Order of Transformations

We have seen that when two transformations are applied to a graph, the order in which the transformations are performed may or may not make a difference to the final graph.

In general, the order **DOES NOT** matter when
- two translations are combined
- two stretches are combined
- a translation and a stretch at right angles to one another are combined
- reflections and stretches are combined

The order **DOES** matter when
- a translation and a stretch in the same direction are combined
- most reflections and translations are combined

BEDMAS

*translations +/−
reflections
stretches ×/÷*

Note Unless otherwise indicated, use the following order to describe how to transform from one graph to another.

    1. Stretches   **2.** Reflections   **3.** Translations.

Class Ex. #1 Describe a series of transformations required to transform graph A to graph B.

reflection on the y-axis $x \to -x$
vertical trans. 3 units up $y \to y - 3$
horizontal trans 2 units left $x \to x + 2$
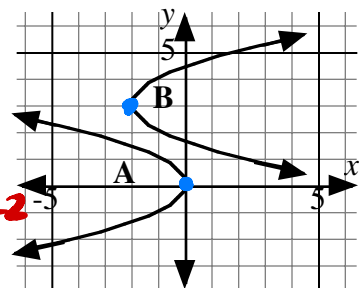
$(x, y) \to (-x - 2, y + 3)$
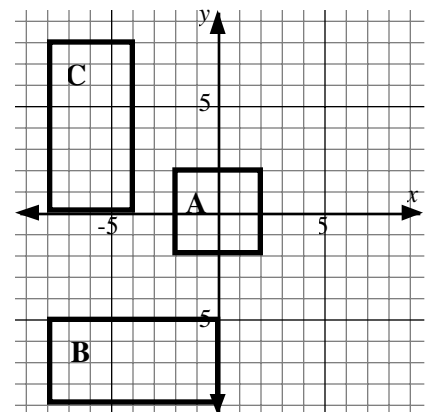$(0, 0) \to (-2, 3)$

Class Ex. #2 Describe a series of transformations required to transform
a) graph A to graph B

b) graph A to graph C

c) graph B to graph C.

Complete Assignment Questions #1 - #2

Class Ex. #3

Describe which transformations are applied to a graph of a function when the following changes are made to its equation. Does the order in which the transformations are performed affect the final graph?

a) Replace x with $3x$ and y with $y + 4$.   **b)** Replace x with $\frac{2}{3}x$, y with $-3y$, and x with $x + 2$.

[handwritten in red, top right] $(x, y) \rightarrow (\frac{3}{2}x - 2, -\frac{1}{3}y)$

[handwritten, left side]
$x \rightarrow 3x$ hor. comp. by a factor of $\frac{1}{3}$
$y \rightarrow y+4$ vert. trans. 4 units down
$(x, y) \rightarrow (\frac{1}{3}x, y - 4)$
ORDER DOESN'T MATTER
diff. variables.

[handwritten, right side]
$x \rightarrow \frac{2}{3}x$ hor. exp. by a factor of $\frac{3}{2}$
$y \rightarrow -3y$ reflection on the x-axis
  vert. comp. by a factor of $\frac{1}{3}$
$x \rightarrow x + 2$ hor. trans. 2 units left
ORDER MATTERS for "x"

Class Ex. #4

A graph of the parabola $y = x^2 + 1$ is shown. The following transformations are applied to $y = x^2 + 1$ **in the order shown**.

- a horizontal translation 2 units left
- a reflection in the x-axis
- a vertical stretch about the x-axis by a factor of 0.5
- a vertical translation 3 units down

a) For each transformation

- graph the image on the grid
- write the replacement for x or y and the current equation in the table
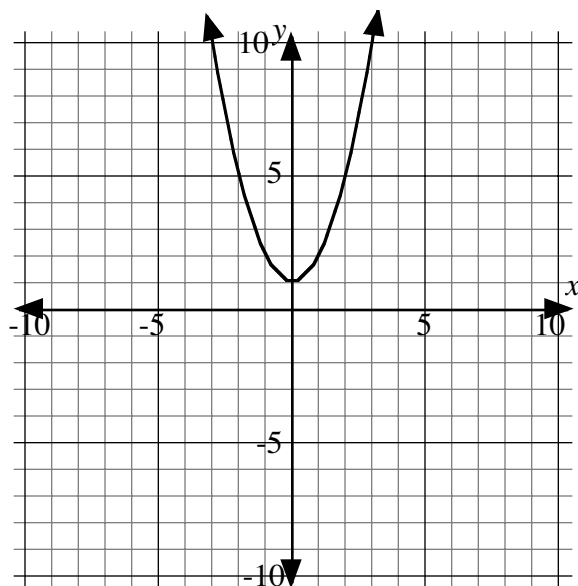
Transformation	Replacement	Current Equation
1. a horizontal translation 2 units left		
2. a reflection in the x-axis		
3. a vertical stretch about the x-axis by a factor of 0.5		
4. a vertical translation 3 units down		

b) Write the equation which represents the final position of the graph and verify using a graphing calculator.

Complete Assignment Questions #3 - #9

[handwritten in blue] #1-3, 5