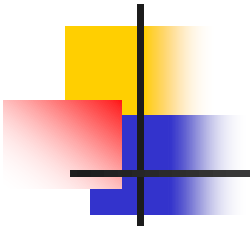

Solving Quadratic Equations by Completing the Square

Perfect Square Trinomials

- Examples
- $x^2 + 6x + 9$
- $x^2 - 10x + 25$
- $x^2 + 12x + 36$

Creating a Perfect Square Trinomial

- In the following perfect square trinomial, the constant term is missing.
  $X^2 + 14x + \_\_\_\_\_$
- Find the constant term by squaring half the coefficient of the linear term.
- $(14/2)^2$
  $X^2 + 14x + 49$

Perfect Square Trinomials

- Create perfect square trinomials.
- $x^2 + 20x + \_\_\_\_$ 100
- $x^2 - 4x + \_\_\_\_$ 4
- $x^2 + 5x + \_\_\_\_$ 25/4

Solving Quadratic Equations by Completing the Square

Solve the following equation by completing the square:

$$x^2 + 8x - 20 = 0$$

Step 1: Move quadratic term, and linear term to left side of the equation

$$x^2 + 8x = 20$$

Solving Quadratic Equations by Completing the Square

Step 2: Find the term that completes the square on the left side of the equation. Add that term to both sides.

$$x^2 + 8x + \square = 20 + \square$$

$\frac{1}{2} \bullet (8) = 4$ then square it, $4^2 = 16$

$$x^2 + 8x + 16 = 20 + 16$$

Solving Quadratic Equations by Completing the Square

Step 3: Factor the perfect square trinomial on the left side of the equation. Simplify the right side of the equation.

$$x^2 + 8x + 16 = 20 + 16$$

$$(x-4)(x-4) = 36$$

$$(x-4)^2 = 36$$

Solving Quadratic Equations by Completing the Square

Step 4:

Take the square root of each side

$$\sqrt{(x+4)^2} = \sqrt{36}$$

$$(x+4) = \pm 6$$

Solving Quadratic Equations by Completing the Square

Step 5: Set up the two possibilities and solve

$$x = -4 \pm 6$$

$$x = -4 - 6 \text{ and } x = -4 + 6$$

$$x = -10 \quad \text{and} \quad x=2$$

Completing the Square-Example #2

Solve the following equation by completing the square:

$$2x^2 - 7x + 12 = 0$$

Step 1: Move quadratic term, and linear term to left side of the equation, the constant to the right side of the equation.

$$2x^2 - 7x = -12$$

Solving Quadratic Equations by Completing the Square

Step 2: Find the term that completes the square on the left side of the equation. Add that term to both sides.

$$2x^2 - 7x + \square = -12 + \square$$

$$\frac{2x^2}{2} - \frac{7x}{2} + \square = -\frac{12}{2} + \square$$

$$x^2 - \frac{7}{2}x + \square = -6 + \square$$

The quadratic coefficient must be equal to 1 before you complete the square, so you must divide all terms by the quadratic coefficient first.

$$\frac{1}{2} \bullet \left(\frac{7}{2}\right) = \frac{7}{4} \text{ then square it, } \left(\frac{7}{4}\right)^2 = \frac{49}{16}$$

$$x^2 - \frac{7}{2}x + \frac{49}{16} = -6 + \frac{49}{16}$$

Solving Quadratic Equations by Completing the Square

Step 3: Factor the perfect square trinomial on the left side of the equation. Simplify the right side of the equation.

$$x^2 - \frac{7}{2}x + \frac{49}{16} = -6 + \frac{49}{16}$$

$$\left(x - \frac{7}{4}\right)^2 = -\frac{96}{16} + \frac{49}{16}$$

$$\left(x - \frac{7}{4}\right)^2 = -\frac{47}{16}$$

Solving Quadratic Equations by Completing the Square

Step 4:

Take the square root of each side

$$\sqrt{\left(x-\frac{7}{4}\right)^2}=\sqrt{\frac{-47}{16}}$$

$$\left(x-\frac{7}{4}\right)=\pm\frac{\sqrt{-47}}{4}$$

$$x=\frac{7}{4}\pm\frac{i\sqrt{47}}{4}$$

$$x=\frac{7\pm i\sqrt{47}}{4}$$

Solving Quadratic Equations by Completing the Square

Try the following examples. Do your work on your paper and then check your answers.

1. $x^2 + 2x - 63 = 0$
2. $x^2 + 8x - 84 = 0$
3. $x^2 - 5x - 24 = 0$
4. $x^2 + 7x + 13 = 0$
5. $3x^2 + 5x + 6 = 0$

1. $(-9, 7)$
2. $(6, -14)$
3. $(-3, 8)$
4. $\left(\frac{-7 \pm i\sqrt{3}}{2}\right)$
5. $\left(\frac{-5 \pm i\sqrt{47}}{6}\right)$