3.1 Notes: Quadratic Graphs

Recall the following facts regarding the graph of $y=x^{2}$.

* Vertex is at $(0,0)$
* $x=0$ is the line (axis) of symmetry
* Opens up.

Thus, the more general quadratic function $y=a(x-h)^{2}+k$ contains all possible dilations, translations, and reflections across the $x$ axis (allowing for $a$ to be negative). Note from our previous lesson on graphing techniques that:

* Vertex is at $(h,k)$
* $x=h$ is the line (axis) of symmetry.
* Stretched vertically if |$a|>1$ and shrunk vertically if $|a|<1$.
* Opens up if $a>0$ and down if $a<0$.

So our strategy for graphing quadratic functions is simple.

* Know the features of $y=x^{2}$ extremely well.
* Complete the square if necessary to write the function in vertex form: $y=a(x-h)^{2}+k$
* Graph and/or write down key features based on the translations, dilations, and reflections present.
* $y$-intercepts and $x$-intercepts are often helpful in forming the graph. Do you remember how to find them?
	+ Find the $y$-intercept by …
	+ Find the $x$-intercept(s) by …

**Examples:** Give the vertex, axis of symmetry, domain, range, the largest open interval of the domain for which the function is increasing and decreasing, $y$-intercept, $x$-intercept(s), and the minimum or maximum value of the function. Also graph the function.

$$f\left(x\right)=3(x-2)^{2}-12$$

$$f\left(x\right)=-(x+3)^{2}+9$$

$$y=x^{2}+3$$

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

$$y=-4(x+3)^{2}-8$$

$$f\left(x\right)=x^{2}+6x+10$$

$$y=-x^{2}-4x+5$$

Given the following graphs, write the equations that will produce the graphs and state the same information as the previous problems.



