1-5: Parent Functions and Transformations (Parent Functions)

Precalculus

Mr. Gallo

Common Parent Function: $y = x$
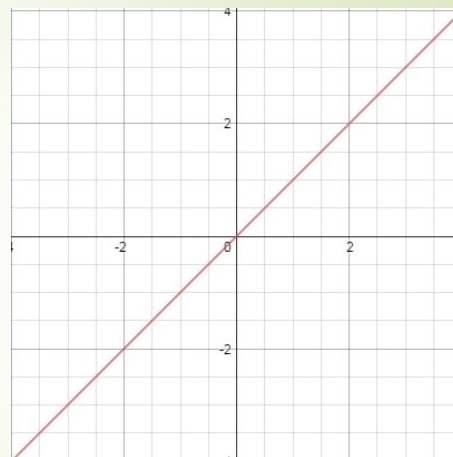
Name: **Linear**

Domain: $\left(-\infty, \infty\right)$

Range: $\left(-\infty, \infty\right)$

Asymptotes: **None**

Points of Discontinuity: **None**
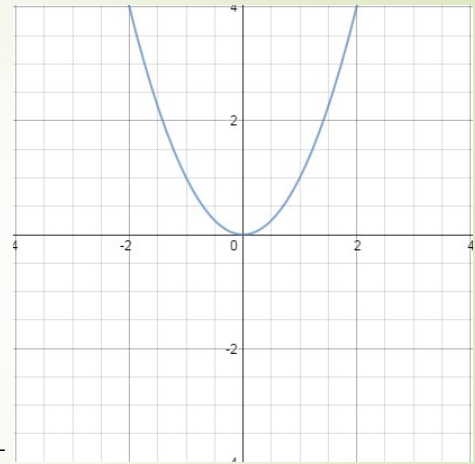
Common Parent Function: $y = x^2$

Name: **Quadratic**

Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

Asymptotes: **None**

Points of Discontinuity: **None**

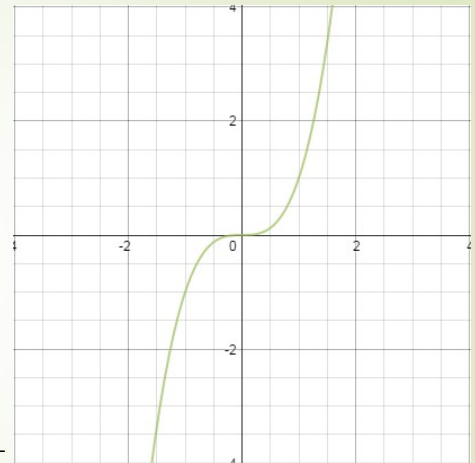
Common Parent Function: $y = x^3$

Name: **Cubic**

Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

Asymptotes: **None**

Points of Discontinuity: **None**
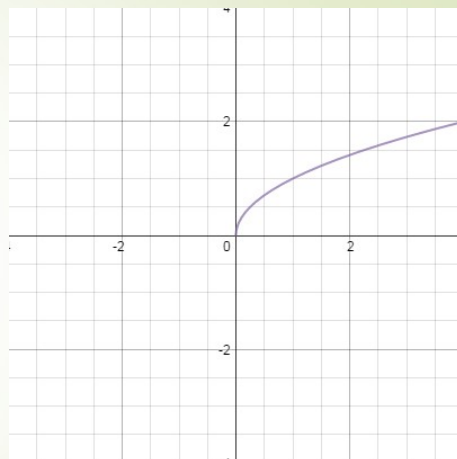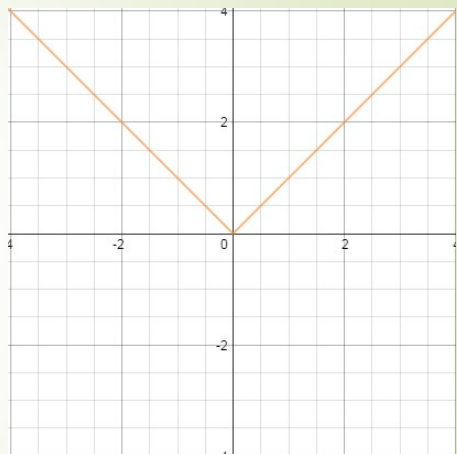
Common Parent Function: $y = \sqrt{x}$

Name: **Square Root**

Domain: $\left[0, \infty\right)$

Range: $\left[0, \infty\right)$

Asymptotes: **None**

Points of Discontinuity: **None**

Common Parent Function: $y = |x|$

Name: **Absolute Value**

Domain: $\left(-\infty, \infty\right)$

Range: $\left[0, \infty\right)$

Asymptotes: **None**

Points of Discontinuity: **None**
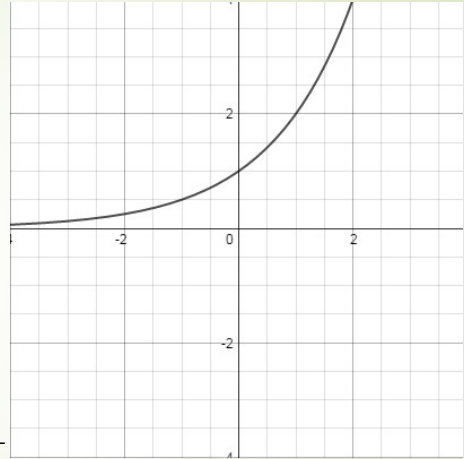
Common Parent Function: $y = b^x$

Name: **Exponential**

Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

Asymptotes: $y = 0$

Points of Discontinuity: **None**

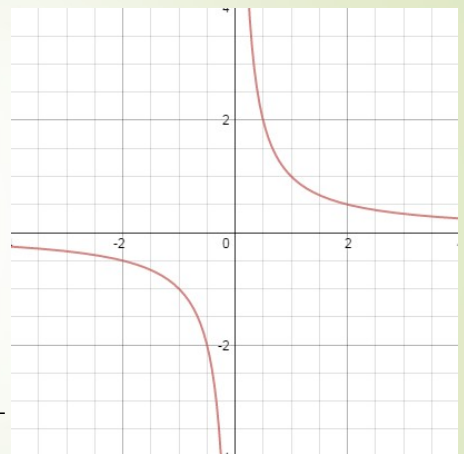Common Parent Function: $y = \dfrac{1}{x}$

Name: **Inverse (Reciprocal)**

Domain: $(-\infty, 0) \cup (0, \infty)$

Range: $(-\infty, 0) \cup (0, \infty)$

Asymptotes: $x = 0, \ y = 0$

Points of Discontinuity: $x = 0$
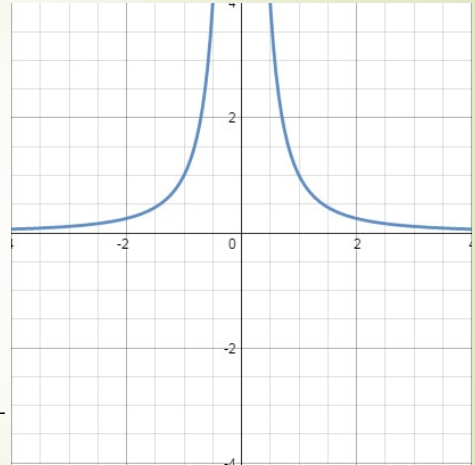
Common Parent Function: $y = \dfrac{1}{x^2}$

Name: **Inverse Squared**

Domain: $\left(-\infty, 0\right) \cup \left(0, \infty\right)$

Range: $\left(0, \infty\right)$

Asymptotes: $x = 0, \ y = 0$

Points of Discontinuity: $x = 0$

Common Parent Function: $y = \lfloor x \rfloor$

Name: **Greatest Integer (Floor)**
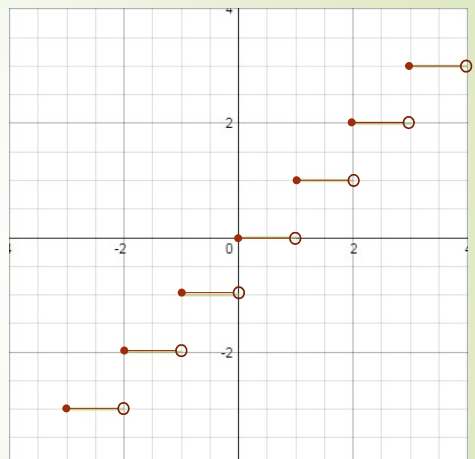
Domain: $\left(-\infty, \infty\right)$

Range: $\{y \mid y \in \mathbb{Z}\}$

Asymptotes: **None**

Points of Discontinuity:

Integral Values or *x*
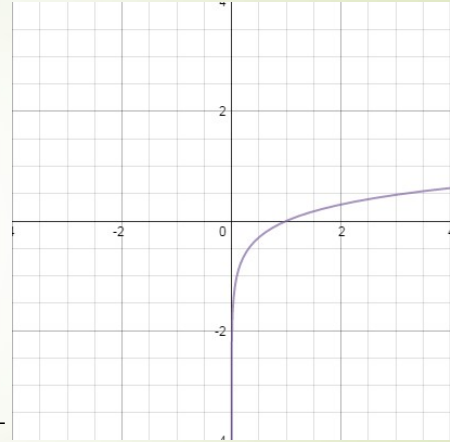
Common Parent Function: $y = \log x$

Name: **Logarithmic**
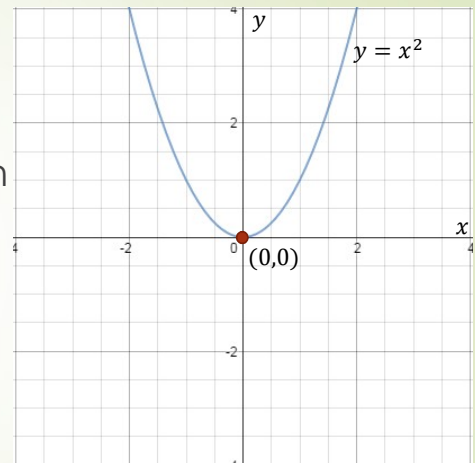
Domain: $(0, \infty)$

Range: $(-\infty, \infty)$

Asymptotes: $x = 0$

Points of Discontinuity: $x = 0$

What Needs to be Shown on a Graph

➤ Axes are labeled

➤ Scales on the axes are shown

➤ Characteristic shape can be seen

➤ Intercepts are shown

➤ Points of discontinuity are shown

➤ Name of function is included

$y = x^2$

$(0,0)$

Homework: Parent Functions WS

1-5: Parent Functions and Transformations

Precalculus

Mr. Gallo

I. Transformations

       A.) Performed on Parent Fns.

       B.) Rigid – SIZE and SHAPE stay the same.

       C.) Non-rigid –Distorted shape

II. Translations

A.) Vertical Translation –
$$y = f(x) \pm c$$ - Up or Down c units

B.) Horizontal Translation -
$$y = f(x \pm c)$$ - Left or Right c units
NOTE: Horizontal movements are always opposite the sign!!!!

C.) Ex.- Describe the translation of the following function:
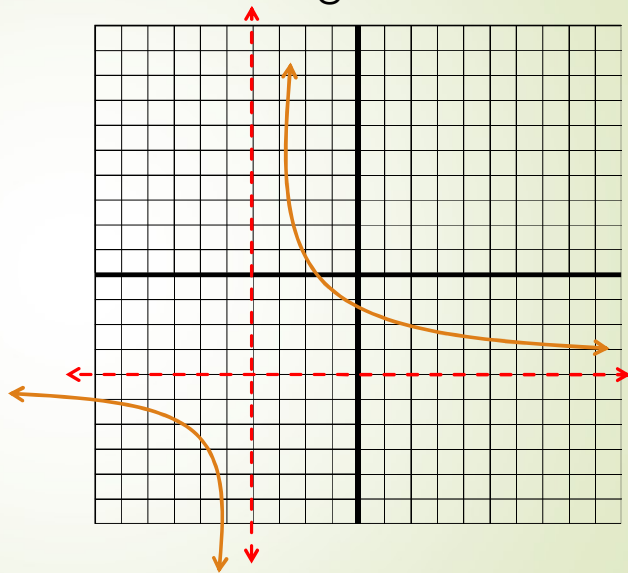$$f(x) = |x - 2| + 4$$

Translate $f(x)$ 2 units to the right horizontally
And up 4 units vertically

D.) Ex.- Find the equation of the following translation of

$$y = \frac{1}{x}$$

$$y = \frac{1}{x + 4} - 4$$

III. Reflections

A.) A FLIP of the graph of f over the x-axis or y-axis.

B.) Across the x-axis - $y = -f(x)$

C.) Across the y-axis – $y = f(-x)$

D.) Ex: Find an equation for the reflection of the following function across both axes.

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

$$f(x) = -2^{(-x)}$$

IV. Stretches and Shrinks

Let c be a positive real number

A.) Horizontal – $y = f(cx)$

1.) A <u>SHRINK</u> by a factor of c if c > 1
2.) A <u>STRETCH</u> by a factor of c if c < 1

B.) Vertical - $y = cf(x)$

1.) A <u>STRETCH</u> by a factor of c if c > 1
2.) A <u>SHRINK</u> by a factor of c if c < 1

C.) Ex: Determine the equation for the following stretches/shrinks for the graph of
$$y = f(x) = \log x$$

1.) Vert. stretch by 2. $f(x) = 2\log x$

2.) Hor. shrink by 2 $f(x) = \log(2x)$

3.) Vert. shrink by 2 $f(x) = \frac{1}{2}\log x$

4.) Hor. stretch by 2. $f(x) = \log\left(\frac{x}{2}\right)$

V. Combining Transformations

Perform transformations in the order given to you.

Ex: Complete the following transformations to the graph of $f(x) = x^2$

- Reflection over the x-axis. $f(x) = -(x)^2$
- Stretch vertically by a factor of 4. $f(x) = -4x^2$
- Translate vertically by -2 and horizontally right 1.

$$f(x) = -4(x-1)^2 - 2$$

VI. Identifying Transformations

RST!!! - Reflect – Str./Shrink - Trans.

(ALWAYS GET COEFFICIENT OF x TO BE +1

Ex: Identify, in order, the transformations applied to the graph of $f(x) = x^2$ that would result in the function

$$f(x) = -2(x+4)^2 - 7$$

- Reflection over the x-axis.
- Stretch vertically by a factor of 2.
- Translate vertically down 7 and horizontally left 4.

Ex: Identify, in order, the transformations applied to the graph of $f(x) = \lfloor x \rfloor$ that would result in the function

$$f(x) = \frac{1}{2}\lfloor 3 - 3x \rfloor + 2$$

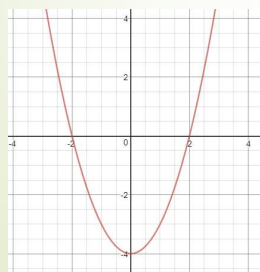$$f(x) = \frac{1}{2}\lfloor -3(x-1) \rfloor + 2$$

- Reflection over the y-axis.
- Shrink horizontally by a factor of 3.
- Shrink vertically by a factor of 2.
- Translate vertically up 2 and horizontally right 1.
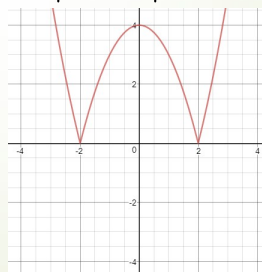

VII. Absolute Value Transformations

A.) $y = \left| f(x) \right|$

Reflection of any parts of the graph below the x-axis.
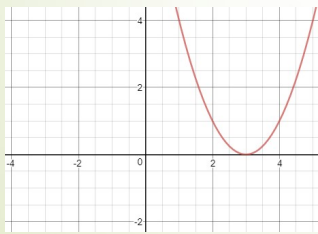
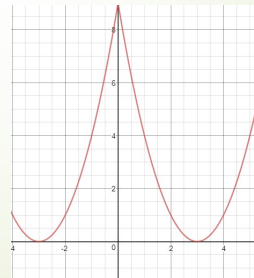$f(x) = x^2 - 4$ $\qquad\qquad$ $y = \left| f(x) \right|$

B.) $y = f(|x|)$

Reflection of any parts of the graph to the right   of the y-axis.
$f(x) = (x-3)^2$

$y = f(|x|)$

Homework: p.52 #1-3, 7-16, 20-23