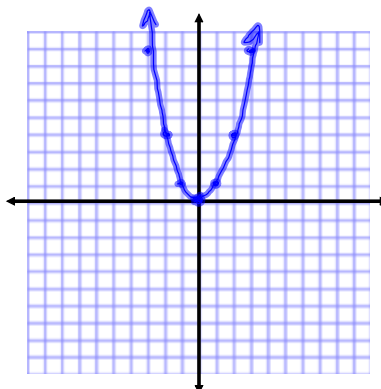


Transformations Review

The parent (basic) function for the quadratic is:

$$y = x^2 \text{ or } f(x) = x^2 \text{ in function notation}$$

Table of values	
x	$y = x^2$
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



Feb 22-9:25 PM

In grade 10 you studied four transformations that the basic function can undergo; we will review those today

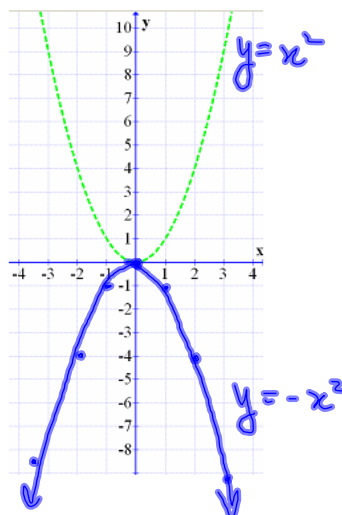
Reflection along the x-axis: *(vertical reflection)*

$$y = ax^2, \quad a < 0$$

$$y = af(x), \quad a < 0 \text{ where } f(x) = x^2$$

Ex: Graph $y = -x^2$

x	$y = x^2$	Multiply y by -1 to get $y = -x^2$
-3	9	-9
-2	4	-4
-1	1	-1
0	0	0
1	1	-1
2	4	-4
3	9	-9



Feb 23-9:20 PM

Vertical Scaling:

$$y = ax^2, \quad a > 0$$

$$y = af(x), \quad a > 0 \quad \text{where } f(x) = x^2$$

There are two types of vertical scaling:

vertical stretch: $a > 1$ (parabola gets skinnier)

ex: $y = 2x^2$ this is a vertical scaling by a factor of 2

or better yet: a vertical stretch by a factor of 2

vertical compression: $0 < a < 1$ (parabola gets wider)

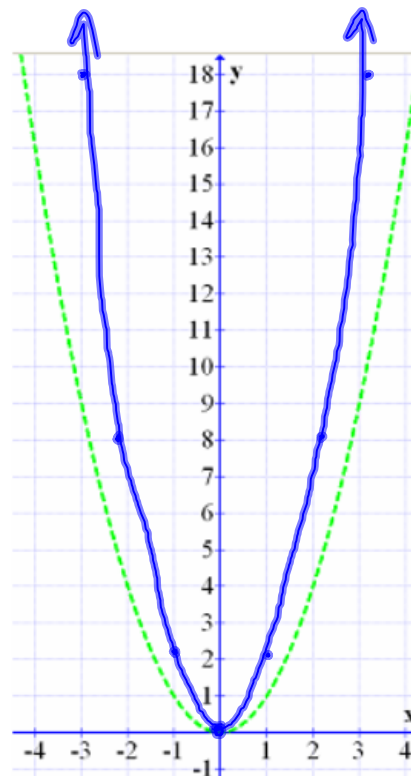
ex: $y = \frac{1}{2}x^2$ this is a vertical scaling by a factor of 0.5

or better yet: a vertical compression by a factor of 2

Ex: Graph $y = 2x^2$

Table of values

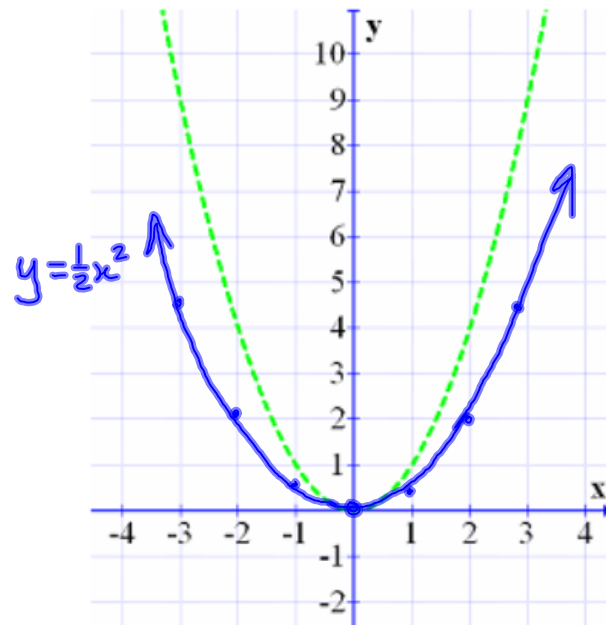
x	$y = x^2$	Multiply y by 2 to get $y = 2x^2$
-3	9	18
-2	4	8
-1	1	2
0	0	0
1	1	2
2	4	8
3	9	18



Ex: Graph $y = \frac{1}{2}x^2$

Table of values

x	$y = x^2$	Multiply y by $\frac{1}{2}$ to get $y = \frac{1}{2}x^2$
-3	9	4.5
-2	4	2
-1	1	0.5
0	0	0
1	1	0.5
2	4	2
3	9	4.5



Vertical Translation:

$$y = x^2 + q$$

\rightarrow k from $y = a(x-h)^2 + k$
* reuse k for new meaning

$$y = af(x) + q, \text{ where } f(x) = x^2$$

There are two types of vertical translation:

vertical shift up: $q > 0$ (parabola moves up)

ex: $y = x^2 + 1$, this is a vertical shift up 1 unit

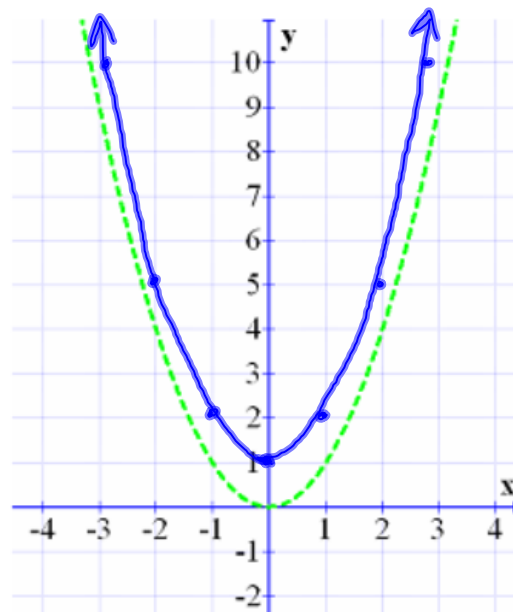
vertical shift down: $q < 0$ (parabola moves down)

ex: $y = x^2 - 2$, this is a vertical shift down 2 units

Ex: Graph $y = x^2 + 1$

Table of values

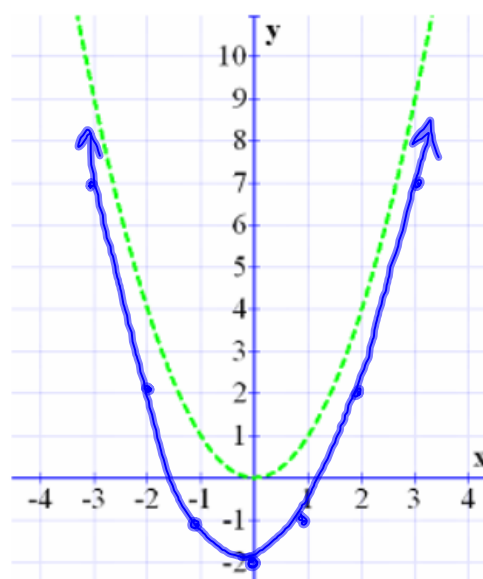
x	$y = x^2$	Add 1 to y to get $y = x^2 + 1$
-3	9	10
-2	4	5
-1	1	2
0	0	1
1	1	2
2	4	5
3	9	10



Ex: Graph $y = x^2 - 2$

Table of values

x	$y = x^2$	Subtract 2 from y $y = x^2 - 2$
-3	9	7
-2	4	2
-1	1	-1
0	0	-2
1	1	-1
2	4	2
3	9	7



Horizontal Translation:

$$y = (x - p)^2$$

using p instead of h
vertex at (p, q)

$$y = af(x - p), \text{ where } f(x) = x^2$$

There are two types of horizontal translation:

horizontal shift right: $p > 0$ (parabola moves right)

ex: $y = (x - 3)^2$ this is a horizontal shift right 3 units

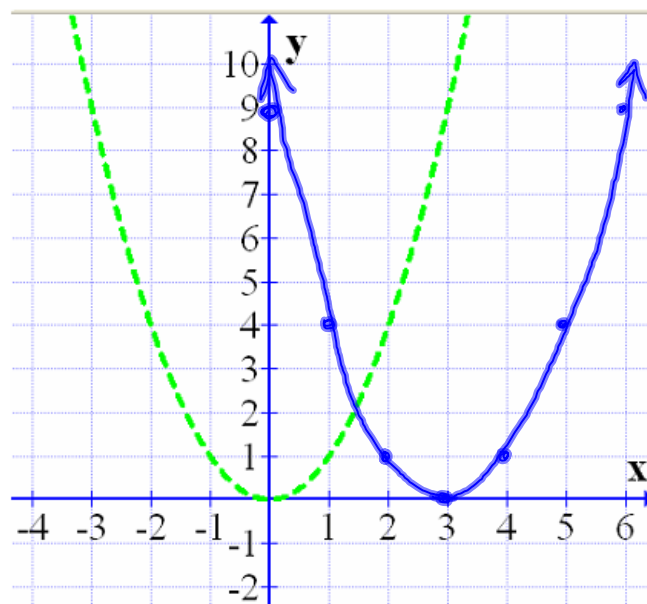
horizontal shift left: $p < 0$ (parabola moves left)

ex: $y = (x + 2)^2$, this is a horizontal shift left 2 units

Ex: Graph $y = (x - 3)^2$

Table of values

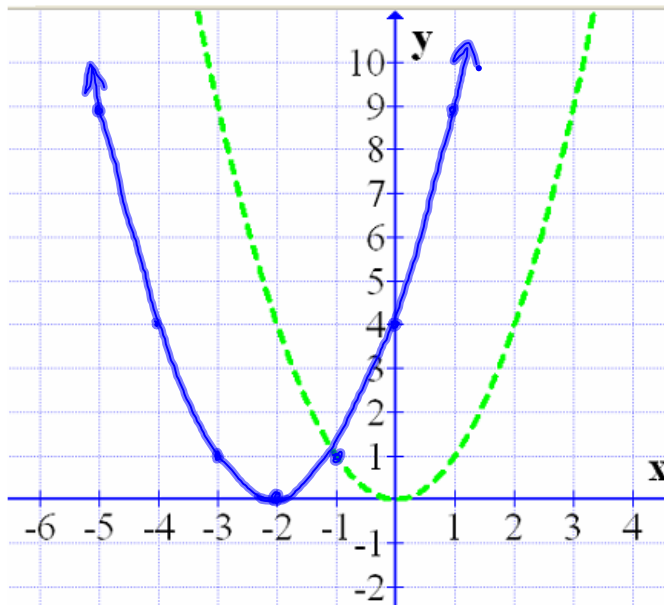
Add 3 to x to get $y = (x - 3)^2$	x	$y = x^2$
0	-3	9
1	-2	4
2	-1	1
3	0	0
4	1	1
5	2	4
6	3	9



Ex: Graph $y = (x + 2)^2$

Table of values

Subtract 2 from x to get $y = (x + 2)^2$	x	$y = x^2$
-5	-3	9
-4	-2	4
-3	-1	1
-2	0	0
-1	1	1
0	2	4
1	3	9



Assigned Work:

hand out:

1) Sketch each of the following parabolas. State the direction of the opening, the coordinates of the vertex, the equation of the axis of symmetry, the optimal value (and whether it is a maximum or minimum), the zeros, and the domain and range.

a) $y = x^2 - 4$

b) $y = -(x + 3)^2 - 5$

2) Describe the transformations that transforms the function $y = x^2$ onto

a) $y = x^2 + 3$

b) $y = 4x^2$

c) $y = -x^2$

d) $y = (x - 5)^2 + 1$

3) Find the image of the point $(-3, -2)$ under each translation

a) 4 units upward

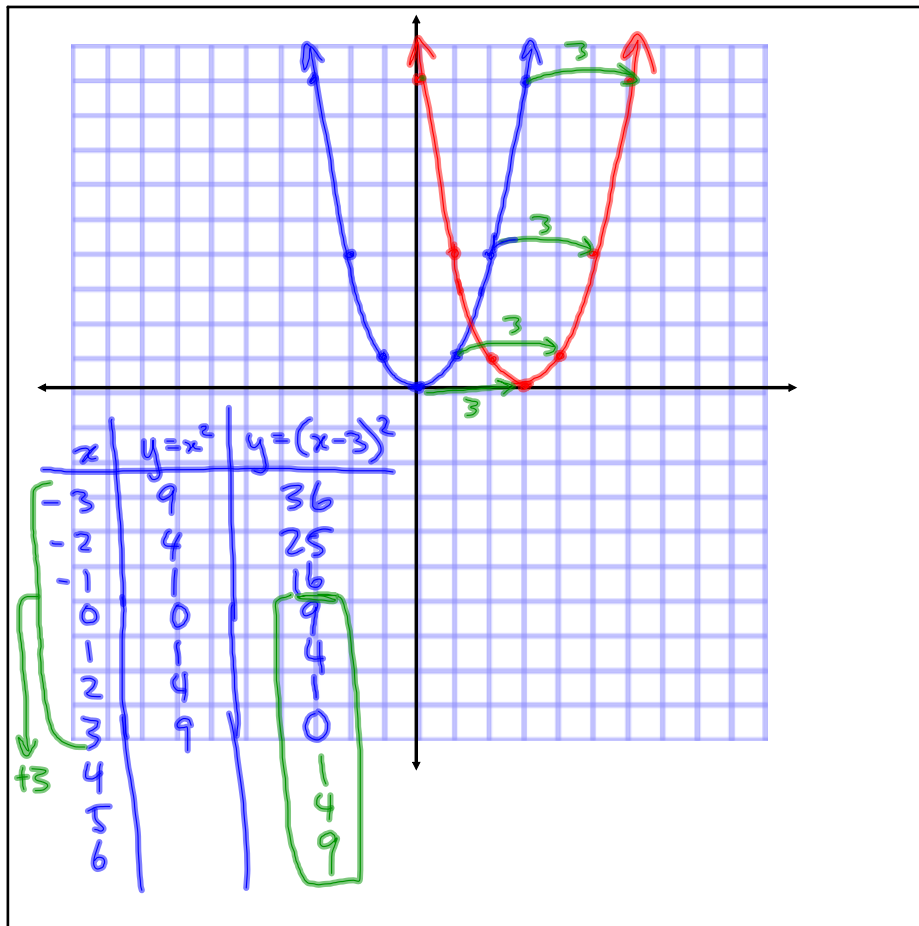
b) 6 units left

c) 2 units downward and 4 units to the right

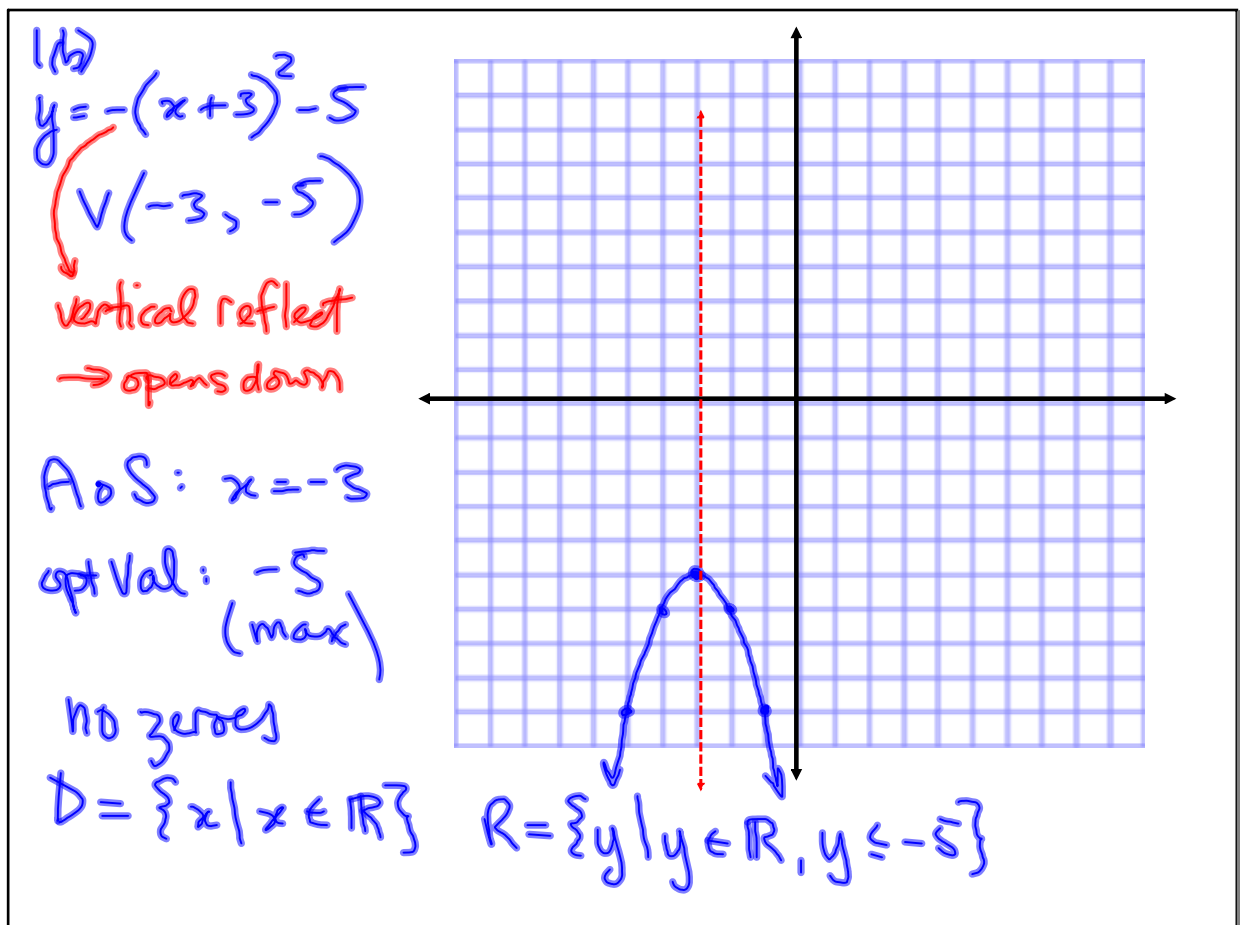
4) Name the translation that transformed $(8, -2)$ onto $(0, -3)$.

Pg. 189 #1achj

Pg. 230 #5bd



Mar 1-11:15 AM



Mar 2-9:07 AM