Class # 25 – Thurs, Oct. 28

- More on parabolas (= graphs of quadratic polynomials):

$$y = ax^2 + bx + c$$

- quadratic formula (solving $ax^2+bx+c=0$) $\Rightarrow$ x-intercepts

- y-intercept? Plug in $x = 0$ into $y = ax^2+bx+c \Rightarrow y = a(0^2)+b(0)+c = c$

$\Rightarrow (0, c)$

- vertex / "axis of symmetry": $x = -\frac{b}{2a}$

Note: Finish / submit Quiz #3 (due Fri 5p)

Review
- Quadratic Formula
- Square Root Property (#7-9)

WebWork:

- "Shifting Parabolas" (last time)
  - start w/ basic parabola: $y = x^2$
  - vertical shifts: $y = x^2 + k$.
  - horizontal shifts: $y = (x-h)^2$
  - combined (vertical and horizontal) shifts?

Combined: vertical and horizontal shift (of $y = x^2$):

$$y = (x-h)^2 + k$$

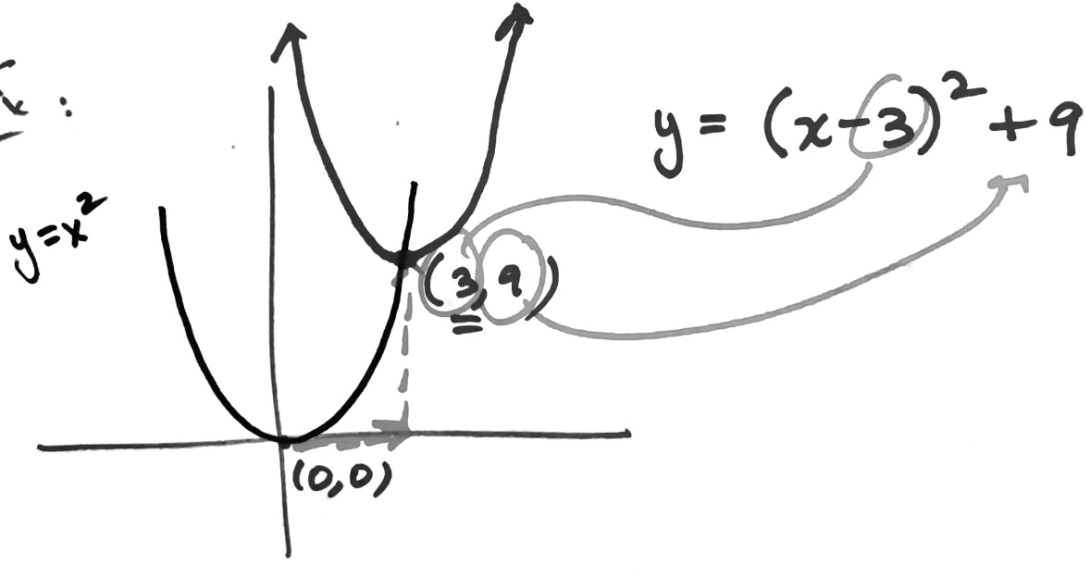
h: horizontal

k: vertical

(See my "Parabola Shifts" Desmos graph)

Ex:

$y = (x-3)^2 + 9$



WebWork: "Parabola Vertices-Cts"

Example (9.60 from OpenStax)

Graph $y = (x^2 + 6x) + 5$ using "shifts":

Subtract constant term from both sides

(1) + Completing the square:

$y - 5 \overset{+9}{\cancel{}} = (x^2 + 6x \underline{+9}) \cancel{+5}$

add same # to LHS to keep equation in balance

"complete the square" inside the parentheses on RHS

[using $\left(\frac{b}{2}\right)^2 = \left(\frac{6}{2}\right)^2 = 3^2 = 9$]

We will rewrite the given quadratic polynomial in the form

$y = (x-h)^2 + k$

(by completing the square!)

$\Rightarrow y + 4 = (x+3)^2$ [facts RHS - "perfect square trinomial"]

$\Rightarrow \boxed{y = (x+3)^2 - 4} \longrightarrow$ vertex is at $(-3, -4)$

WebWork: "Parabola Vertices - Cts" : #1

Given: $y = x^2 + 10x + 26$

(1) Move the constant term to LHS:

$y - 26 = x^2 + 10x$

(2) Complete the square on the RHS
(and add that # to the LHS – "to keep the equation in balance")

$y - 26 + 25 = x^2 + 10x + 25$

$\left(\frac{10}{2}\right)^2 = 5^2 = 25$

(3) Factor the RHS:

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

(4) $y = (x+5)^2 + 1$ → vertex: $(-5, 1)$

Example: "Parabola Vertices - Vertex Formula"

$x = -\frac{b}{2a}$

#1: Graph: $y = 1x^2 + 2x - 6$

Step 1: x-coord of vertex?

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

Step 2: Find the y-coord of the vertex:
(by plugging in the x-coord ($x = -1$) into $y = x^2 + 2x - 6$)

$x = -1 \Rightarrow y = (-1)^2 + 2(-1) - 6$

$= 1 - 2 - 6 = -7$

So the vertex is at $(-1, -7)$.

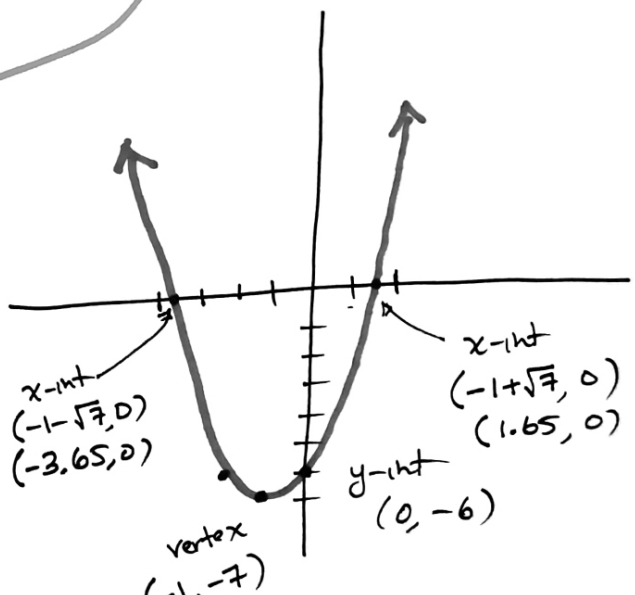
Let's use this to actually sketch the graph

$$y = x^2 + 2x - 6$$

- vertex is at $(-1, -7)$
- y-intercept is at $(0, -6)$
- x-intercepts ?

Solve quadratic eqn

$$x^2 + 2x - 6 = 0$$:



Use QF:

$$x = \frac{-2 \pm \sqrt{4 - 4(-6)}}{2}$$

$$= \frac{-2 \pm \sqrt{28}}{2} = \frac{-2 \pm 2\sqrt{7}}{2} = -1 \pm \sqrt{7} \approx \begin{cases} 1.65 \\ -3.65 \end{cases}$$