

1. What is the difference between the graphs of $f(x) = x^2 + 1$ and $g(x) = x^2 - 1$?

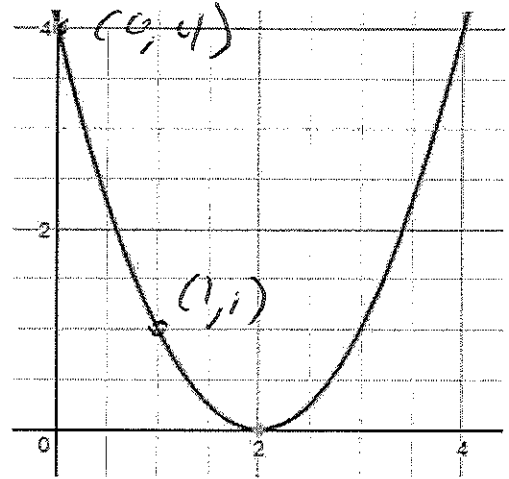
$g(x)$ is translated down 2 steps.

2. What is the difference between the graphs of $f(x) = x^2 + 1$ and $h(x) = -x^2 + 1$?

$h(x)$ is oriented down (vertical reflection)

3. Linsey want to create a design on desmos and started with the parabola shown. What equation did she use to create this parabola?

$$y = (x - 2)^2$$
 Check: $1 \stackrel{?}{=} (1 - 2)^2$
 $1 = (-1)^2$ ✓
 $4 \stackrel{?}{=} (0 - 2)^2$
 $4 = (-2)^2$ ✓



4. Without graphing, describe everything you know about the parabola that represents the function

$k(x) = (x - 1)(x + 1)$. x-ints: $(1, 0)$ & $(-1, 0)$

Opens up. Vertex: Halfway, so $x = 0$. If $x = 0$, $y = (0 - 1)(0 + 1) = -1$.
 \therefore V: $(0, -1)$ = y-int.

5. Without graphing, describe everything you know about the parabola that represent the function

$m(x) = -(x + 3)(x - 5)$. x-ints: $(-3, 0)$ & $(5, 0)$

Opens down. Vertex: $-3 + \frac{5}{2} = \frac{2}{2} = 1 = x$. If $x = 1$, $y = -(1 + 3)(1 - 5) = -(4)(-4) = 16$.
 \therefore V: $(1, 16)$. y-int = $(0, 15)$

6. Without graphing, describe the differences in the parabolas that represent the function $p(x) = 4x^2$ and

$q(x) = 0.25x^2$. $p(x)$ is much taller and skinnier
 $(16x)$ $(4x)$

Vocabulary: Same vertex.

Parent Graph: the graphical representation of the most basic form of function family. The parent graph for Quadratic Functions is the graph of $y = x^2$.

Transformation: changes to the shape, orientation or location of the parent graph. There are three main types of transformations that we will study -- *Translation, Dilation and Reflection* (in Geometry, you also explored *Rotation*).

- **Translation** (Slide): moving all points on a graph horizontally or vertically a fixed amount.
 - Notation:
 - Vertical Translation $f(x) + k$
 - Horizontal Translation $f(x - k)$

- Dilation (Stretch or Compression): an increase or decrease in the height (vertical dilation) or width (horizontal dilation) of a graph by a factor. For example, $y = 3x^2$ vertically stretches the parent function by a factor of 3.
 - Notation:
 - Vertical Dilation $kf(x)$
 - Horizontal Dilation $f(kx)$
- Reflection (Flip): mirroring a graph over a fixed line (typically the x-axis or y-axis).
 - Notation:
 - Vertical Reflection $-f(x)$
 - Horizontal Reflection $f(-x)$

7. For each function below, describe how the parent function $f(x) = x^2$ was transformed. The first one is done as an example.
- $y = x^2 - 3$ the parent function was translated 3 units down.
 - $y = x^2 + 10$ " 10 units up
 - $y = (x - 4)^2$ " 4 units right
 - $y = 0.5x^2$ Vertical compression of $\frac{1}{2}$
 - $y = (2x)^2$ Horizontal compression of 2
 - $y = -(x - 1)^2$ (describe both transformations) Vertical reflection & right 1
 - $y = 5(x + 2)^2 - 5$ (describe all transformations) Left 2, down 5, vertical stretch of 5.