2.7 A PREVIEW OF TRANSFORMATIONS

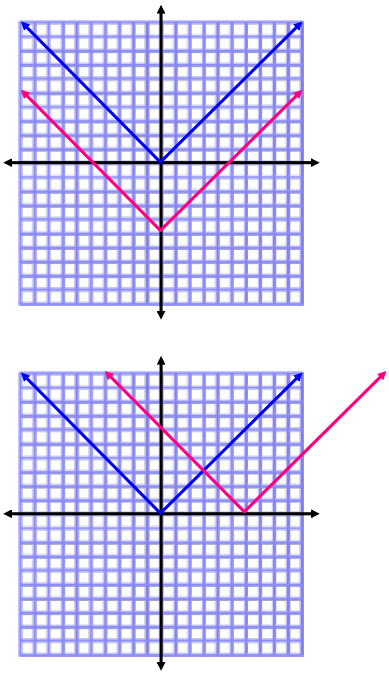
3 Types of Transformations

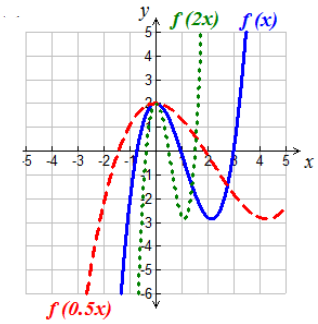
1. Translation: moving the graph up, down, left or right
2. Stretch or Compression: stretching or "squishing" the graph
3. Reflection: reflecting the graph across an axis

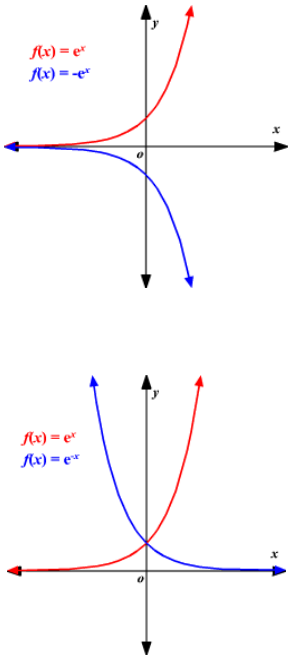
HIOVOS: A trick for remembering

Horizontal
Inside
Opposite
Vertical
Outside
Same

If you see...	Then it means...
Addition or Subtraction	Translation Horizontal: "inside" the function/OPPOSITE (left or right) Vertical: "outside" the function/SAME (up or down)
Multiplication (Integers & Fractions)	Stretch or Compression Horizontal: "inside" the function/OPPOSITE (reciprocal)Vertical: "outside" the function/SAME State the factor by which the graph is stretched (greater than 1) or compressed (greater than zero/less than 1)
Negative Sign	Reflection Horizontal: "inside" the function (over y-axis) Vertical: "outside" the function (over x-axis)







TRANSLATION

Original: $y = x^2$

Inside: $y = (x + 2)^2$ hor. translation left 2 units

$y = (x - 2)^2$ hor. translation right 2 units

Outside: $y = x^2 + 2$ vert. translation up 2 units

$y = x^2 - 2$ vert. translation down 2 units

STRETCH/COMPRESSION

Original: $y = x^2$

Inside: $y = (2x)^2$ hor. compression by a factor of ½

$y = (\frac{1}{2}x)^2$ hor. stretch by a factor 2

Outside: $y = 2x^2$ vert. stretch by a factor of 2

$y = \frac{1}{2}x^2$ vert. compression by a factor of $\frac{1}{2}$

REFLECTION

Original: $y = x^2$

Inside: $y = (-x)^2$ hor. reflection over y-axis

Outside: $y = -x^2$ vert. reflection over x-axis

Describe the transformations of each from $y = |x|$.

1. $y = 4|x|$ vertical stretch by a factor of 4
2. $y = |4x|$ hor. compression by a factor of $\frac{1}{4}$
3. $y = -|x|$ vert. reflection over x-axis
4. $y = |\frac{1}{3}x| - 2$ hor. stretch by a factor of 3
   vert. translation down 2 units
5. $y = |x - 2|$ hor. translation 2 units right
6. $y = -|5x| + 2$ vert. reflection over x-axis
   hor. compression by a factor of ⅕
   vert. translation up 2 units
7. $y = \frac{1}{2}|x| - 1$ vertical compression by a factor of ½
   vert. translation down 1 unit
8. $y = -2|x - 4| + 5$ vert. reflection over x-axis
   vert. stretch by a factor of 2
   hor. translation right 4 units
   vert. translation up 5 units

Write an equation of the transformed function described below in each problem.

9. [x] +3 outside inside +2
Step Function: Vertical shift up 3 units, Horizontal shift to the left 2 units, Vertical compression by a factor of 1/2 mult. by ½

$y = \frac{1}{2}[x + 2] + 3$

10. |x| outside −4 outside −
Absolute Value: Vertical shift down 4 units, Reflection over the x-axis, Horizontal compression by a factor of 1/2 inside mult. by 2

$y = -|2x| - 4$

11. [ ] outside +1 inside −5
Step Function: Vertical shift up 1 unit, Horizontal shift to the right 5 units, Vertical stretch by a factor of 2 outside mult. by 2

$y = 2[x - 5] + 1$

Graph each function. Find the domain and range.

13. $y = 1[\frac{1}{2}x] - 5$ step function

hor. stretch by a factor of 2

vert. trans. 5 units down