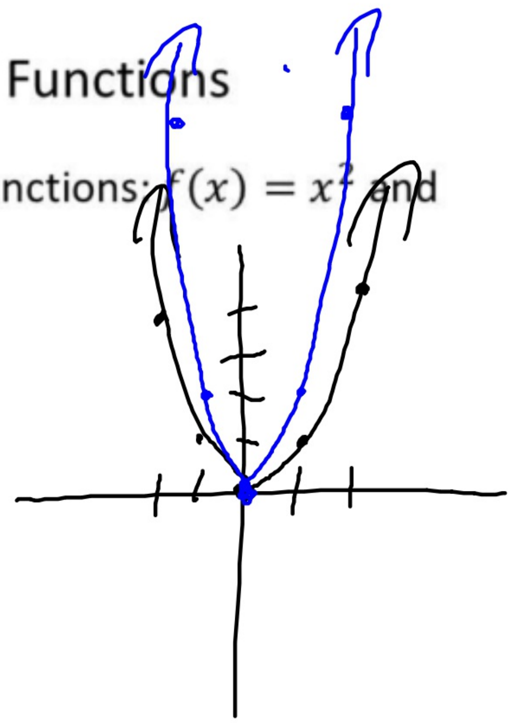
- Be able to apply the properties of stretch and compression in graphing various functions.
- Be able to determine the scale factor of the stretch or compression.

Transformation of Functions

Let's go ahead and compare the two functions: $f(x) = x^2$ and $g(x) = 2x^2$

x	x^2
-2	4
-1	1
0	0
1	1
2	4

x	$2x^2$
-2	8
-1	2
0	0
1	2
2	8

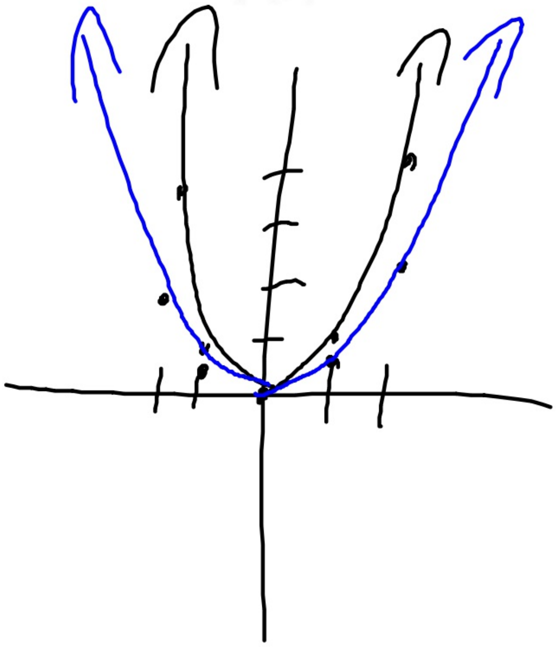


Transformation of Functions

Let's go ahead and compare the two functions: $f(x) = x^2$ and $g(x) = \frac{1}{2}x^2$

x	x^2
-2	4
-1	1
0	0
1	1
2	4

x	$\frac{1}{2}x^2$
-2	2
-1	$1/2$
0	0
1	$1/2$
2	2



Transformation: Stretch and Compression

As observed, the transformation that took place was a vertical **stretch or a compression** by a certain **scale factor**. This can be generalized by the following:

For $y = cf(x)$

If $c > 1$, stretch the graph of $y = f(x)$ vertically by a factor of c.

If $0 < c < 1$, compress the graph of $y = f(x)$ vertically by a factor of c.

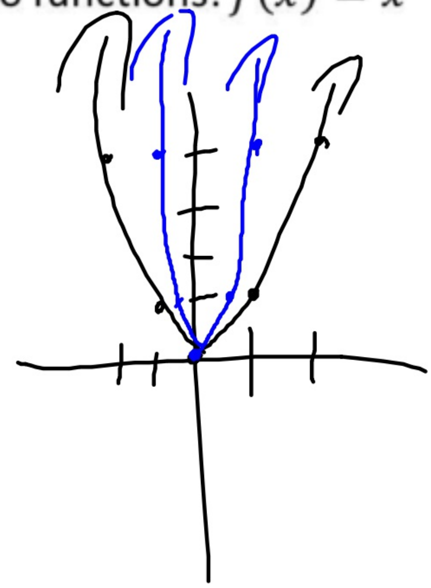
$\frac{1}{2}$

Transformation of Functions

Now let's go ahead and compare the two functions: $f(x) = x^2$ and $g(x) = (2x)^2$

x	$(2x)^2$
-1	4
$-1/2$	1
0	0
$1/2$	1
1	4

x	x^2
-2	4
-1	1
0	0
1	1
2	4



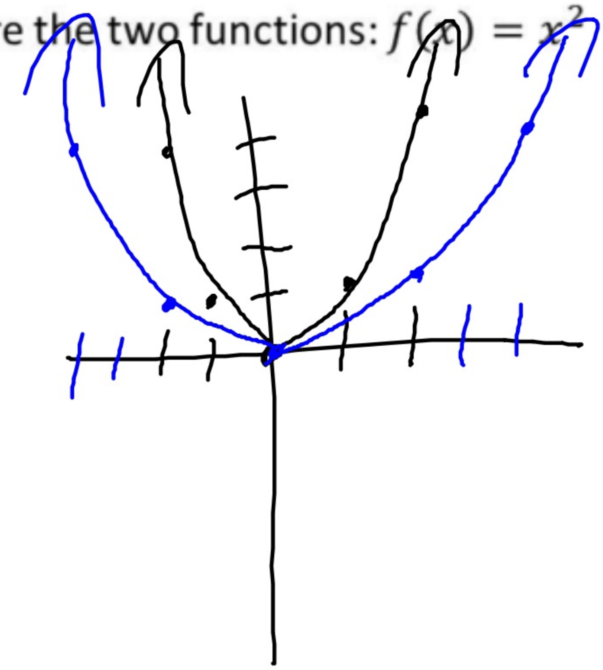
$\frac{1}{1/2} = 2$

Transformation of Functions

Now let's go ahead and compare the two functions: $f(x) = x^2$ and $g(x) = \left(\frac{1}{2}x\right)^2$

x	x^2
-2	4
-1	1
0	0
1	1
2	4

x	$\left(\frac{1}{2}x\right)^2$
-4	4
-2	1
0	0
2	1
4	4



Transformation: Stretch and Compression

As observed, the transformation that took place was a horizontal **stretch or a compression** by a certain **scale factor**. This can be generalized by the following:

For $y = f(cx)$

If $c > 1$, compress the graph of $y = f(x)$ horizontally by a factor of $\frac{1}{c}$

If $0 < c < 1$, stretch the graph of $y = f(x)$ horizontally by a factor of $\frac{1}{c}$

Note the **opposite relationship** of the scale factor between vertical and horizontal stretch/compression.

Examples

Determine whether the function has a vertical or a horizontal stretch/compression, and determine its scale factor.

a. $f(x) = 3x^2$

Vert. stretch

~~sa~~ S.F. : 3

b. $f(x) = \left(\frac{1}{2}x\right)^3$

horiz. stretch

S.F = 2

c. $h(x) = \frac{3}{4}(x - 1)^{19}$

Vert. comp.

S.F = 3/4

d. $p(x) = \sqrt{3x}$

horiz. comp

S.F = 1/3

e. $f(x) = \frac{5}{4}|x|$

Vertical stretch.

S.F = 5/4

f. $q(x) = \frac{8}{5}\sqrt[6]{x-1}$

Vert. stretch.

S.F = 8/5.

g. $u(x) = \frac{10}{11}(x-990)^5$

Vert. comp.

S.F = $\frac{10}{11}$

h. $t(x) = 3\sqrt{\frac{7}{6}(x+5)}$

Vert. stretch. S.F = 3

horiz. comp. S.F = 6/7

Examples

For the function given function f, write the equation for the final transformed graph, based on the description of the transformation done.

$f(x) = \sqrt[3]{x}$; shift 3 units to the left, stretch vertically by a factor of 5, and reflect in the x-axis.

$f(x) = -5\sqrt[3]{x+3}$

Examples

Explain how the graph of g is obtained from the graph of f.

$f(x) = |x|$, $g(x) = 3|x| + 1$

$f(x) = |x|$, $g(x) = -|x + 1|$

Homework 9/12

Transformation WKSHT