

# 1.3 Graphs of Important Functions & Their Transformations

## ESSENTIAL QUESTION:

What things should be included on every graph you sketch in order to make it meaningful?

In your groups, complete the investigation into the graphs of 12 important functions. (20 minutes)

## Transforming Graphs in the Coordinate Plane

### Horizontal (phase) shifts

Let  $c$  be positive.

$$y = f(x + c) \rightarrow \text{shift } f(x) \text{ left } c \text{ units}$$

$$y = f(x - c) \rightarrow \text{shift } f(x) \text{ right } c \text{ units}$$

### Vertical shifts

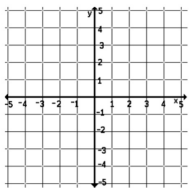
Let  $d$  be positive

$$y = f(x) + d \rightarrow \text{shift } f(x) \text{ up } d \text{ units}$$

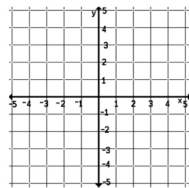
$$y = f(x) - d \rightarrow \text{shift } f(x) \text{ down } d \text{ units}$$

### examples:

1. Graph  $y = (x - 3)^2$ .



2. Graph  $y = e^x + 1$



### Reflect in the x-axis

$$y = -f(x)$$

### Reflect in the y-axis

$$y = f(-x)$$

### Changing the "steepness" of the graph

$$y = a \cdot f(x)$$

$a > 1$ , graph is steeper

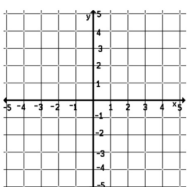
$0 < a < 1$ , grapher is less steep

$a < -1$ , graph is steeper & reflect in x-axis

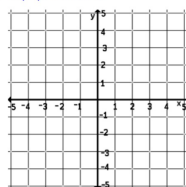
$-1 < a < 0$ , graph is less steep & reflect in x-axis

### Graph:

1.  $y = -\sqrt{x}$



2.  $f(x) = 2|x|$



3.  $y = e^{-x}$

