# U3D8_T Combining Transformations

Monday, March 18, 2019 7:35 PM

U3D8_T Combinin...

U3D8

**Warm Up**:

Describe the transformations that have occurred to h(x) to obtain the function $y = -5h\left(\frac{2}{3}x\right)$

reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$ or 1.5

1. reflection in x-axis
2. vertical stretch factor 5 } $-5xy$
3. Horizontal Stretch factor 1.5 } $1.5x$

If (-1, 4) is a point on the function h(x), what would be the new point on the transformed function?

$(x, y) \rightarrow (1.5x, -5y)$

$(-1, 4) \rightarrow (1.5(-1), -5(4))$

$(-1, 4) \rightarrow (-1.5, -20)$

$(-1, 4)$ reflected in x-axis becomes $(-1, -4)$

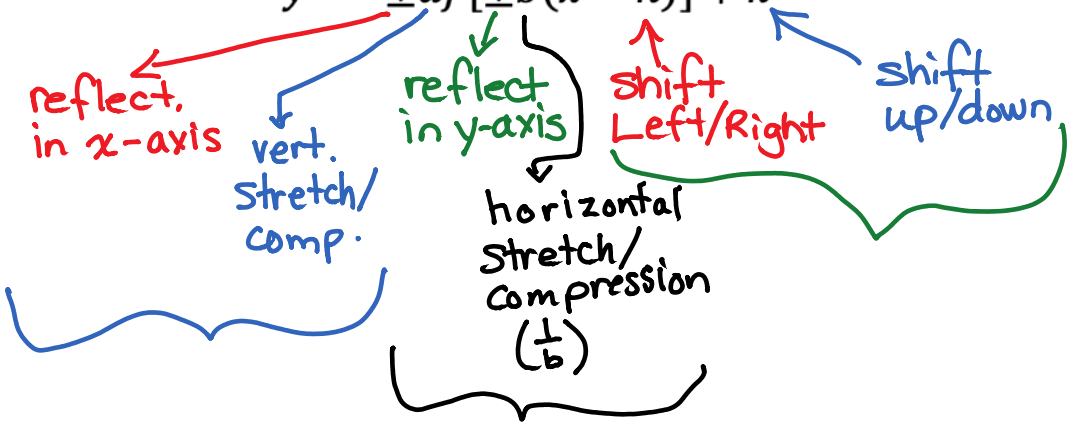
$(-1, -4)$ with vertical stretch factor 5 becomes $(-1, -20)$

$(-1, -20)$ with horizontal stretch factor $\frac{3}{2}$ becomes $(-1.5, -20)$

## Combining Transformations

When a function has a combination of transformations, apply them in order left to right when in the form:

$$y = \pm af[\pm b(x - h)] + k$$




1. Reflection in x-axis with Vertical Stretches and Compressions.
2. Reflection in y-axis with Horizontal Stretches and Compressions.
3. Translations (Horizontal and Vertical Shifts)

**Example 1**:

a) Describe, in order, how the graph of $y = -2f(4(x-2))$ can be obtained from the graph of $y = f(x)$.

$\frac{1}{b} = \frac{1}{4}$

1. reflection in x-axis
2. vertical Stretch factor 2 } $-2 \times y$ (multiply by $\frac{1}{4}$)
3. Horizontal Compression factor $\frac{1}{4}$ (or horizontal compression by 4) "divide by 4" } $\frac{1}{4}x + 2$
4. Shift right 2.

the word compression is most important. A compression factor of 4 means you are dividing by 4 but if you say compression factor $\frac{1}{4}$, it means you are multiplying by $\frac{1}{4}$ both give same result.

b) If (x, y) was a point on f(x), what would the value of the coordinates be after the 4 transformations?

$(x, y) \rightarrow (\frac{1}{4}x + 2, -2y)$

OR $(\frac{x}{4} + 2, -2y)$

Our textbook interchanges these ... Some textbooks consistently do it one way or the other. As long as I see the word Compression, I am not concerned whether you write $\frac{1}{4}$ or 4.

**Example 2:**

Given $f(x) = x^2 + 3$

a) Describe how the graph of $y = -\frac{1}{2}f(2x+6) - 2$ can be obtained from $f(x)$.

*First factor out the coefficient on $x$ if $b \neq 1$ and $h \neq 0$.

$$y = -\frac{1}{2}f[2(x+3)] - 2$$

1. reflect in x-axis. } $-\frac{1}{2} \times y$
2. vert. comp. factor $\frac{1}{2}$
3. Hor. Comp. factor $\frac{1}{2}$
4. Shift left 3
5. Shift down 2

b) What is the new "image equation"?

$y = -\frac{1}{2}f[2(x+3)] - 2$ $\quad f(x) = x^2 + 3$

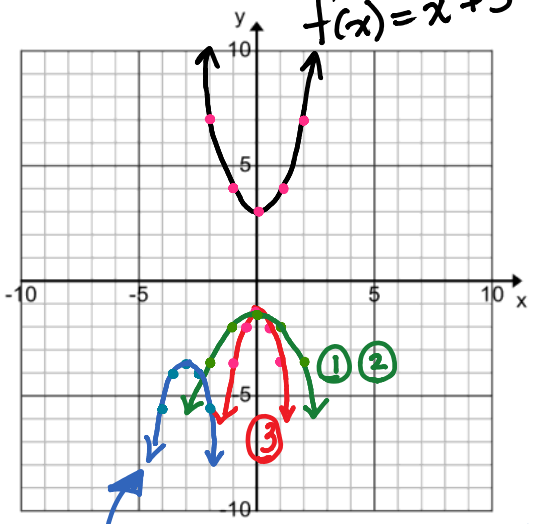
$$y = -\frac{1}{2}\left[(2[x+3])^2 + 3\right] - 2$$

$$y = -\frac{1}{2}\left[(2)^2(x+3)^2 + 3\right] - \frac{2}{1}$$

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

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

c) Graph.




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

$y=-\frac{1}{2}f[2(x+3)]-2$

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

$V(-3,-3.5)$

U3D8 Practice: p. 240 #7(odd), 8-9(odd, sketch one from each), 14