

5-9: TRANSFORMING POLYNOMIAL FUNCTIONS

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Algebra 2

PARENT FUNCTIONS OF QUADRATIC FUNCTIONS

- Parent Function: $y = x^2$
 - Basic function you started with.

$-a$: Reflection

$a > 1$: Narrower

$0 < a < 1$: Wider

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

Diagram illustrating the vertex form of a parabola: $y = a(x - h)^2 + k$. The diagram shows the relationship between the parameters and the graph's features:

- Right or Left** (yellow box) points to h .
- Wider or Narrower** (yellow box) points to a .
- Up or Down** (blue box) points to k .

This is the *Vertex Form of a Parabola*.

What is an equation of the graph of $y = x^2$ under:

1. A vertical compression by the factor 2.

$$y = 2x^2$$

2. Followed by a reflection across the x-axis.

$$y = -2x^2$$

3. Followed by a horizontal translation 1 unit to the left.

$$y = -2(x+1)^2$$

4. Followed by a vertical translation 3 units up.

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

PARENT FUNCTIONS OF CUBIC FUNCTIONS

○ Parent Function: $y = x^3$

- Basic function you started with.

$-a$: Reflection

$a > 1$: Narrower

$0 < a < 1$: Wider

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

Diagram illustrating the components of the cubic function equation $y = a(x-h)^3 + k$:

- Right or Left** (yellow box) points to h .
- Wider or Narrower** (yellow box) points to a .
- Up or Down** (blue box) points to k .

What is an equation of the graph of $y = x^3$ under:

1. Vertical stretch by the factor of 3.

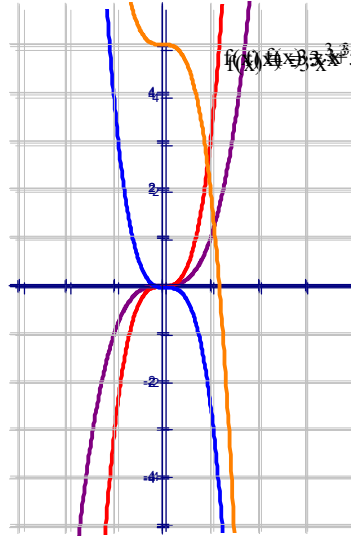
$$y = 3x^3$$

2. Reflection in the x-axis.

$$y = -3x^3$$

3. Vertical translation 5 units up.

$$y = -3x^3 + 5$$



What is an equation of the graph of $y = x^3$ under:

1. A vertical stretch by the factor 2.

$$y = 2x^3$$

2. Followed by a horizontal translation 3 units to the left.

$$y = 2(x+3)^3$$

3. Followed by a vertical translation 4 units down.

$$y = 2(x+3)^3 - 4$$

FINDING ZEROS OF A TRANSFORMED CUBIC FUNCTION

- A “zero” is also called an **x-intercept**
so $y = 0$

What are all the real zeros of $y = \frac{1}{2}(x-2)^3 - 3$?

$$0 = \frac{1}{2}(x-2)^3 - 3$$

$$3 = \frac{1}{2}(x-2)^3$$

$$6 = (x-2)^3$$

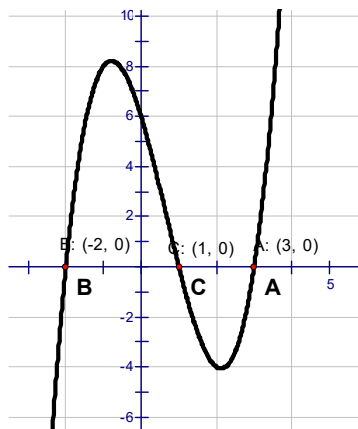
$$\sqrt[3]{6} = x - 2$$

$$3.82 \approx \sqrt[3]{6} + 2 = x$$

Note: Transformed cubic functions have only **one real** root.

NOTE: Not all cubic functions are obtained by transforming $y = x^3$.

$y = x^3 - 2x^2 - 5x + 6$ has three x-intercepts and cannot be obtained by transforming $y = x^3$.



Remember: If the function is a transformation of the parent function it will only have **one real zero**. It will be of the form:

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

POWER FUNCTIONS

- ⊙ A function of the form $y = a \cdot x^b$, where a and b are nonzero real numbers.

Examples:

$$y = 0.5x^6 \quad y = \frac{1}{2}x^2 \quad y = -4x^{\frac{2}{3}} \quad y = x^{0.25}$$

- ⊙ These examples are similar to direct variations, but with powers greater than 1.
 - a is called the constant of proportionality

The power P (in kilowatts) generated by a wind turbine varies directly as the cube of the wind speed v (in meters per second). A wind turbine generates 1200kW of power in a 20 m/s wind. How much power does this turbine generate in a 12m/s wind to the nearest kW?

1). $P = av^3$ 2). Find a when $P = 1200$, $v = 20$

$$1200 = (20^3)a$$

$$1200 = 8000a$$

$$\frac{3}{20} = \frac{1200}{8000} = a$$

3). $P = \frac{3}{20}v^3$

$$4). P = \frac{3}{20}(12^3) = 259.2 \approx 259 \text{ kW}$$

Homework: p.343 #7-17 odd, 25, 26