Warm-up:

Solve each quadratic equation by factoring.

2·1

1) $x^2 + 3x + 2 = 0$

$(x+2)(x+1)=0$

$x+2=0 \quad x+1=0$

$x=-2 \text{ & } x=-1$

2) $2x^2 - 11x = -12$

$+12 \quad +12$

$2x^2 - 11x + 12 = 0$

24·1
12·2
8·3
6·4

$(2x^2 - 8x)(-3x + 12) = 0$

$2x \qquad -3$

$2x(x-4) - 3(x-4) = 0$

$(x-4)(2x-3)=0$

$x-4=0 \qquad 2x-3=0$

$2x=3$

$x=4$

$x=3/2$

Multiply the Complex Number Together:

3) $(7-4i)(-1+2i)$ FOIL

$-7 + 14i + 4i - 8i^2$

$i^2 = -1$

$-7 + 18i - 8i^2$

$-7 + 18i - 8(-1)$

$-7 + 18i + 8$

$1 + 18i$

Solve the quadratic equation by the square root method:

4) $2x^2 + 9 = -41$

$-9 \quad -9$

$\frac{2x^2}{2} = \frac{-50}{2}$

$x^2 = -25$

$\sqrt{x^2} = \pm\sqrt{-25}$

$x = \sqrt{25} \cdot \sqrt{-1}$

$x = \pm 5i$

Agenda:

1) **Warm-up**
2) **Homework questions**
3) **New Lesson---3.3 Completing the Square**
4) **Homework/in-class activity**

Algebra 2: 3.3 Completing the Square:

Learning Targets for Today:

1) Solve quadratic equations using square roots.
2) Solve quadratic equations by completing the square.
3) Write quadratic equations in vertex form.

(A) Solving a Quadratic Equation using Square Roots

We have solved quadratics by using the square-root method before:

Step 1: Isolate the squared part

Step 2: Take the square-root of both sides

Try:

1) $3(x-1)^2 - 2 = 73$

$+2 \quad +2$

$\frac{3(x-1)^2}{3} = \frac{75}{3}$

$\sqrt{(x-1)^2} = \pm\sqrt{25}$

$x - 1 = 5 \text{ or } -5$

$+1 \quad +1 \quad +1$

$\boxed{x = 6 \text{ or } -4}$

Our main goal today is to take quadratic equations from standard form to vertex form:

$x^2 + 2x + 3 \longrightarrow (x+1)^2 + 2$

Because vertex form is way easier to graph from and you can solve by the square-root method!

- This process is called Completing the Square!

(B) Completing the Square:

Completing the Square:

Step 1: The leading coefficient must be 1. (if it is not, then divide by the number in front of the x^2)

Step 2: Write your equation in the correct form:

$a(x^2 + bx \quad\quad) + c$

Step 3: Take half of b...then "square" it....add & subtract it

Step 4: Move the negative one outside of the ( )

Step 5: Factor the ( )

Example:

$X^2 + 10x - 3$

Step 1: a must be 1 (it is!)

Step 2: Correct form

Step 3: half of "b"

Step 4: move negative one outside

Step 5: Factor

$x^2 + 10x - 3$

$(x^2 + 10x + 25 - 25) - 3$ -25

$(5)^2 = 25$

$(x+5)^2 - 28$

Vertex: $(-5, -28)$

Try/Together:

$x^2 + 6x - 8$

step 1 & step 2

$(x^2 + 6x + 9 - 9) - 8$

$(3)^2 = 9$

$(x^2 + 6x + 9) - 8 - 9$

$(x+3)^2 - 17$

Try:

1) $x^2 + 2x$

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

$(1)^2 = 1$

$(x+1)^2 - 1$

2) $x^2 - 8x + 11$

$(x^2 - 8x + 16 - 16) + 11$ (-16)

$(4)^2 = 16$

$(x^2 - 8x + 16) - 5$

$(x-4)^2 - 5$

3) $x^2 + 7$

It's already in vertex form. No regular x

a is not 1

Example:

$3x^2 - 6x + 8 = 0$

step 1 & step 2

$(3x^2 - 6x \quad) + 8 = 0$

$3(x^2 - 2x + 1 - 1) - 3 + 8 = 0$

$(1)^2 = 1$; be careful!

$3(x^2 - 2x + 1) + 5 = 0$

$3(x-1)^2 + 5 = 0$

Try/Together:

$5x^2 - 10x + 16 = 0$

$(5x^2 - 10x \quad) + 16 = 0$

$5(x^2 - 2x + 1 - 1) - 5 + 16 = 0$

$(1)^2 = 1$

$5(x-1)^2 + 11 = 0$

Try:

1) $3x^2 - 12x + 16 = 0$

$\left(\frac{3x^2}{3} - \frac{12x}{3}\right) + 16 = 0$

$3(x^2 - 4x + 4 - 4) - 12 + 16 = 0$

$(2)^2 = 4$

$3(x^2 - 4x + 4) + 4 = 0$

$3(x-2)^2 + 4 = 0$

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

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

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

-12

$(2)^2 = 4$

$3(x^2 - 4x + 4) - 11$

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

*Right now we can complete the square...so we can find the vertex and slope...but it also helps us solve a quadratic (find x-int)

Solving by Completing the Square:

Step 1: Complete the Square:

- this should put your equation into this form: $a(x-h)^2+k$

Step 2: isolate the squared part ( )^2

Step 3: take the square-root of both sides

- should get two answers

Example:

$X^2 - 10x - 3 = 0$

$(x^2 - 10x + 25 - 25) - 3 = 0$

$(5)^2 = 25$

$(x^2 - 10x + 25) - 28 = 0$

$(x-5)^2 - 28 = 0$

Now I Solve:

$\sqrt{(x-5)^2} = \sqrt{28}$

$x - 5 = \pm\sqrt{28}$

$\sqrt{28}$
$\sqrt{7 \cdot 4}$
$\sqrt{4} \cdot \sqrt{7}$
$2\sqrt{7}$

$x - 5 = \pm 2\sqrt{7}$
$+5 \quad +5$

$x = 5 \pm 2\sqrt{7}$

Try:

$$x^2 + 2x - 9 = 0$$

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

$(1)^2 = 1$

$(x^2 + 2x + 1) - 10 = 0$

Now solve

$(x+1)^2 - 10 = 0$

$\sqrt{(x+1)^2} = \sqrt{10}$

$x + 1 = \pm\sqrt{10}$ (subtract 1 from both sides) $\rightarrow$ $x = -1 \pm \sqrt{10}$

Example:

$$2x^2 - 12x + 14 = 0$$

$(2x^2 - 12x \quad) + 14 = 0$

$2(x^2 - 6x + 9 - 9) - 18 + 14 = 0$

$(3)^2 = 9$

$2(x^2 - 6x + 9) - 4 = 0$

$2(x-3)^2 - 4 = 0$

$\frac{2(x-3)^2}{2} = \frac{4}{2}$ $\rightarrow$ $(x-3)^2 = 2$

$x - 3 = \pm\sqrt{2}$

$x = 3 \pm \sqrt{2}$

"OR"

$2x^2 - 12x + 14 = 0$

$2(x^2 - 6x + 7) = 0$

$2(x - \quad)(x - \quad) = 0$ Nope

Try:

$$-3x^2 - 18x - 6 = 0$$

$(-3x^2 - 18x \quad) - 6 = 0$

$-3(x^2 + 6x + 9 - 9) + 27 - 6 = 0$

$(3)^2 = 9$

$\rightarrow -3(x^2 + 6x + 9) + 21 = 0$

$-3(x+3)^2 + 21 = 0$

$-3(x+3)^2 = -21$

$(x+3)^2 = 7$

$x + 3 = \pm\sqrt{7}$

$x = -3 \pm \sqrt{7}$

Pg. 116 (25 – 32, 37, 41 – 47)