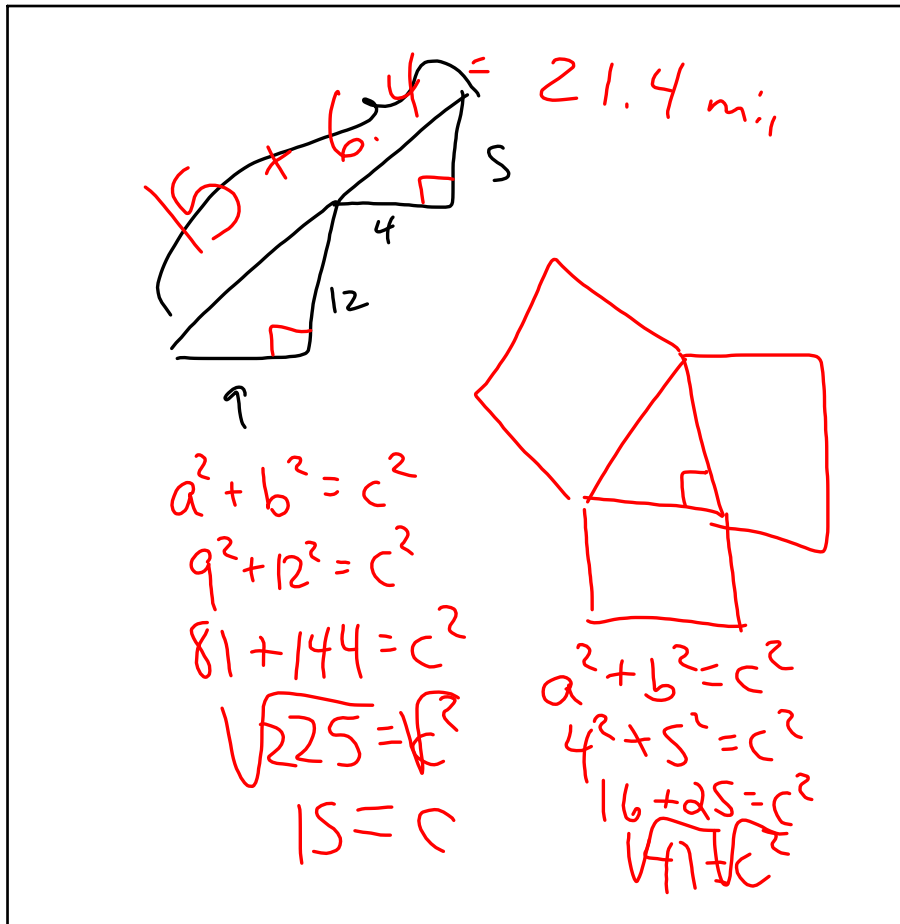


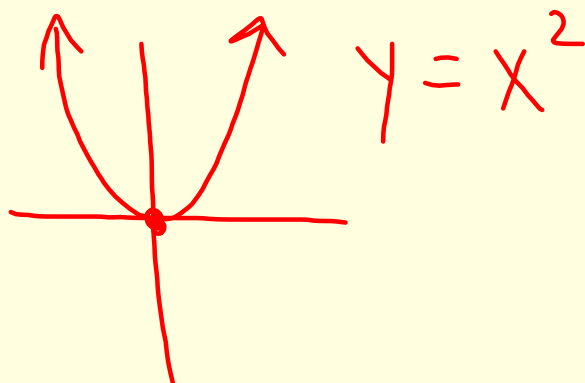
Jun 2-2:08 PM



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9-3

Transformations of Quadratic Functions



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A **transformation** changes the position or size of a figure.

One transformation, a **translation**, moves the figure **right, left, up or down**.

Vertical Translation

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

$k > 0$, that many units up

$k < 0$, that many units down

Horizontal Translation

$$g(x) = (x - h)^2$$

$h > 0$, that many units right

$h < 0$, that many units left

(h, k) vertex

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Ex. 1

Describe how the graph of each function is related to the graph of $f(x) = x^2$

a) $g(x) = 10 + x^2$ 10 units up

b) $g(x) = x^2 - 8$ 8 units down

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Ex. 2:

Describe how the graph of each function is related to the graph of $f(x) = x^2$

a.) $g(x) = (x + 1)^2$ one unit left
 $(x - (-1))^2$

b.) $g(x) = (x - 4)^2$ 4 units right

Jun 2-2:18 PM

Ex. 3:

Describe how the graph of each function is related to the graph of $f(x) = x^2$

a.)

$$g(x) = (x + 1)^2 + 1$$

$$(-1, 1)$$

h (-1) k left one unit
and
up one unit

b.)

$$g(x) = (x - 2)^2 + 6$$

2 right
and
6 up

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Another **transformation** is a **dilation**.

A **dilation** makes the graph **narrower** or **wider**.

Dilation

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

$a > 1$, graph is narrower (stretched vertically)

$a < 1$, graph is wider (compressed vertically)

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Ex. 4:

Describe how the graph of each function is related to the graph of $f(x) = x^2$

a.)

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

Compressed
vertically

b.)

$$m(x) = 2x^2 + 1$$

stretches vertically
and
up one unit

$$h=0 \quad k=1 \\ (0,1)$$

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A **Reflection** is a flip across a line.

$-f(x)$ is a flip over the x-axis of $f(x)$

(when a is negative, the parabola opens downward, remember?)

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Ex. 5

Describe how the graph of each function is related to the graph of $f(x) = x^2$

a.)

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

a reflection,
stretched vertically,
up one unit.

b.)

$$g(x) = \frac{1}{5}x^2 - 7$$

Compressed vertically
and
7 units down

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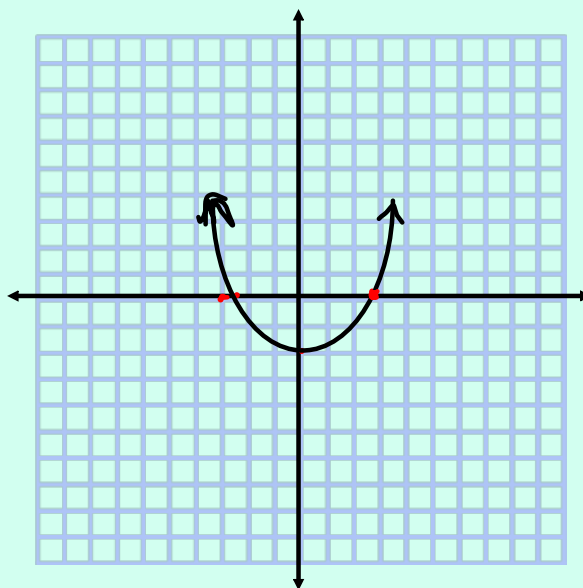
Which is an equation for the function shown in the graph?

A $y = \frac{1}{3}x^2 - 2$

~~B $y = 3x^2 + 2$~~

~~C $y = -\frac{1}{3}x^2 + 2$~~

~~D $y = 3x^2 - 2$~~



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

h, Horizontal Translation
 h units to the right if h is positive
 $|h|$ units to the left if h is negative

$h = 0$

a, Reflection
 If $a > 0$, the graph opens up.
 If $a < 0$, the graph opens down.

k, Vertical Translation
 k units up if k is positive
 $|k|$ units down if k is negative

a, Dilation
 If $|a| > 1$, the graph is stretched vertically. If $0 < |a| < 1$, the graph is compressed vertically.

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O.T.L.

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