Challenge:

Can you convert a quadratic in standard form to vertex form by completing the square?

$$f(x) = x^2 - 6x + 8$$
$$-8 \qquad\qquad -8$$

$$f(x) - 8 + 9 = x^2 - 6x + 9$$

$$\left(\frac{6}{2}\right)^2 = (3)^2 = 9$$

$$f(x) + 1 = (x-3)^2$$
$$-1 \qquad -1$$

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

$f(x) = x^2 - 6x + 8$

$-8 \qquad -8$

$c = \left(\frac{b}{2}\right)^2 = \left(\frac{-6}{2}\right)^2 = 9$

$f(x) - 8 + \underline{9} = x^2 - 6x + \underline{9}$

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

$-1 \qquad -1$

$f(x) = (x-3)^2 - 1$

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IBE

Graph the following on the same sheet of graph paper:

a) $f(x) = x$

b) $f(x) = x+3$

c) $f(x) = x-3$

d) $f(x) = -x$

e) $f(x) = 3x$

f) $f(x) = (1/3)x$

What happens to the graph when...

a) You add 3 to it?

b) You subtract 3 from it?

c) You multiply it by -1?

d) You multiply it by 3?

e) You multiply it by 1/3?

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Learning Target:

2G - I can graph a quadratic function in vertex form ($f(x) = a(x-h)^2 +k$), and can identify the key information of the function (including vertex, max/min, line of symmetry, domain/range, and number of roots).

How does this make me college ready?

- Quadratics are the gateway for the study of higher order functions.

- The concept of a maximum is fundamental to differential calculus, and is used in many different areas of study in college including: engineering, physics, business, economics, finance

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Vertex Form of a quadratic is:

2.1

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

- skinny/wide
- opens up/down

Vertex: (h, k)

Line of symmetry -----> $x = h$

To make finding the axis of symmetry and vertex of a quadratic easier, we can use the vertex form of a quadratic instead of standard form.

$(x-5)^2+2$

$\boxed{x=5}$

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How do I find roots in vertex form?

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

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Example 1: Graph $f(x) = 1/2(x-4)^2 - 2$

Think! What do we know about the parabola?

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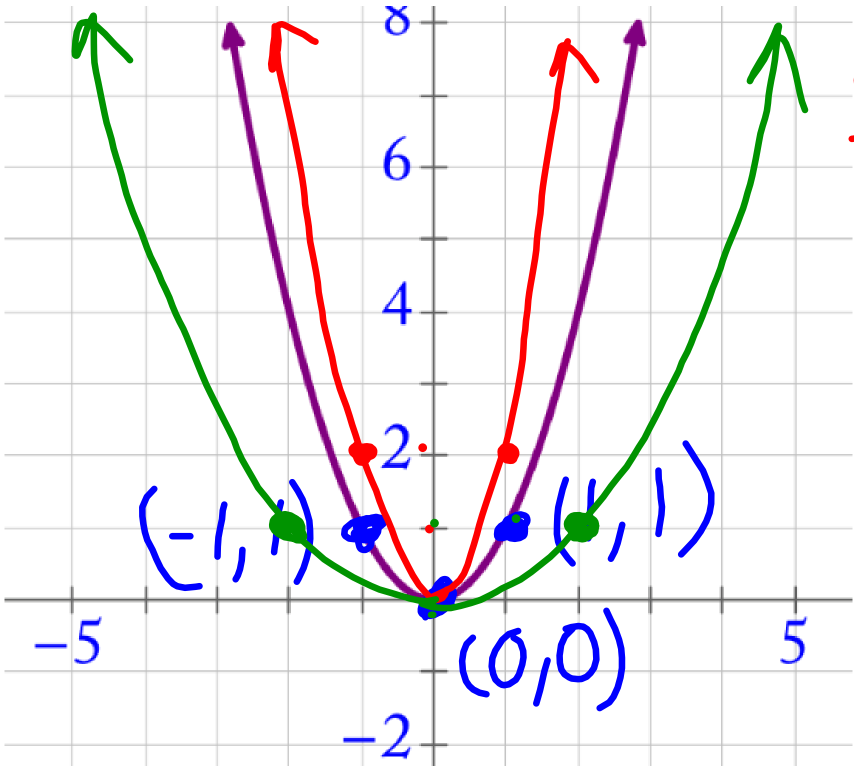
Parent Function: $y = x^2$

$f(x) = x^2$



$2(x-2)^2$

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

$\frac{1}{1}$

Transformations

Transf.	Type	Effect of graph
$y = x^2$	Parent function	parabola with vertex at (0,0)
$y = x^2 + k$	Vertical shift	shift graph of $y=x^2$ up by k units
$y = x^2 - k$	Vertical shift	shift graph of $y=x^2$ down by k units
$y = (x+ k)^2$	Horizontal shift	shift graph of $y=x^2$ left by k units
$y = (x- k)^2$	Horizontal shift	shift graph of $y=x^2$ to right by k units

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Vertex Form of a quadratic:

$x-h=0$

$x=h$

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

- skinny/wide
- opens up/down

shift parent function to the right by h units

shift parent function down by k units

$(x-3)^2+2$

$x-3=0$

$x=3$

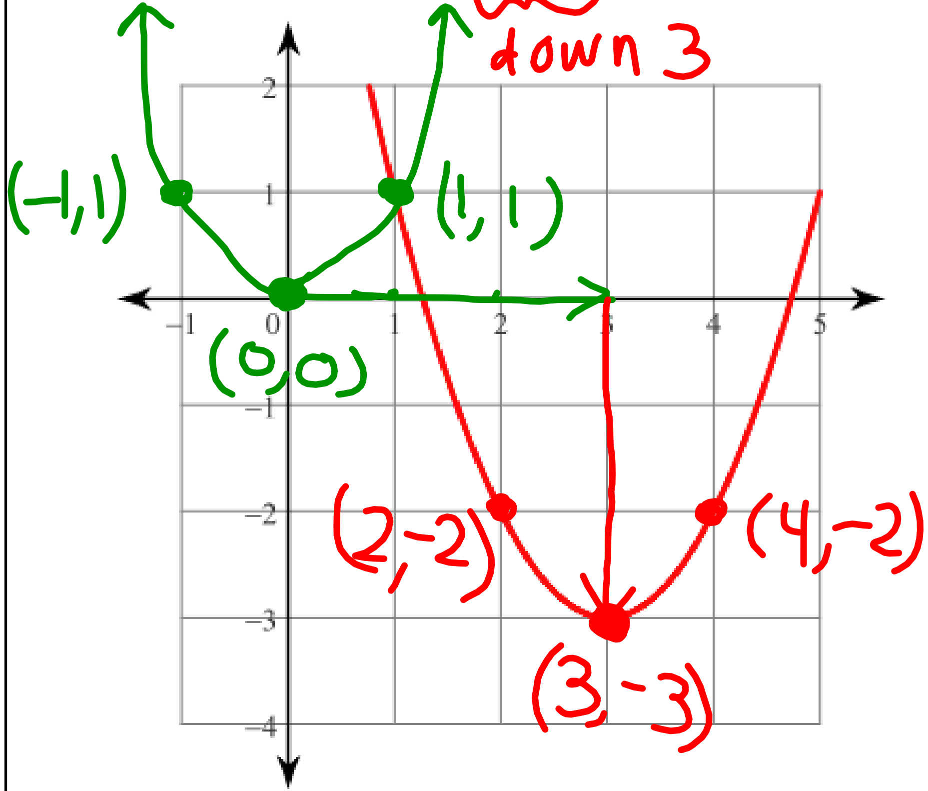
right 3

Example: Quadratics in Vertex Form

$x-3=0$
$x=3 \rightarrow$ right 3

1) $f(x) = (x-3)^2 - 3$

down 3



Transformations:

1) shift right 3
2) shift down 3
3)
4)

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Example: Quadratics in Vertex Form

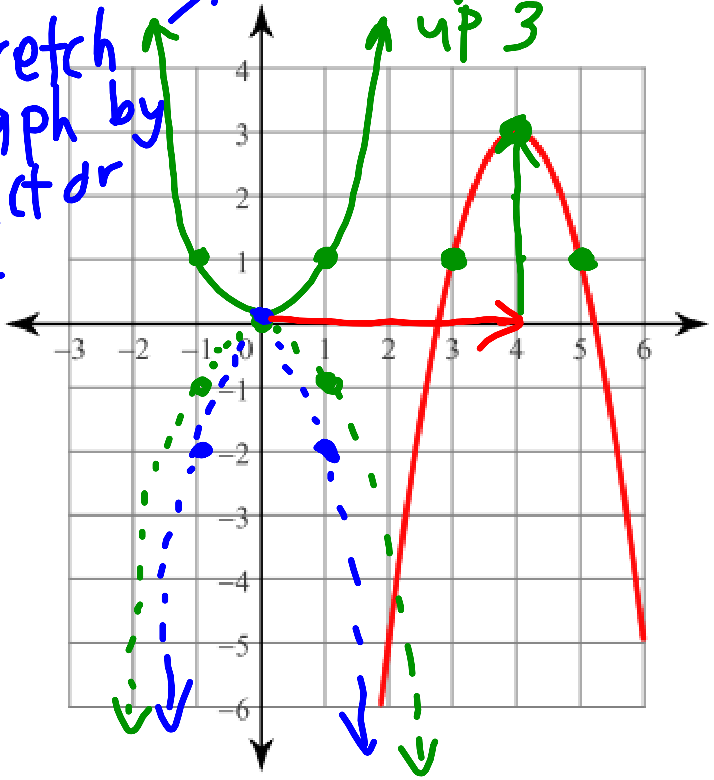
reflect ab x-axis

$x-4=0$ right 4
$x=4$

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

up 3

stretch graph by factor 2



Transformations:

1) Reflect ab. X-axis
2) Stretch graph by factor of 2
3) shift right 4 units
4) shift up 3 units

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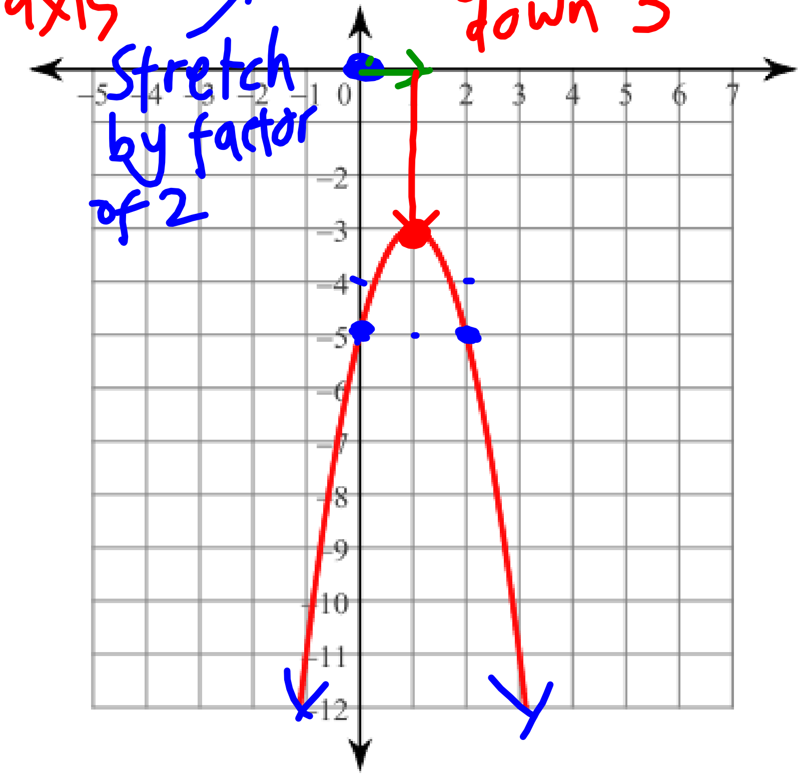
Example: Quadratics in Vertex Form

reflect ab x-axis

$x-1=0$ move right
$x=1$

3) $f(x) = -2(x-1)^2 - 3$

down 3



Transformations:

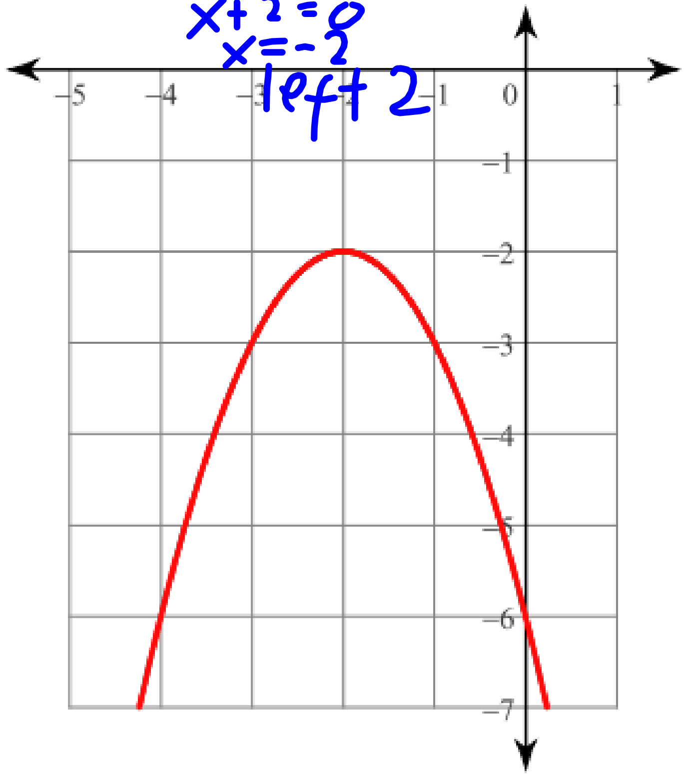
1) reflect about x-axis
2) stretch by factor of 2
3) shift right 1 unit
4) shift down 3

Example: Quadratics in Vertex Form

reflect ab x-axis   down 2

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

$x+2=0$
$x=-2$
left 2



Transformations:

1) reflect ab x-axis
2) shift left 2
3) shift down 2
4)

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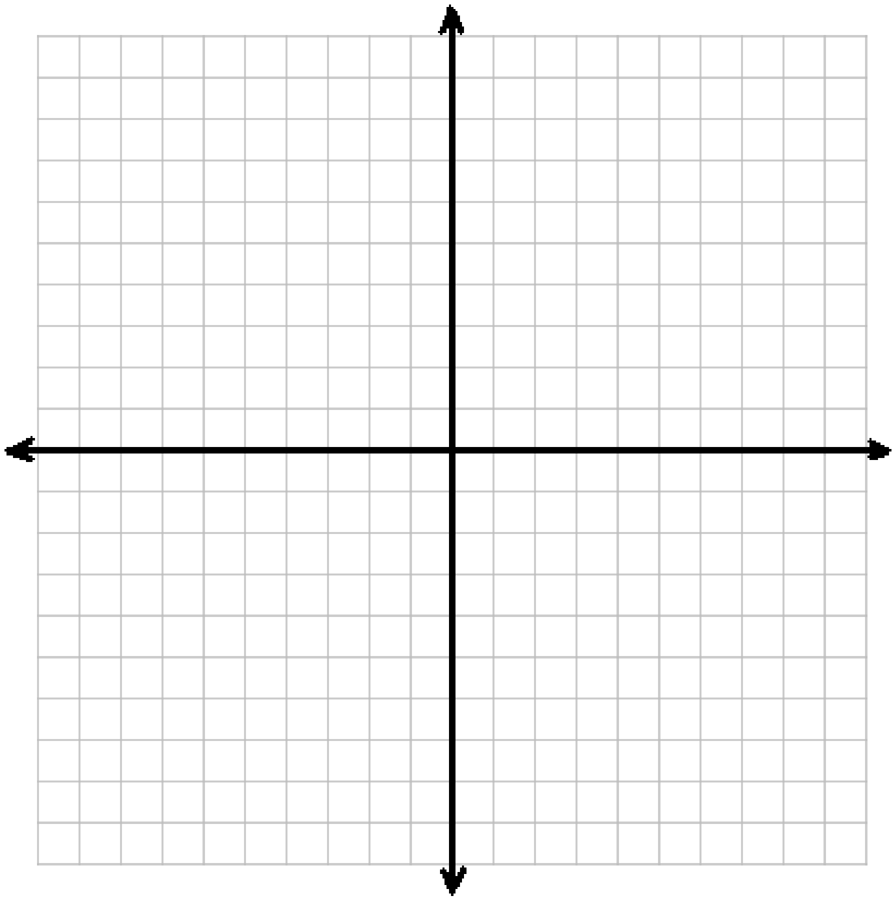
Example: Graph $f(x) = (x+4)^2 + 4$



Transformations:

1)

2)

3)

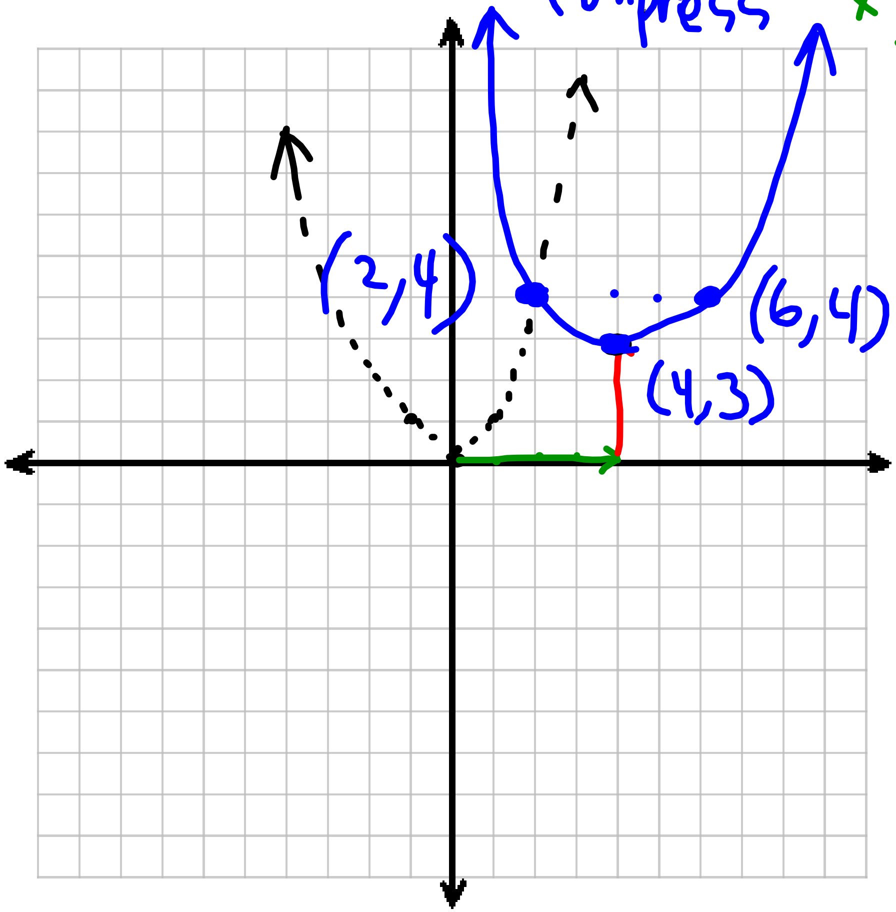
4)

Example: Graph $f(x)=\frac{1}{2}(x-4)^2+3$

compress

$x-4=0$
$x=4$
right 4

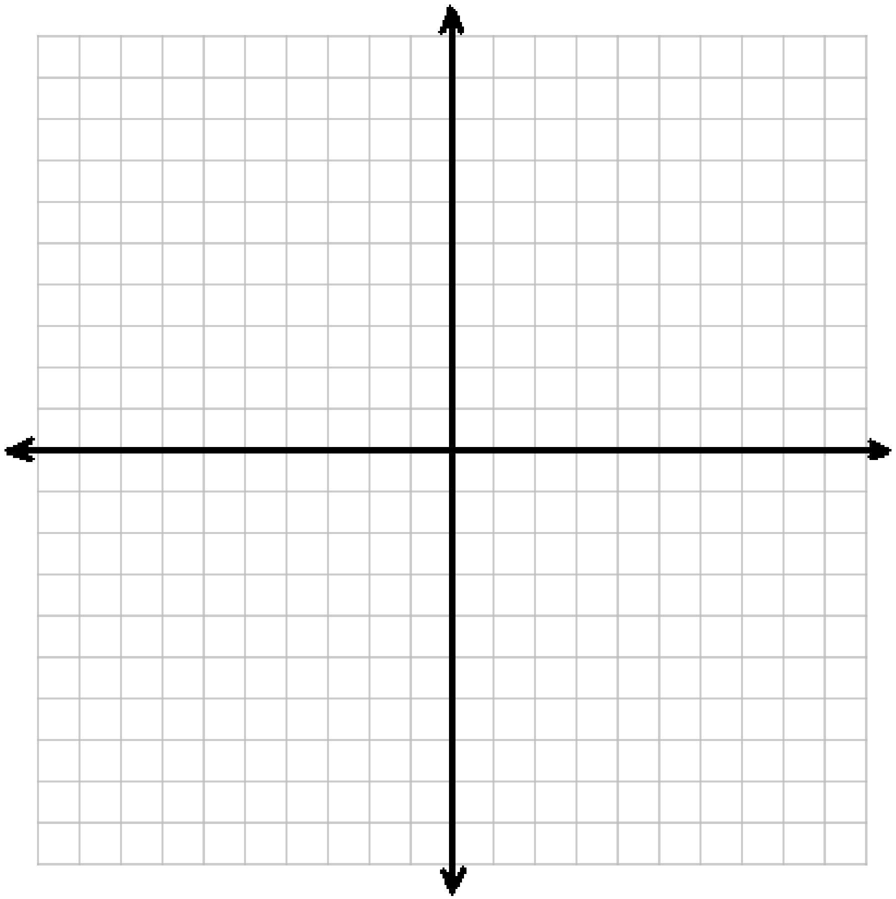
up 3



Transformations:

1) compress by factor of 1/2
2) shift right 4
3) Shift up 3
4)

Example: Graph $f(x) = -2(x+4)^2 - 2$



Transformations:

1)

2)

3)

4)

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