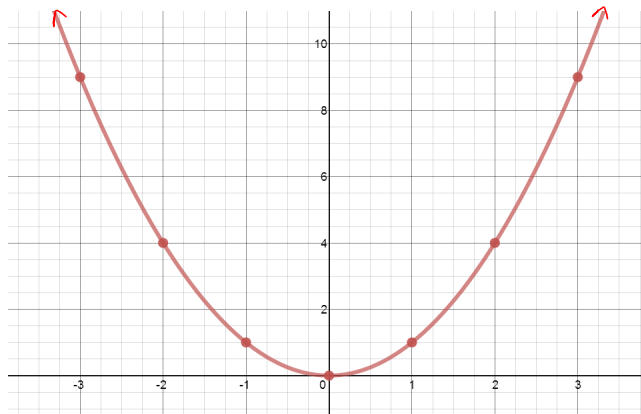


3.3A Investigate Transformations - Day 1

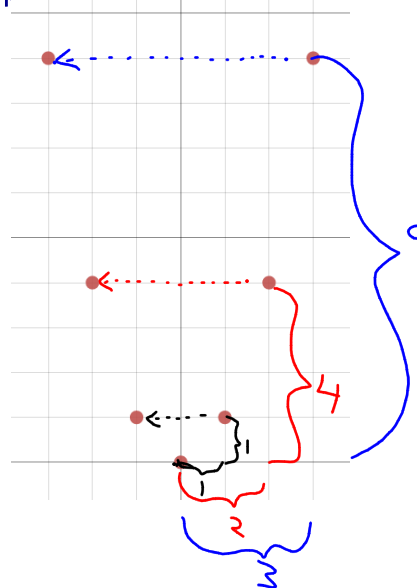
The base graph of all parabolas is $y = x^2$.

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 to each of the points shown. Each square represents 1 unit.

$1 \rightarrow 1^2 = 1 \uparrow$
 $2 \rightarrow 2^2 = 4 \uparrow$
 $3 \rightarrow 3^2 = 9 \uparrow$



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

Transformations include:

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

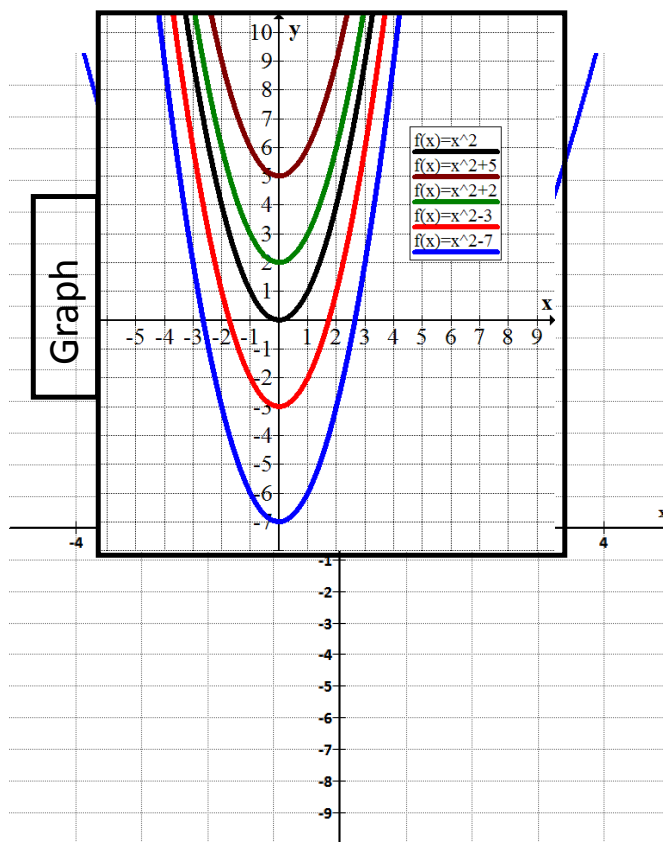
A. Investigate $y = x^2 + k$

Use graphing technology!

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

Sketch the graphs in your notebook.

- a) $y = x^2$
- b) $y = x^2 + 5$
- c) $y = x^2 + 2$
- d) $y = x^2 - 3$
- e) $y = x^2 - 7$



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

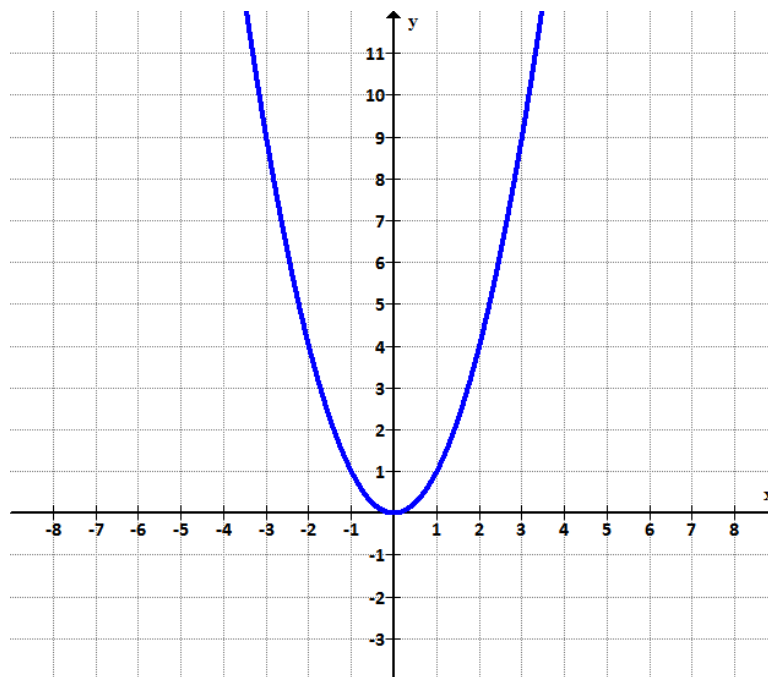
if $k > 0$, translated UP k units

if $k < 0$, translated DOWN k units

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

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

- a) $y = x^2$
- b) $y = (x + 5)^2$
- c) $y = (x + 8)^2$
- d) $y = (x - 2)^2$
- e) $y = (x - 10)^2$



Graph

$y = (x - h)^2$
 ex: $h = -5$
 ex: $y = (x - (-5))^2$
 $\quad = (x + 5)^2$

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

- if $h > 0$, translate RIGHT by h units
- if $h < 0$, translate LEFT by h units

ex: $h = 3$
 $y = (x - 3)^2$

ex $h = -4$
 $y = [x - (-4)]^2$
 $y = (x + 4)^2$

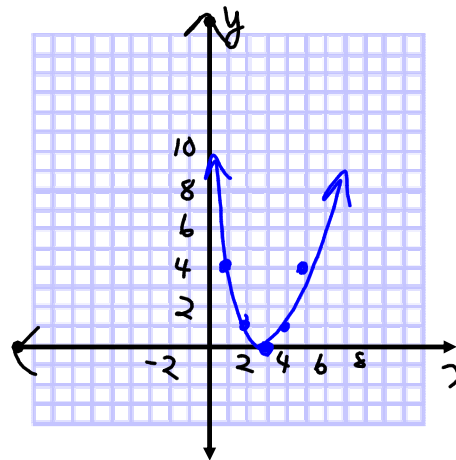
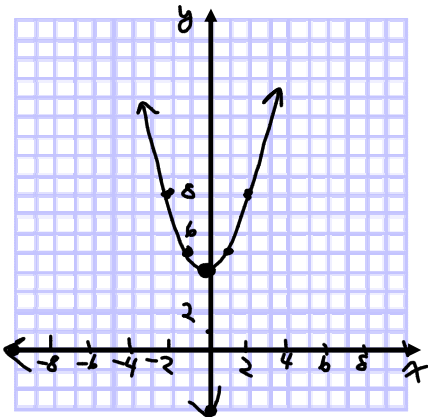
Ex. 1 State the transformations on $y = x^2$ and sketch the graph.

a) $y = x^2 + 4$

— translated UP 4 units

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

— translated RIGHT 3 units



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

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

Your Turn:
Page 178-179
#2,3,6,7,9

