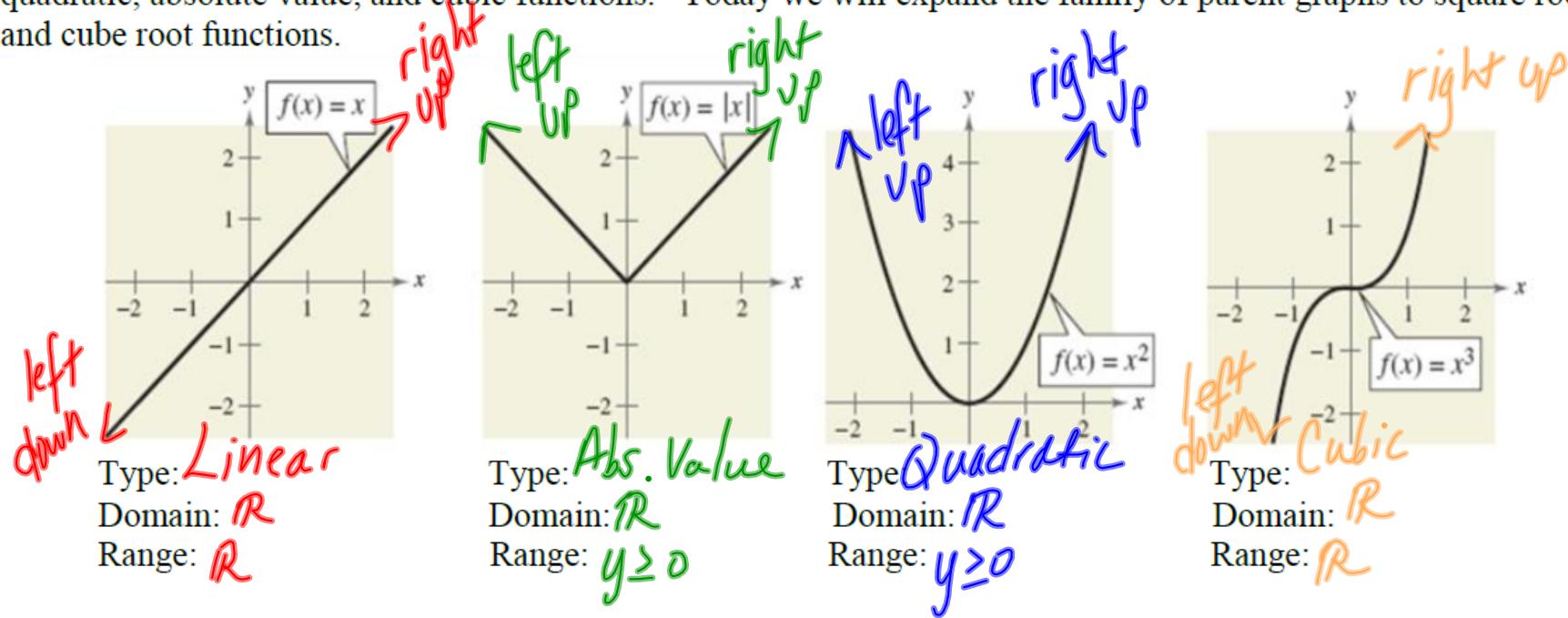


## Math Lab: Investigating Radical Functions

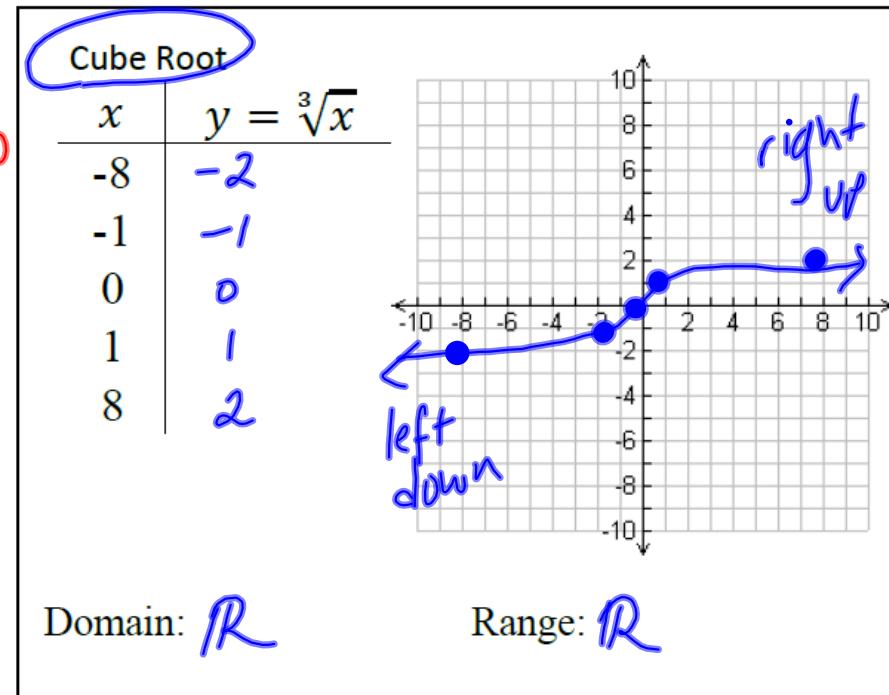
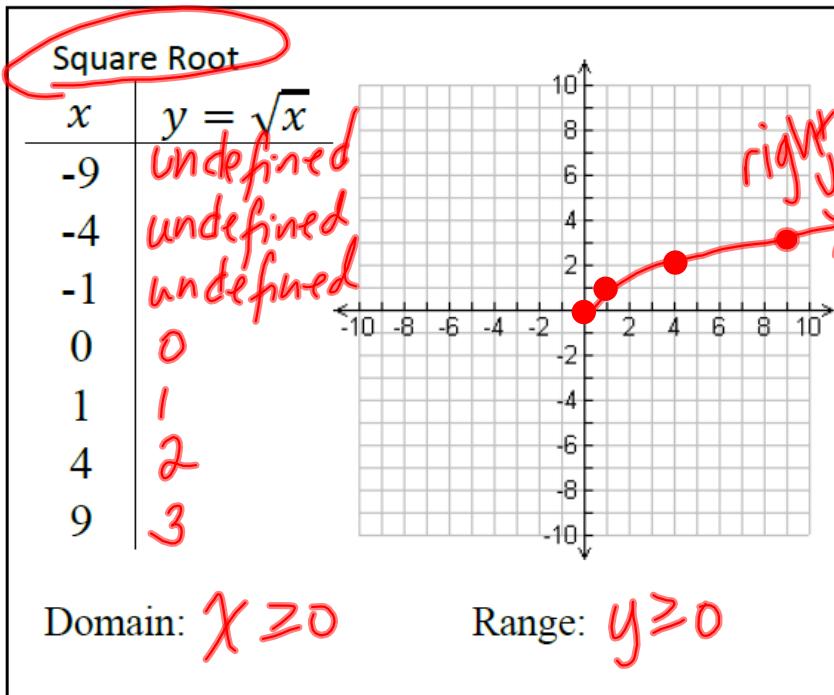
*R means "all real numbers"*

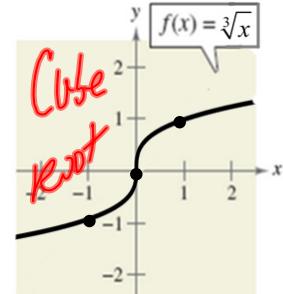
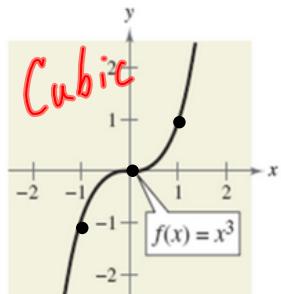
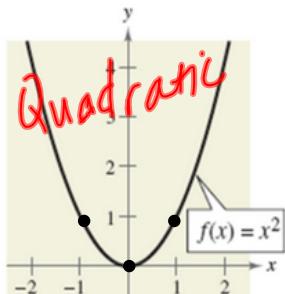
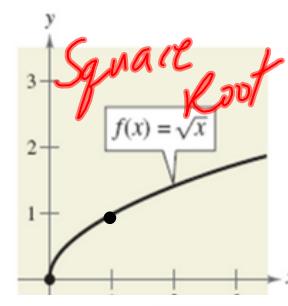
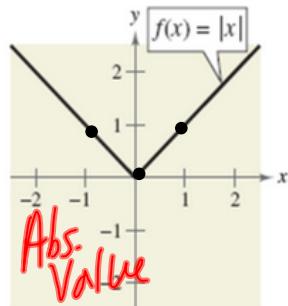
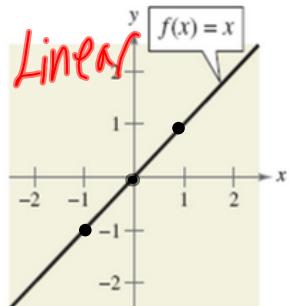
### Parent Graphs

A parent graph is the most basic graph of a function. So far this year we have studied the graphs of linear, quadratic, absolute value, and cubic functions. Today we will expand the family of parent graphs to square root and cube root functions.



1] Complete the table of ordered pairs and sketch the parent graphs of the square root and cube root functions. Then state their domain and range.





- 2] What two points do all six of the parent graphs have in common?

$(0,0)$  and  $(1,1)$

- 3] All parent graphs have the same domain, except for which function?

square root

- 4] Which parent graphs have the same range?

$\mathbb{R}$	$y \geq 0$
linear	quadratic
cubic	abs. value
cube root	square root

- 5] Which parent graphs have symmetry about the y-axis? (If you fold the graph along the y-axis, you get a mirror image on both sides.)

quadratic & abs. value

- 6] Which parent graphs have symmetry about the origin? (If you rotate the graph 180 degrees, you get the same graph you started with.)

linear, cubic, cube root

- 7] Which parent graph has no symmetry?

square root

## Graphing Using Transformations

When we studied quadratic and absolute value graphs earlier in the year, we learned that they can be graphed quickly using transformations from the equation on the parent graph. Square root and cube root graphs can be sketched the same way. Use what you learned from graphing absolute value and quadratic functions to complete the table of information and examples below.

Linear  
 $y = a(x - h) + k$

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

Cubic  
 $y = a(x - h)^3 + k$

Absolute Value  
 $y = a|x - h| + k$

Square Root  
 $y = a\sqrt{x - h} + k$

Cube Root  
 $y = a\sqrt[3]{x - h} + k$

The function tells you the <u>shape</u> $a < 0$ reflects the graph over the <u>x-axis</u> $x < 0$ reflects the graph over the <u>y-axis</u> $a$ is the slope from <u>(0, 0)</u> to the next point <u>Starting point</u>	+k translates (shifts) the graph <u>up</u> $k$ units $-k$ translates (shifts) the graph <u>down</u> $k$ units $x + h$ translates (shifts) the graph <u>left</u> $k$ units $x - h$ translates (shifts) the graph <u>right</u> $k$ units
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$$8] y = \sqrt{x+6} + 2$$

Transformations:

up 2      slope = 1  
left 6

y-intercept:

$$y = \sqrt{0+6} + 2$$

$$y = \sqrt{6} + 2$$

$$y \approx 4.5$$

$$(4.5, 0)$$

Domain:

$$x \geq -6$$

Two points:

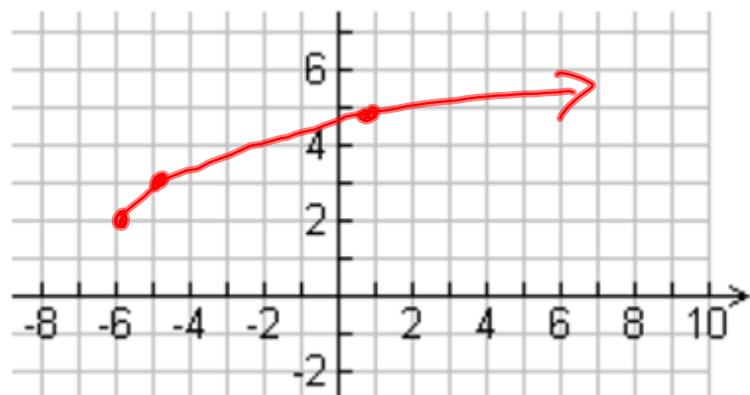
$$(-6, 2)  
(-5, 3)$$

x-intercept:

none

Range:

$$y \geq 2$$



$$9] y = -\sqrt{x} + 6$$

Transformations:

reflect  $x$ -axis  
slope = -1  
up 6

y-intercept:

$$(0, 6)$$

Domain:

$$x \geq 0$$

Two points:

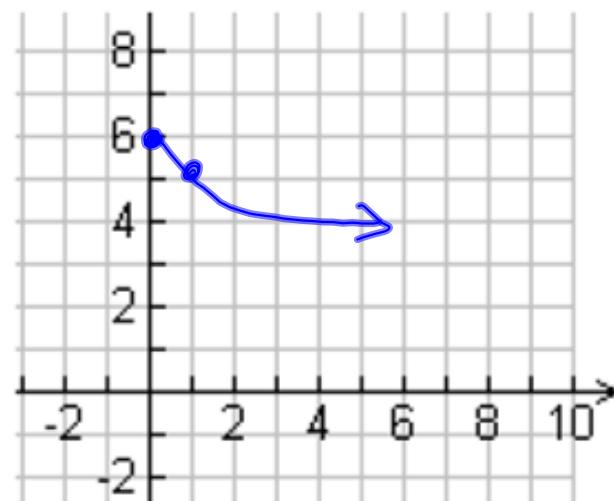
$$(0, 6)$$
$$(1, 5)$$

x-intercept:

$$0 = -\sqrt{x} + 6$$
$$\sqrt{x} = 6$$
$$x = 36$$
$$(36, 0)$$

Range:

$$y \leq 6$$



$$10] y = 3\sqrt{x} - 6$$

Transformations:

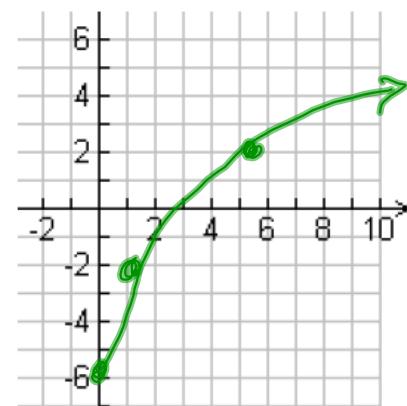
slope = 3  
down 6

y-intercept:

$$(0, -6)$$

Domain:

$$x \geq 0$$



Two points:

$$(0, -6)$$
$$(1, -3)$$

x-intercept:

$$0 = 3\sqrt{x} - 6$$
$$6 = 3\sqrt{x}$$
$$2 = \sqrt{x}$$
$$4 = x$$
$$(4, 0)$$

Range:

$$y \geq -6$$

$$11] y = \sqrt{-x} - 4$$

Transformations:

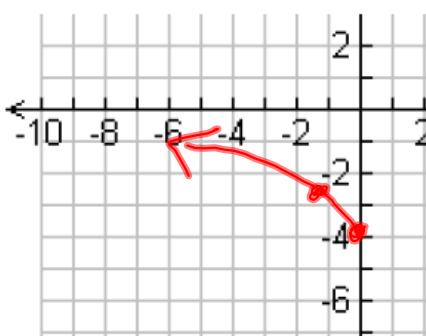
reflect y-axis  
slope = -1  
down 4

y-intercept:

$$(0, -4)$$

Domain:

$$x \leq 0$$



Two points:

$$(0, -4)$$
$$(-1, -3)$$

x-intercept:

$$0 = \sqrt{-x} - 4$$
$$4 = \sqrt{-x}$$
$$16 = -x$$
$$-16 = x$$

Range:  $(-16, 0)$

$$y \geq -4$$

$$12] y = \sqrt[3]{x-6} + 4$$

Transformations:

right 6 / Slope = 1  
up 4

y-intercept:

$$y = \sqrt[3]{0-6} + 4$$

$$y = \sqrt[3]{-6} + 4$$

$$y \approx 2.2$$

$(0, 2.2)$

Domain:

$\mathbb{R}$

Two points:

$$(6, 4)$$

$$(7, 5)$$

x-intercept:

$$0 = \sqrt[3]{x-6} + 4$$

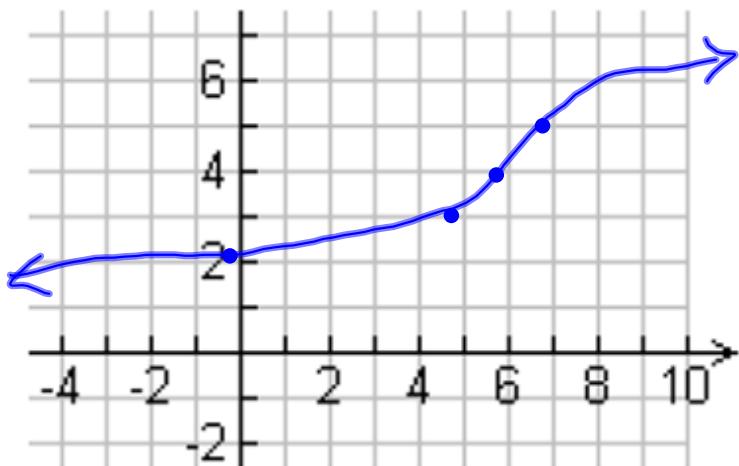
$$-4 = \sqrt[3]{x-6}$$

$$-64 = x-6$$

$$-58 = x \quad (-58, 0)$$

Range:

$\mathbb{R}$



$$13] y = -\sqrt[3]{x} - 6$$

Transformations:

reflect x-axis / slope = -1  
down 6

Two points:

$$(0, -6)$$

$$(1, -7)$$

y-intercept:

$$(0, -6)$$

x-intercept:

$$0 = -\sqrt[3]{x} - 6$$

$$\sqrt[3]{x} = -6$$

$$x = -216$$

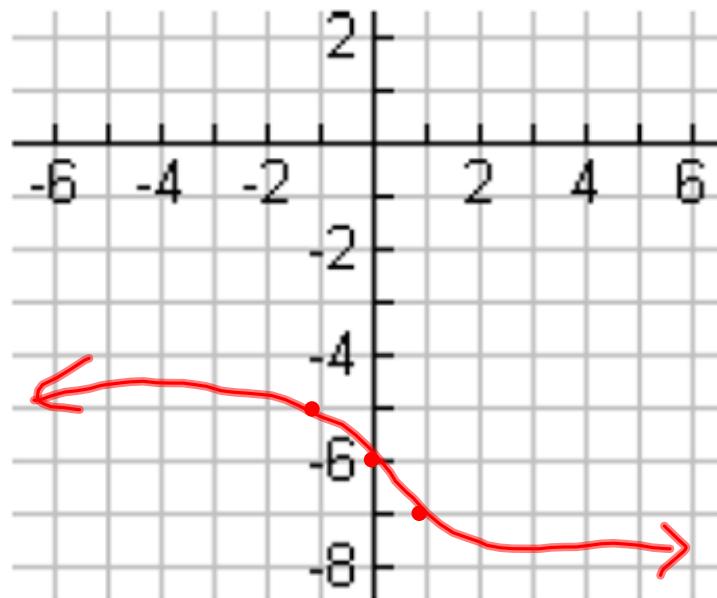
$$(-216, 0)$$

Domain:

$$\mathbb{R}$$

Range:

$$\mathbb{R}$$



$$14] y = 2\sqrt[3]{x+4}$$

Transformations:

Slope = 2  
left + 4

y-intercept:

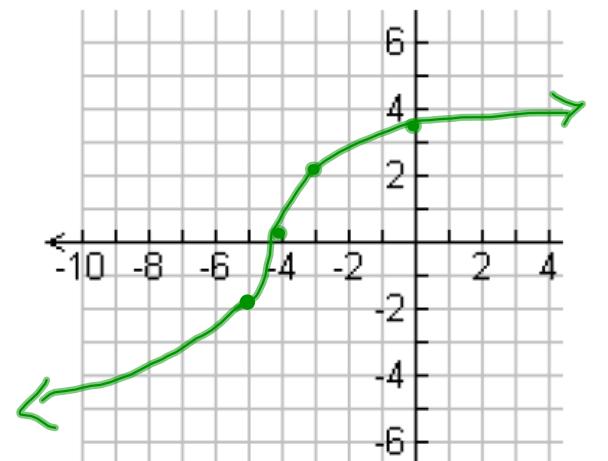
$$y = 2\sqrt[3]{0+4}$$

$$y = 2\sqrt[3]{4}$$

$$\sqrt[3]{y} \approx 3.2 \quad (0, 3.2)$$

Domain:

$\mathbb{R}$



Two points:

$$(-4, 0)$$
$$(-3, 2)$$

x-intercept:

$$(-4, 0)$$

$$15] y = -3\sqrt[3]{x}$$

Transformations:

reflect x-axis  
slope = -3

y-intercept:

$$(0, 0)$$

x-intercept:

$$(0, 0)$$

Domain:

$\mathbb{R}$

