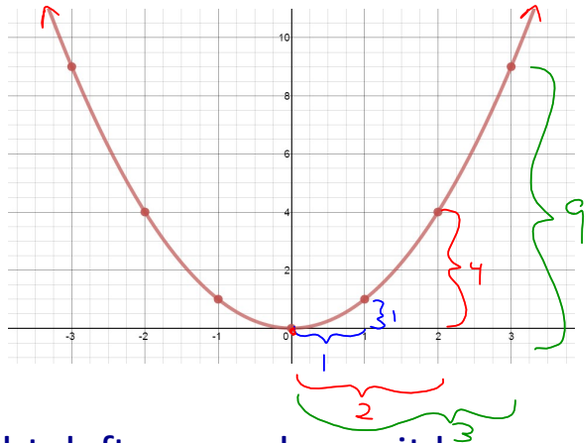
3.3A Investigate Transformations - Day 1

The base graph of all parabolas is $y = x^2$.

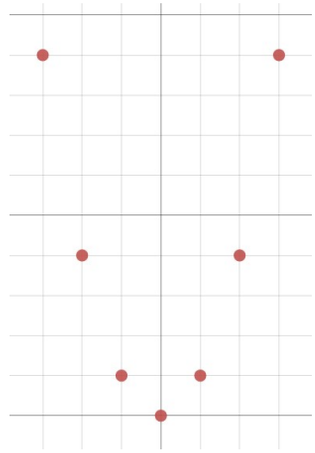
x	$y=x^2$
−3	9
−2	4
−1	1
0	0
1	1
2	4
3	9



If we move $y = x^2$ right, left, up or down, it keeps its shape. Determine a pattern from the vertex to each of the points shown. Each square represents 1 unit.

the pattern from the vertex is:

1 out 1 up
2 out 4 up
3 out 9 up



All other parabolas are transformations on $y = x^2$.

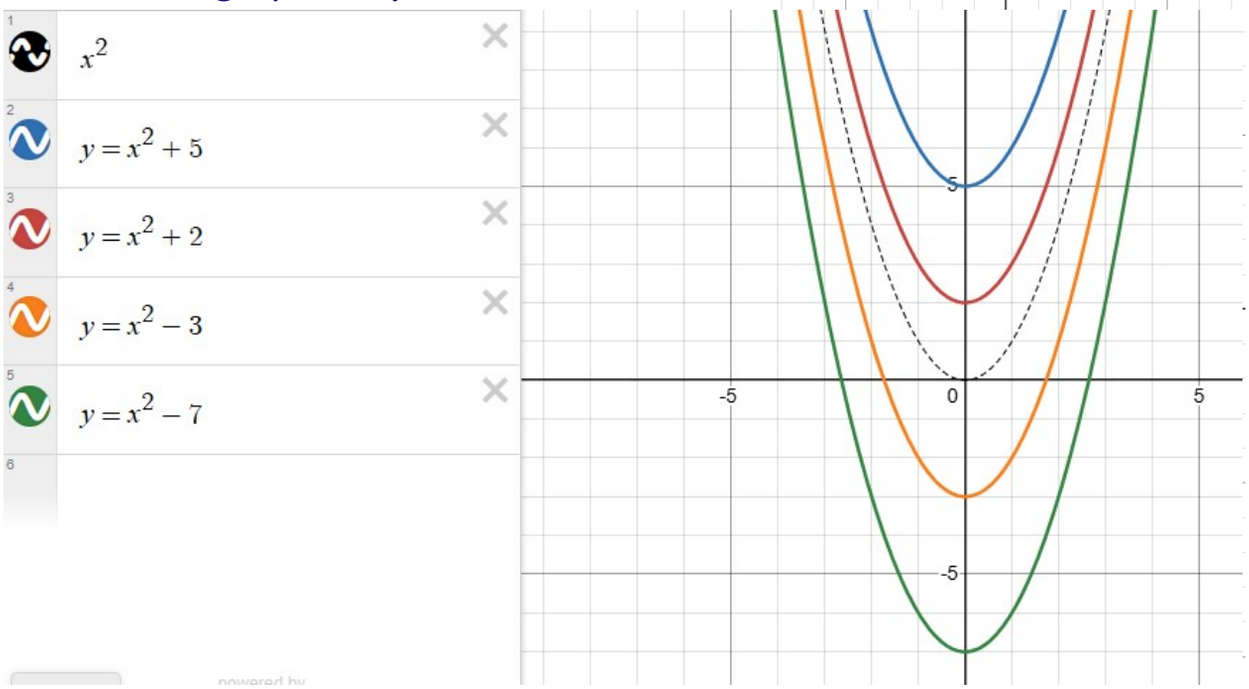
Transformations include:

- translations (shifts up/down, left/right)
- reflections (in the x-axis)
- vertical stretches

A. Investigate $y = x^2 + k$

Use graphing technology!

Compare the following graphs to $y = x^2$.
Sketch the graphs in your notebook.



Compared to $y = x^2$, the graph of $y = x^2 + k$:

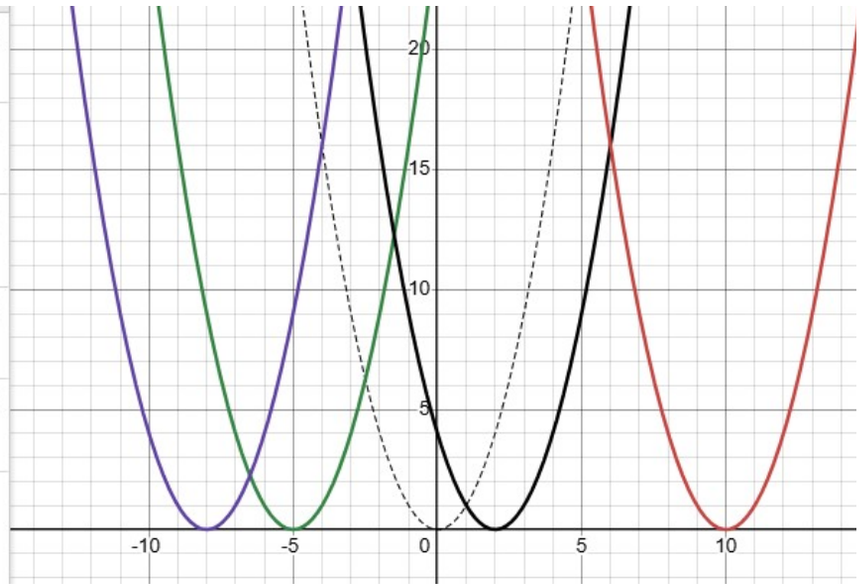
if k >0, there is a vertical shift up k units

if k < 0, there is a vertical shift down k units

B. Investigate $y = (x - h)^2$

Compare the following graphs to $y = x^2$.

1. x^2
2. $y = (x + 5)^2$ $h = -5$
3. $y = (x + 8)^2$ $h = -8$
4. $y = (x - 2)^2$ $h = 2$
5. $y = (x - 10)^2$ $h = 10$
6.



Compared to $y = x^2$, the graph of $y = (x - h)^2$:

if $h > 0$, there is a horizontal shift right h units

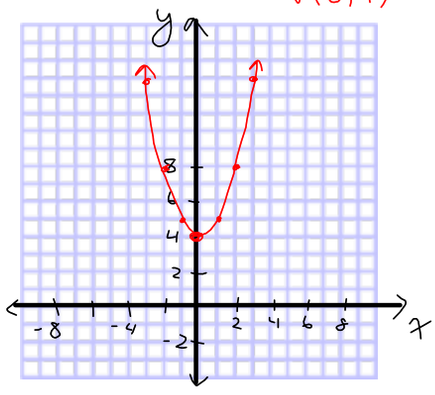
if $h < 0$, there is a horizontal shift left h units

Ex. 1 State the transformations on $y = x^2$ and sketch the graph.

a) $y = x^2 + 4$

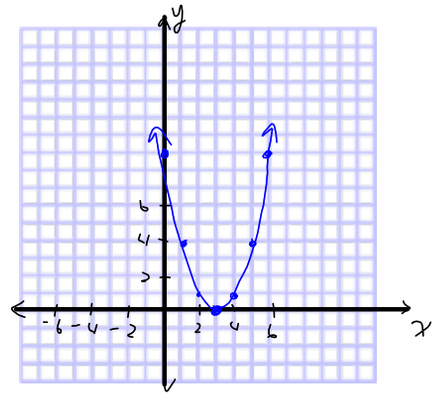
- Vertical shift up 4

V(0,4)



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

- Horizontal shift right 3



Ex. 2 Write the equation of a quadratic relation under the following transformations on $y = x^2$:

a) translated 5 units down

$y = x^2 - 5$

b) translated 7 units right

$y = (x-7)^2$

c) translated 3 units left

$y = (x+3)^2$

d) translated up 4 units and 6 units right

$y = (x-6)^2 + 4$

Homework

p. 178 #2,3,6,7,9