February 6th/7th, 2012

Topic: Graphing/Writing Quadratics in Vertex-Form

Question: Why is vertex form useful? How is completing the square for vertex form different from completing the square for solving?

Warm-Up

#1.) $x^2+34x=0$

add $(\frac{b}{2})^2$

$x^2+34x+289=289$ $(\frac{34}{2})^2$

$(17)^2=289$

$\sqrt{(x+17)^2}=\pm\sqrt{289}$

$x+17=\pm\sqrt{289}$

$x+17=\pm 17$

$x+17=17$ $\quad$ $x+17=-17$

$\boxed{x=0}$ $\quad$ $\boxed{x=-34}$

2.) $2x^2 - 5x + 7 = 3$

$2x^2 - 5x = -4$

$x^2 - \frac{5}{2}x = -2$

$-\frac{5}{4} \times -\frac{5}{4} = \frac{25}{16}$, $-\frac{5}{2}$

$x^2 - \frac{5}{2}x + \frac{25}{16} = -\frac{2}{1} + \frac{25}{16}$

$\left(\frac{-\frac{5}{2}}{2}\right)^2$

$\left(\frac{-5}{4}\right)^2 = \frac{25}{16}$

$x^2 - \frac{5}{2}x + \frac{25}{16} = -\frac{32}{16} + \frac{25}{16}$

$\left(x - \frac{5}{4}\right)^2 = \frac{-7}{16}$

Here you could set up the diamond and factor. However, you know that you have a perfect square... so just do x+ (b/2)

$x - \frac{5}{4} = \pm\sqrt{\frac{-7}{16}}$

$x - \frac{5}{4} = \pm\frac{\sqrt{-7}}{4}$

$x = \frac{5}{4} \pm \frac{\sqrt{-7}}{4}$

$\boxed{x = \frac{5 \pm i\sqrt{7}}{4}}$

$x = \frac{5 \pm \sqrt{-7}}{4}$

Notes. 6.6. Vertex-form

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

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

Example 1.) Graph

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

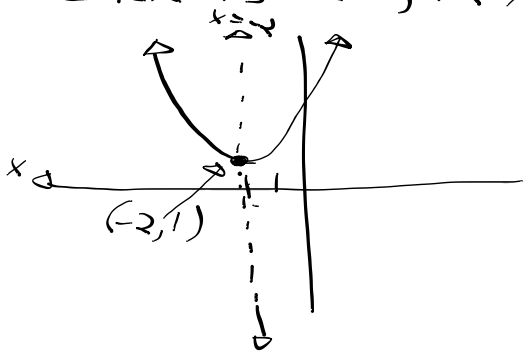
$y = a(x-h)^2 + k$

$a=1 \quad h=-2 \quad k=1$

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

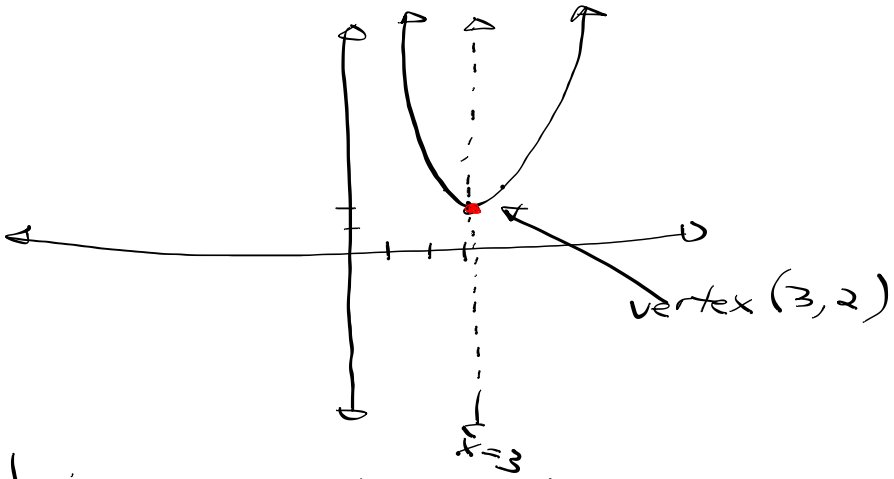
$= (x+2)^2 + 1$

- The axis of symmetry is $x = h$
- The vertex is (h, k)



Ex 2.) Graph $y = (x-3)^2 + 2$

$a=1 \quad h=3 \quad k=2$



As $|a|$ increase, the graph narrows

As $|a|$ gets closer to zero, it fattens

Ex 3. Write $y = x^2 + 8x - 5$ in vertex form

We want this to look like this

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

$y = x^2 + 8x - 5$

$y = (x^2 + 8x + 16) - 16 - 5$ (complete the square, add 16 and the opposite of 16 keep it balanced)

$y = (x+4)^2 - 21$ (factor; simplify)

Ex 4. Write $y = x^2 + 2x + 4$ in vertex form

$\left(\frac{b}{2}\right)^2 = \left(\frac{2}{2}\right)^2 = 1^2 = 1$

$y = (x^2 + 2x \quad) + 4$

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

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

Ex 5. Write in vertex form:

$y = -3x^2 + 6x - 1$

$y = -3x^2 + 6x \quad -1$

We are going to complete the square for these terms...

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

$\left(\frac{b}{2}\right)^2 = \left(\frac{-2}{2}\right)^2 = -1^2 = 1$

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

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

Notice: When we completed the square we "visually" added 1. The one is inside the parentheses which means that it is really being multiplied by -3 which means that the 1 is a -3 in disguise. We need to add 3 to balance it!!!

Example 6: Write $y = -2x^2 - 4x + 2$ in vertex form.

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

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

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

homework:

add ex 4. page 325

page 326 # 15 - 43 odd

55, 56

+2

Eq. #53