Name: _____ **Algebra II**
Date: **Homework 29**

Problem 1. Write the following functions in the form $f(x) = (x \pm h)^2 \pm k$ by completing the square. Describe how x^2 is shifted to obtain $f(x)$. Graph $f(x)$, label the vertex, label all axis intersections. An example of what I expect is given below.

(a) $f(x) = x^2 + 2x - 1$

(b) $f(x) = x^2 - 7x + 10$

(c) $f(x) = x^2 + x + 1$

(d) $f(x) = x^2 - 8x + 15$

(e) $f(x) = x^2 + 3x$

(f) $f(x) = x^2 - 4x + 7$

(g) $f(x) = x^2 + \frac{3}{2}x + \frac{1}{4}$

(h) $f(x) = x^2 - x - 1$

(i) $f(x) = x^2 + 3x + \frac{17}{36}$

Example. $f(x) = x^2 - 2x - 2$

$$\begin{aligned} f(x) &= x^2 - 2x - 2 \\ &= (x^2 - 2x + (1)^2 - (1)^2) - 2 \\ &= ((x-1)^2 - 1) - 2 \\ &= (x-1)^2 - 3 \end{aligned}$$

Then $f(x) = (x-1)^2 - 3$ is the function x^2 shifted right one unit, and shifted down 3 units. To find x-intercepts, we set $f(x) = 0$ and solve for x:

$$\begin{aligned} (x-1)^2 - 3 &= 0 \\ (x-1)^2 &= 3 \\ \sqrt{(x-1)^2} &= \pm\sqrt{3} \\ x - 1 &= \pm\sqrt{3} \\ x &= 1 \pm \sqrt{3} \end{aligned}$$

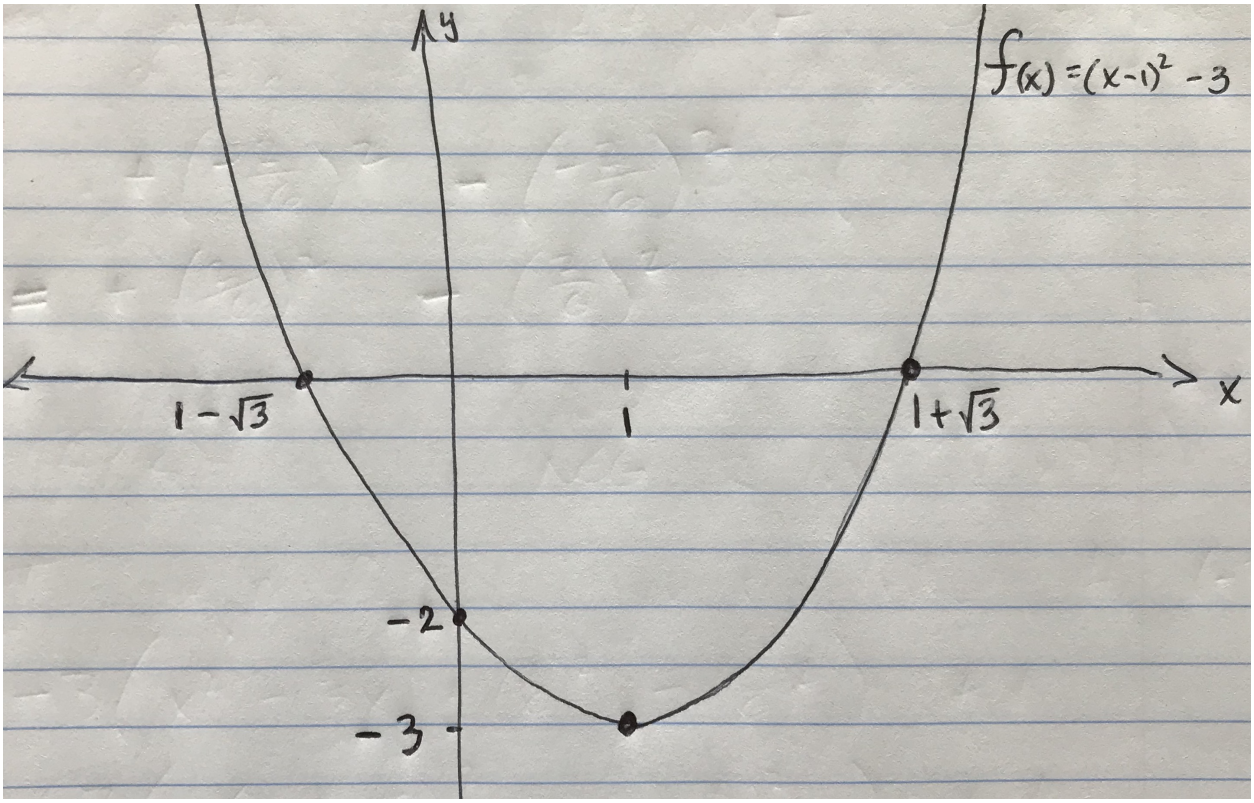
Note that $1 + \sqrt{3}$ is positive and $1 - \sqrt{3}$ is negative. To find the y-intercept, we set $x = 0$ and find $f(0)$:

$$\begin{aligned} f(0) &= (0-1)^2 - 3 \\ &= (-1)^2 - 3 \\ &= 1 - 3 \\ &= -2 \end{aligned}$$

Note that if may have been easier to use the function as originally written to obtain this since

$$f(x) = x^2 - 2x - 2 \implies f(0) = 0^2 - 2(0) - 2 = -2$$

In any case we have $f(0) = -2$ so that our y-intercept is at $y = -2$. Be sure that all intercepts are labeled and that the vertex is indicated as in the graph below.


y
x
$f(x) = (x-1)^2 - 3$
$1-\sqrt{3}$
1
$1+\sqrt{3}$
-2
-3