$$\boxed{y = -\frac{1}{2}(x+3)^2 + 8}$$

vertex: $(-3, 8)$

eq. a.o.s: $x = -3$

dir. of opening: down

Domain: $x = \mathbb{R}$

Range: $y \leq 8$

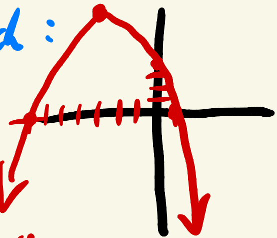
Max/Min: max, 8

y-int: 3.5

x-int's (if any): see below

changes from $y = x^2$: see below

sketch:



changes:

1. refl. on the x-axis
2. vert. comp. by a factor of $\frac{1}{2}$
3. hor. trans. 3 units left
4. vert. trans 8 units up.

x-int's

$0 = -\frac{1}{2}(x+3)^2 + 8$

$-2 \cdot \left[-8 = -\cancel{\tfrac{1}{2}}(x+3)^2\right]$

$\pm\sqrt{16} = \sqrt{(x+3)^2}$

$\pm 4 = x+3$

$-3 \pm 4 = x$

$\boxed{x = 1, -7}$

Quadratic Functions and Equations Lesson #4: Equations and Intercepts from the Vertex and a Point

In the last lesson, we analyzed the graphs of quadratic functions with equations in standard form $y = a(x - p)^2 + q$. In this lesson, we determine the equation of a quadratic function from the graph. To do this we need the vertex of the parabola and a point on it. We will also learn how to find intercepts from the standard form of the equation.

Determining the Equation from the Vertex and a Point

(x, y)

(p, q)

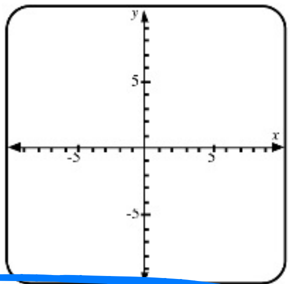
The following procedure will enable us to write quadratic functions in standard form if we are given the coordinates of the vertex and of another point on the parabola.

Step 1		Step 2		Step 3		Step 4
Replace p and q with the coordinates of the vertex.	→	Replace x and y with the coordinates of the point.	→	Solve for a.	→	Replace the values of a, p and q in the equation $y = a(x - p)^2 + q$.

The graph of a quadratic function has vertex $(-2, 8)$ and passes through the point $(-1, 7)$.

(x, y) (p, q)

a) Find the equation of the function in standard form $y = a(x - p)^2 + q$.



$7 = a(-1-(-2))^2 + 8$

$7 = a + 8$

$\boxed{-1 = a}$

$\boxed{y = -(x+2)^2 + 8}$ standard form

b) Rewrite the equation in general form $y = ax^2 + bx + c$.

$y = ax^2 + bx + c$

expand:

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

$y = -x^2 - 4x - 4 + 8$

$\boxed{y = -x^2 - 4x + 4}$ general form

c) Use a graphing calculator to sketch the graph and determine the x and y-intercepts of the graph of the function. Answer to the nearest hundredth if necessary.

Finding Intercepts from the Standard Form

We can use the equation of a quadratic function written in standard form to algebraically determine the x- and y-intercepts of the graph of the function.

x-int → let y=0
y-int → let x=0

Determine, as exact values, the x and y-intercepts of the graph of the function $f(x) = 3(x-1)^2 - 9$.

y-int: let x = 0

$\boxed{y = -6}$

x-int: let y = 0

$0 = 3(x-1)^2 - 9$

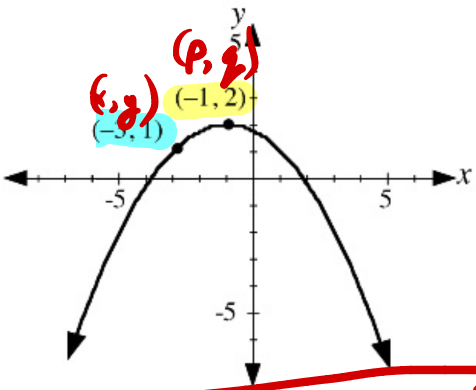
$\frac{9}{3} = \frac{3(x-1)^2}{3}$

$\pm\sqrt{3} = \sqrt{(x-1)^2}$

$\pm\sqrt{3} = x-1$

$\boxed{1 \pm \sqrt{3} = x}$ exact

The graph of a quadratic function is shown.
The maximum point is shown.



a) Find the equation of the function in standard form.

$y = a(x-p)^2 + q$

$1 = a(-3-(-1))^2 + 2$

$1 = 4a + 2$

$\frac{-1}{4} = \frac{4a}{4}$

$\boxed{a = -\frac{1}{4}}$

$\boxed{y = -\frac{1}{4}(x+1)^2 + 2}$

b) Find, algebraically, the x-intercepts and y-intercepts of the graph. Answer both as exact values and to the nearest hundredth.

y-int → let x=0

$\boxed{y = \frac{7}{4}}$

$y = 1.75$

x-int → let y=0

$0 = -\frac{1}{4}(x+1)^2 + 2$

$-4 \cdot \left[-2 = -\frac{1}{4}(x+1)^2\right]$

$\pm\sqrt{8} = \sqrt{(x+1)^2}$

$\pm 2\sqrt{2} = x+1$

$\boxed{-1 \pm 2\sqrt{2} = x}$

$x = -3.83,\ 1.83$

c) State the domain, range and equation of the axis of symmetry.

D: $x \in \mathbb{R}$ R: $y \leq 2$ eq. a.o.s: $x = -1$

Complete Assignment Questions #1 - #12

#1-5, 10-12 & review for quiz #2 Wednesday/Thursday.