

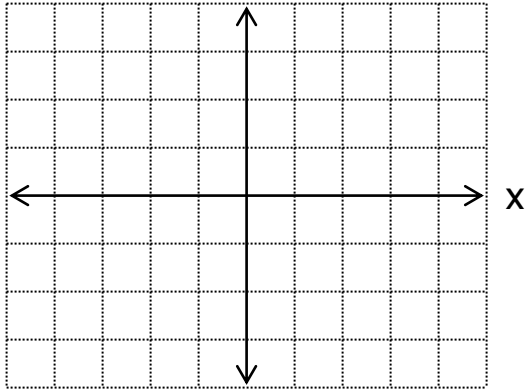
Lesson 6: Exploring Transformations of Parent Functions

Part A – Introduction

Recall: The characteristics of the five basic parent functions.

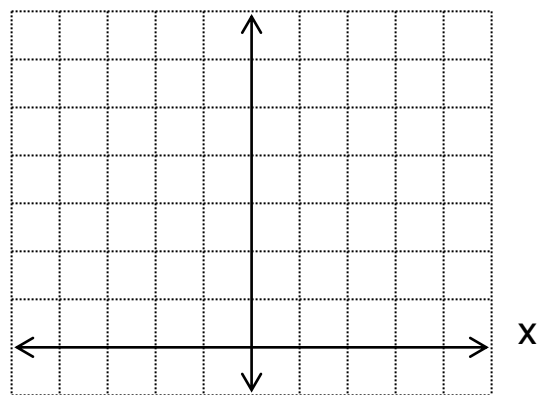
① LINEAR FUNCTION

$$f(x) = x$$



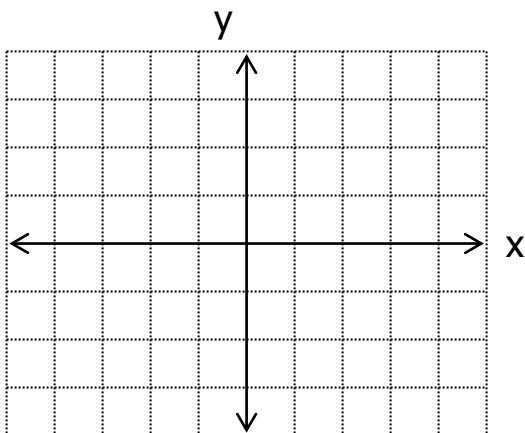
② QUADRATIC FUNCTION

$$f(x) = x^2$$



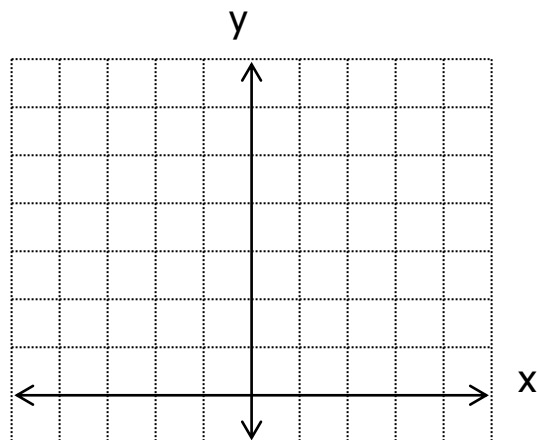
③ RECIPROCAL FUNCTION

$$f(x) = \frac{1}{x}$$



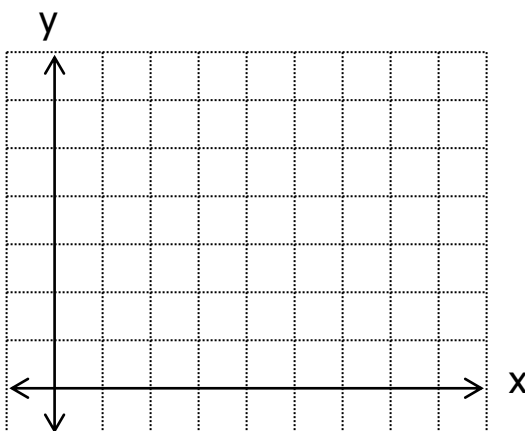
④ ABSOLUTE VALUE FUNCTION

$$f(x) = |x|$$



⑤ SQUARE ROOT FUNCTION

$$f(x) = \sqrt{x}$$



Review: Parent Function $f(x) = x^2$

Vertical Stretch/Compression

If $a > 1$ or $a < -1$, stretch

If $-1 < a < 1$, compression

If $a > 0$ (positive), same direction as parent function

If $a < 0$ (negative), reflected in the x -axis

$$f(x) = a(x-h)^2 + k$$

Horizontal Translation (shift) Left/Right

If adding, shift left

If subtracting, shift right

Vertical Translation (shift) Up/Down

If $k > 0$, shift up

If $k < 0$, shift down

Part B – Exploring Transformations of Functions

Do transformations of other parent functions behave in the same way as transformations of quadratic functions? Let's find out

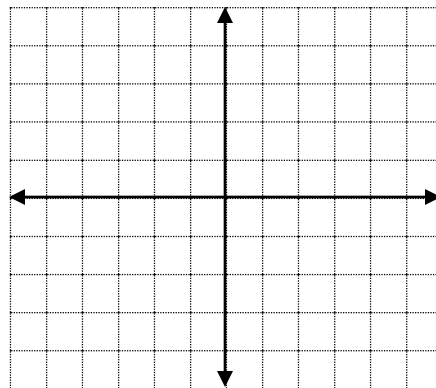
Task 1: Use transformations to sketch the graphs of $y = 3x^2$, $y = \frac{1}{2}x^2$ and $y = -2x^2$ on the same axes.

Describe the transformations in words.

$$y = 3x^2 \longrightarrow$$

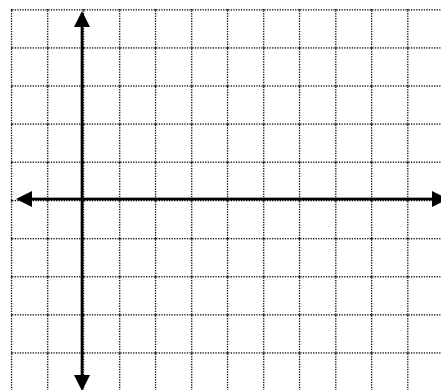
$$y = \frac{1}{2}x^2 \longrightarrow$$

$$y = -2x^2 \longrightarrow$$



Task 2: Predict what the graphs of $y = 3\sqrt{x}$, $y = \frac{1}{2}\sqrt{x}$ and $y = -2\sqrt{x}$ will look like. Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

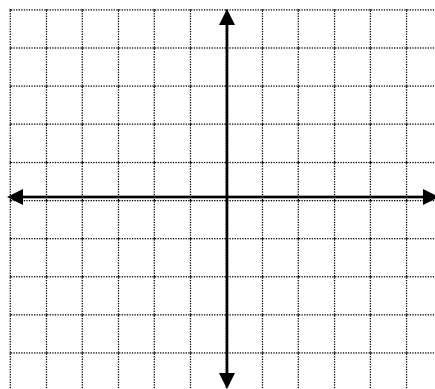
Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Task 3: Predict what the graphs of $y = \frac{3}{x}$, $y = \frac{1}{2x}$ and $y = -\frac{2}{x}$ will look like.

Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

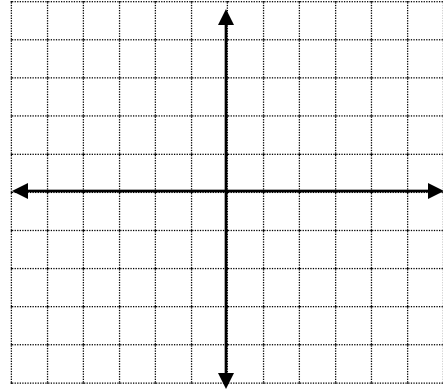
Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Task 4: Predict what the graphs of $y = 3|x|$, $y = \frac{1}{2}|x|$ and $y = -2|x|$ will look like.

Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

Compare the effect of these transformations with the effect of the same transformations on quadratic functions.

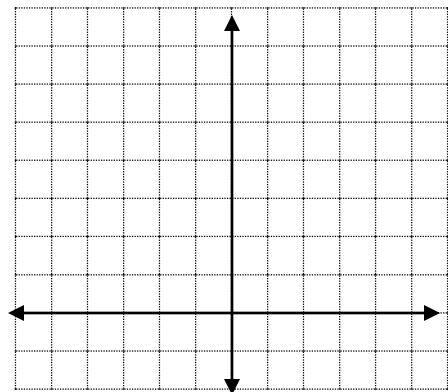


Task 5: Sketch the graphs of $y = 3x^2 + 2$ and $y = 3x^2 - 1$ without a calculator, on the same axes .

Describe the transformation in words.

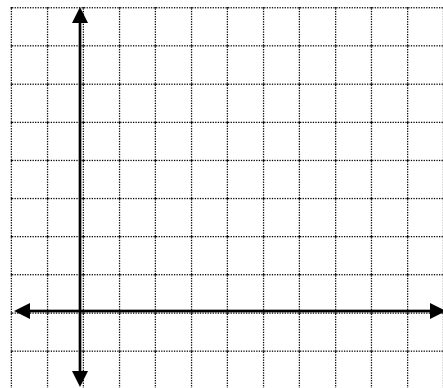
$$y = 3x^2 + 2 \longrightarrow$$

$$y = 3x^2 - 1 \longrightarrow$$



Task 6: Predict what the graphs of $y = 3\sqrt{x} + 2$ and $y = 3\sqrt{x} - 1$ will look like. Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

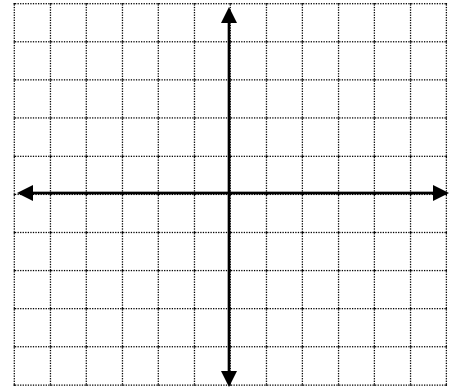
Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Task 7: Predict what the graphs of $y = \frac{3}{x} + 2$ and $y = \frac{3}{x} - 1$ will look like.

Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

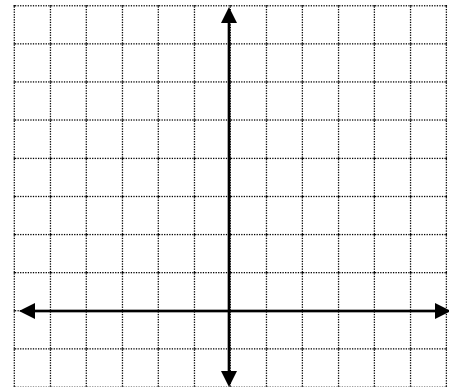
Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Task 8: Predict what the graphs of $y = 3|x| + 2$ and $y = 3|x| - 1$ will look like.

Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Task 9: Predict what the graphs of $y = (x - 2)^2$, $y = \frac{1}{2}(x + 1)^2$ and

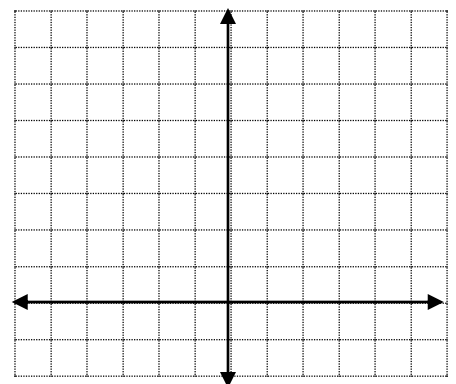
$y = 3(x - 1)^2 + 2$ will look like. Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

Compare the effect of these transformations with the effect of the same transformations on quadratic functions.

$$y = (x - 2)^2 \longrightarrow$$

$$y = \frac{1}{2}(x + 1)^2 \longrightarrow$$

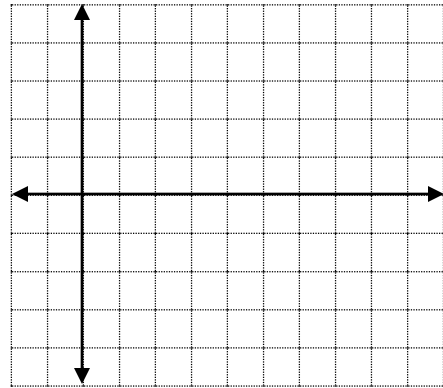
$$y = 3(x - 1)^2 + 2 \longrightarrow$$



Task 10: Predict what the graphs of $y = \sqrt{x-2}$, $y = \frac{1}{2}\sqrt{x+1}$ and

$y = 3\sqrt{x-1} + 2$ will look like. Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

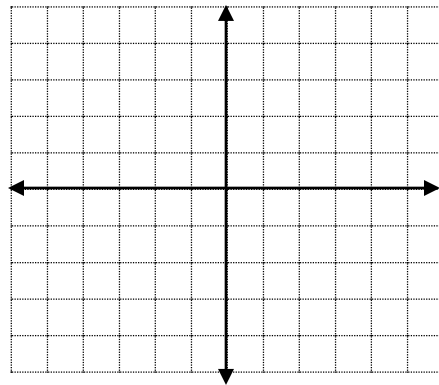
Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Task 11: Predict what the graphs of $y = \frac{1}{x-2}$, $y = \frac{1}{2(x+1)}$ and $y = \frac{3}{x-1} + 2$

will look like. Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

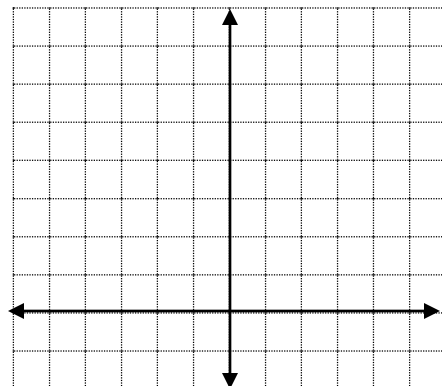
Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Task 12: Predict what the graphs of $y = |x-2|$, $y = \frac{1}{2}|x+1|$ and $y = 3|x-1| + 2$

will look like. Use the graphing calculator to verify your predictions. Sketch and label each curve on the same axes, along with the parent function.

Compare the effect of these transformations with the effect of the same transformations on quadratic functions.



Examine your sketches for each type of transformation. Did the transformations have the same effect on the new parent functions as they had on quadratic functions? Explain.

Vertical Stretch/Compression

If $a > 1$ or $a < -1$, stretch
If $-1 < a < 1$, compression
If $a > 0$ (positive), same direction as parent function
If $a < 0$ (negative), reflected in the x -axis

Vertical Translation (shift) Up/Down

If $c > 0$, shift up
If $c < 0$, shift down

$$y = af(x - d) + c$$

Horizontal Translation (shift) Left/Right

If adding, shift left
If subtracting, shift right