$(x+2)(x+2) = x^2+4x+4 = x^2+4x+2^2$

$(x+3)(x+3) = x^2+6x+9 = x^2+6x+3^2$

$(x-7)(x-7) = x^2-14x+49 = x^2-14x+7^2$

$(x-11)(x+11) = x^2-121 =$

$(x-11)(x-11) = x^2-22x+121 = x^2-22x+11^2$

Complete the square

$\underline{y = x^2 - 8x + 0}$

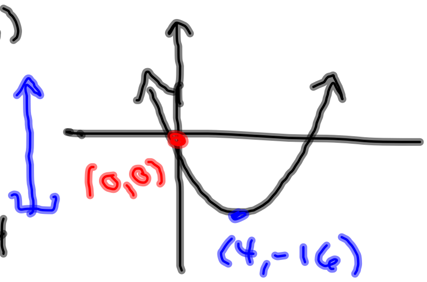
$\frac{8}{2} = 4 \rightsquigarrow 4^2$

$y = \underbrace{x^2 - 8x + 4^2}_{} - 16$

$y = (x-4)^2 - 16$

$x^2 \xrightarrow{} (x-4)^2 \xrightarrow{} (x-4)^2 - 16$

Right 4 (Delay) Down 16



Vertex $= (h,k) = (4,-16)$

Axis of symmetry: $x=4$

Increasing: $x \in [4,\infty)$

Decreasing: $x \in (-\infty,4]$

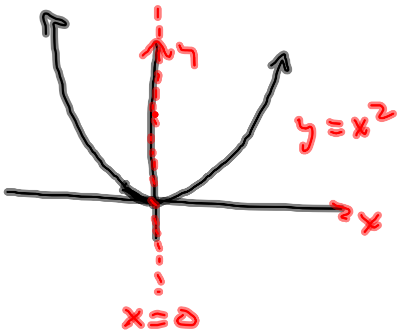
} x-values for which the desired trait is manifest.

$\mathcal{D} = (-\infty,\infty)$

$\mathcal{R} = \{y \mid y = f(x) \text{ for some } x \in \mathcal{D}\}$

$= [-16,\infty)$

$\boxed{\text{Min value is } y=-16}$ @ $x=4$



Axis of Symmetry : $x = 0$

$\mathcal{D} = \mathbb{R}$

$\mathcal{R} = [0, \infty)$

Inc: $[0, \infty)$

Dec: $(-\infty, 0]$

$(h, k) = (0, 0)$

$a(x-h)^2+k$

14

$y = 3x^2 - 12x + 1 \rightarrow (0,1)$

$y = 3(x^2 - 4x \qquad) + 1$

$y = 3(x^2 - 4x + 2^2 - 4) + 1$

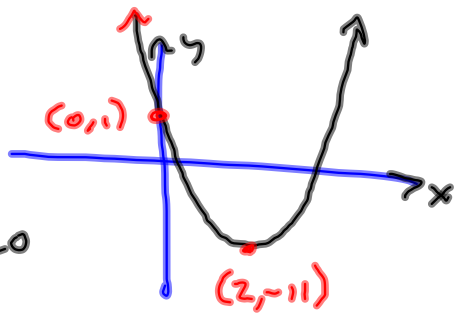
$= 3(x^2 - 4x + 2^2) + 3(-4) + 1$

$= 3(x-2)^2 - 12 + 1$

$= 3(x-2)^2 - 11$

Good enough for #s 9-20

Roughed it in.



#s 21-24
Find the vertex

22) $f(x) = -2x^2 - 8x + 9$

$a = -2,\ b = -8,\ c = 9$

$-\frac{b}{2a} = -\frac{-8}{2(-2)} = -2$

$f\left(-\frac{b}{2a}\right) = -2(-2)^2 - 8(-2) + 9$

$= -8 + 16 + 9$

$= 17 \rightarrow \boxed{(-2, 17) = (h, k)}$

Using $-b/2a$ to obtain

$-2(x+2)^2 + 17$

$a(x-h)^2 + K$

$$\begin{array}{r|rrr} -2 & -2 & -8 & 9 \\ & & 4 & 8 \\ \hline & -2 & -4 & 17 \end{array}$$

$17 \rightarrow K$

$f(-2)$

My Way:

$f(x) = -2x^2 - 8x + 9$

$= -2(x^2 + 4x + 2^2 - 4) + 9$

$= -2(x+2)^2 + \underbrace{8+9}_{17}$

$(h, k) = (-2, 17)$

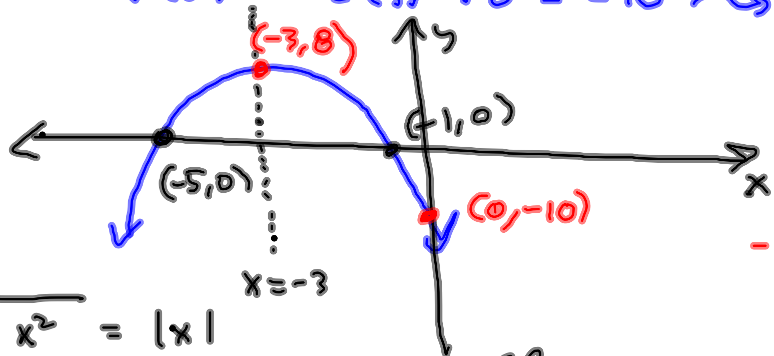
#s 41-52 is really about a complete graph. All intercepts, etc.

(50) $y = -2(x+3)^2 + 8 = f(x)$

$(h,k) = (-3, 8)$

opens down

$f(0) = -2(3)^2 + 8 = -10 \rightsquigarrow (0,-10)$



x-int:

$-2(x+3)^2 + 8 = 0$

$-2(x+3)^2 = -8$

$(x+3)^2 = 4$

$x+3 = \pm 2$

$x = -3 \pm 2$

$x = -1$ or $x = -5$

$(-1,0)$, $(-5,0)$

$\sqrt{x^2} = |x|$

Recall:

$\sqrt{(x+3)^2} = \sqrt{4}$

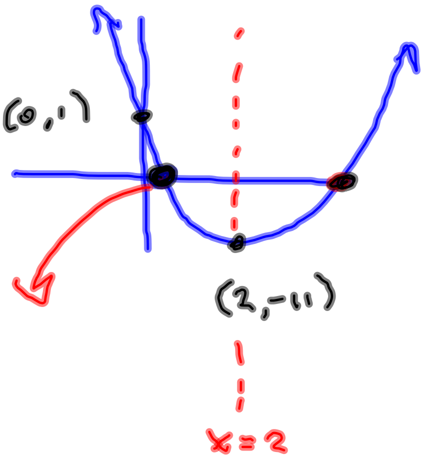
$|x+3| = 2$

$x+3 = \pm 2$

$(\sqrt{x})^2 = x$, and the assumption going in is that $x \geq 0$, lest $\sqrt{x}$ be nonreal.

Let's do the same thing for an uglier one.

$$y = 3x^2 - 12x + 1$$
$$= 3(x^2 - 4x + 2^2 - 4) + 1$$
$$= 3(x-2)^2 - 11$$



Leanne

x-int:

$$3(x-2)^2 - 11 = 0$$
$$3(x-2)^2 = 11$$
$$(x-2)^2 = \frac{11}{3}$$
$$x-2 = \pm\sqrt{\frac{11}{3}}$$
$$x = 2 \pm \sqrt{\frac{11}{3}}$$
$$= 2 \pm \frac{\sqrt{33}}{3}$$