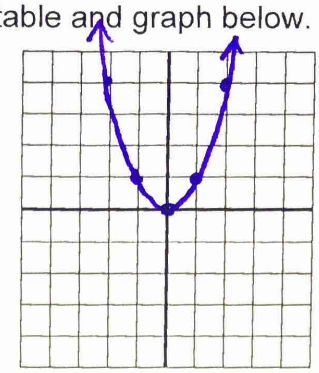
Lesson 3.4 – Quadratic Functions

In Lesson 3.3 we learned how to translate a function. What other types of functions could we translate? Go to Desmos.com and click the start graphing button.

1. Graph $f(x) = x^2$ and fill in the table and graph below.

x	y
-2	4
-1	1
0	0
1	1
2	4



Quadratic function
→ x^2
→ Parabola

Vertex

2. Where is the lowest point of the graph located?
(0,0)

Symmetric: Both (x,y) & (-x,y) are on $y=x^2$

3. For what value of x does...

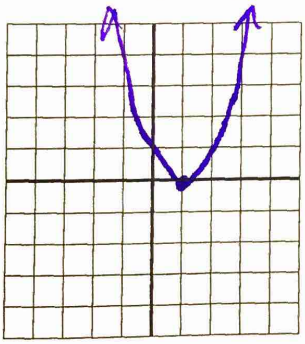
$f(x) = 16$?	$f(x) = 9$?	$f(x) = 25$?	$f(x) = 0$?
-4 & 4	-3 & 3	-5 & 5	0

Axis of symmetry goes through vertex

What do you notice?
All the answers are ± except for the last one.

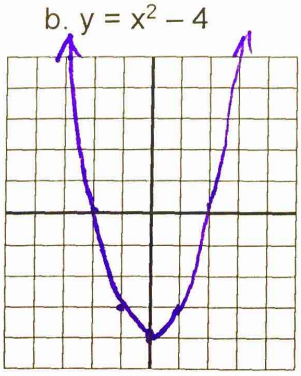
4. Use your knowledge from previous lessons to graph each of the following functions **without Desmos.** When you are done, check your graphs in Desmos and describe how the graph has transformed from the parent function, $f(x) = x^2$?

a. $y = (x - 1)^2$



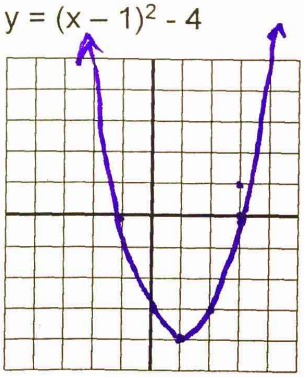
Vertex: (1,0)
Axis of Symmetry: x=1
Transformation: Right 1

b. $y = x^2 - 4$



Vertex: (0,-4)
Axis of Symmetry: x=0
Transformation: Down 4

$y = (x - 1)^2 - 4$



Vertex: (1,-4)
Axis of Symmetry: x=1
Transformation: Right 1 down 4

$y = (x-h)^2 + k$ vertex: (h,k) axis of sym.: x=h

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Lesson 3.4 – Translations and the Quadratic Family

Important ideas:	Translations of $y = x^2$	Solving Quadratics:
Quadratic Parent function: $y = x^2$ Vertex: (0,0) Axis of sym: $x = 0$	$y = (x-h)^2 + k$ Right h, up k Vertex: (h,k) Axis: $x = h$	Undo x^2 with $\sqrt{}$ *Use SADMEP to get x alone. *Be careful of $\pm$

Check Your Understanding

1. Describe the translations of the graph of $y = x^2$ needed to produce the graph of each equation.

a. $y = x^2 - 6$

Down 6

b. $y = (x + 5)^2$

Left 5

c. $y = (x - 3)^2 - 9$

Right 3
Down 9

2. Find the vertex of each parabola.

a. $y = x^2 + 3$

$(x-0)^2 + 3$

(0, 3)

b. $y = (x - 2)^2 + 0$

(2, 0)

c. $y = -8 + (x + 5)^2$ (k, h)

(−5, −8)

3. Each parabola described is the graph of $y = x^2$. Write an equation for each parabola and sketch its graph.

a. The parabola is translated horizontally −3 units.

$y = (x+3)^2$

4. Describe what happens to the graph of $y = x^2$ in the following situations.

a. y is replaced with $(y + 1)$.

$y + y = x^2$
$-1 \quad -1$
$y = x^2 - 1$

Down 1

b. x is replaced with $(x - 5)$.

$y = (x-5)^2$

Right 5

5. Solve.

a. $x^2 + 6 = 31$

$-6 \quad -6$
$\sqrt{x^2} = \sqrt{25}$
$x = \pm 5$

b. $x^2 - 12 = 52$

$+12 \quad +12$
$x^2 = 64$
$x = \pm 8$

c. $\sqrt{(x-3)^2} = \sqrt{100}$

$x - 3 = 10$ → $x = 13$

$x - 3 = -10$ → $x = -7$

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