# REFLECTIONS, SCALE CHANGES, AND TRANSLATIONS

Procedure: Begin with a function whose graph you know. Work one step at a time, replacing either x or y as described below. Start with the equation of your basic graph and rewrite it, one step at a time, until you have reached the desired equation. It is usually best to do translations last. Delay your graphing until you have created your list of equations.

	<u>Replacement</u>	<u>Effect on Graph</u>
REFLECTIONS	**Interchange x and y.**	**Reflection about the line y = x.**
	Replace x by -x.	**Reflection about the Y-axis.**
	Replace y by -y.	**Reflection about the X-axis.**
SCALE CHANGES	**Replace x by Ax** where A>0.	**Horizontal scale change** If A > 1, graph shrinks toward Y-axis. If A < 1, graph stretches away from Y-axis.
	Replace y by By where B>0.	**Vertical scale change** If B > 1, graph shrinks toward X-axis. If B < 1, graph stretches away from X-axis.
TRANSLATIONS	**Replace x by x - C.**	**Horizontal translation** If C > 0, graph goes right C units. If C < 0, graph goes left | C | units.
	Replace y by y - D.	**Vertical translation** If D > 0, graph goes up D units. If D < 0, graph goes down | D | units.

<u>Example 1</u> **Graph $y = -3^x$**
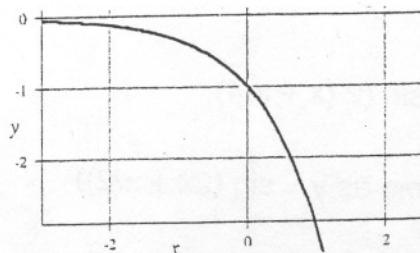
Basic equation: $y = 3^x$
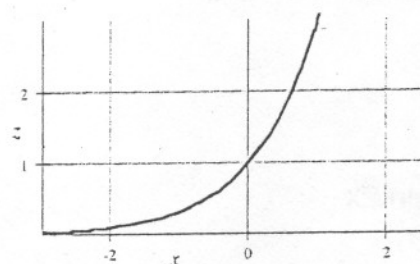
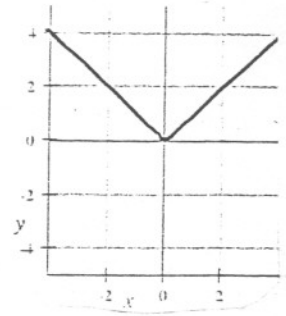$-y = 3^x$ <u>Reflect</u> about the X-axis

(Same as $y = -3^x$)
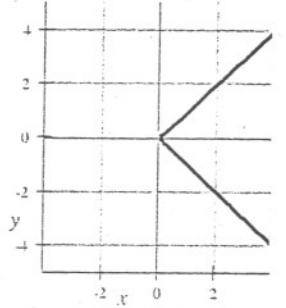
Example 2   **Graph x = |2 y + 6|**

Basic equation: y = |x|

x = |y| Reflect about line y = x
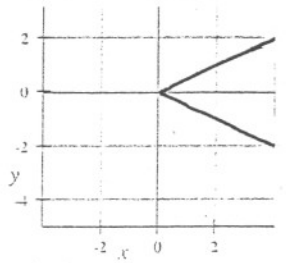

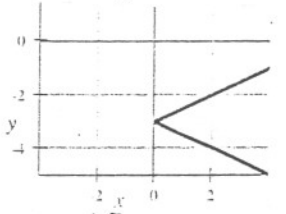x = |2 y| Shrink vertically
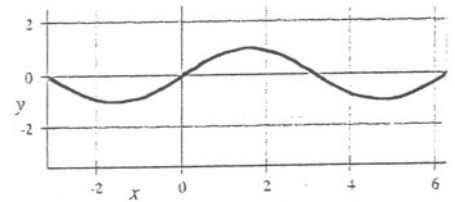   (toward X-axis)

x = |2 (y + 3)| Translate vertically
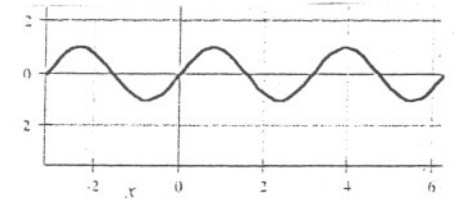   (down 3)

(Same as x = |2 y + 6|)

Example 3   **Graph y = sin (2 x + π/2)**

Basic equation: y = sin x

y = sin 2x   Shrink horizontally
                           (period changes from 2 π to π)

y = sin (2 (x + π/4)   Translate horizontally
                           (left π/4)

(Same as y = sin (2x + π/2))