

10.7A Completing the Square

Solve each quadratic.

$$x^2 = 16$$

$$x^2 = 16$$

$$x = \pm 4$$

$$\sqrt{(x+2)^2} = \sqrt{9}$$

$$x+2 = \pm 3$$

$$x = -2 \pm 3$$

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

$$(x + 2)^2 = 9$$

$$\sqrt{(x-3)^2} = \sqrt{25}$$

$$x-3 = \pm 5$$

$$x = 3 \pm 5$$

$$x = 8 \text{ or } -2$$

$$\sqrt{(x-6)^2} = \sqrt{12}$$

$$x-6 = \pm 2\sqrt{3}$$

$$x = 6 \pm 2\sqrt{3}$$

$$(x - 3)^2 = 25$$

$$(x - 6)^2 = 12$$

Factor

$$1) x^2 + 6x + 9$$

$$(x+3)(x+3)$$

$$(x+3)^2$$

$$2) x^2 + 10x + 25$$

$$(x+5)(x+5)$$

$$(x+5)^2$$

$$3) x^2 + 20x + 100$$

$$(x+10)(x+10)$$

$$(x+10)^2$$

$$4) x^2 + 12x + 36$$

$$(x+6)(x+6)$$

$$(x+6)^2$$

Based on the pattern from #1-4, how would you complete 5 and 6?

$$5) x^2 + 14x + ???$$

$$49$$

$$6) x^2 + 3/2x + ???$$

$$\frac{9}{16}$$

Based on this pattern:

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

Complete each quadratic to write it as a perfect square. Then solve.

$$1. x^2 + 6x + \underline{9} = 36$$

$$(x+3)^2 = 36$$

$$x+3 = \pm 6$$

$$x = 3 \pm 6$$

$$x = 9 \text{ or } -3$$

$$(x-6)^2 = 45$$

$$x-6 = \sqrt{45}$$

$$x-6 = \pm 3\sqrt{5}$$

$$x = 6 \pm 3\sqrt{5}$$

$$2. x^2 - 12x + \underline{36} = 45$$

$$(x-6)^2 = 9$$

$$x-6 = \pm 3$$

$$x = 6 \pm 3$$

$$x = 9 \text{ or } 3$$

$$(x+2)^2 = 16$$

$$x+2 = \pm 4$$

$$x = -2 \pm 4$$

$$x = 2 \text{ or } -6$$

$$3. x^2 - 16x + \underline{64} = 24$$

$$(x-8)^2 = 24$$

$$x-8 = \pm 2\sqrt{6}$$

$$x = 8 \pm 2\sqrt{6}$$

$$4. x^2 + 4x + \underline{4} = 16$$

Solving Quadratic Equations by Completing the Square ($ax^2 + bx + c = 0$)

1. Collect variables terms on one side and constants on the other side of the equation
2. If 'a' is NOT 1 - divide all terms by 'a'. If $a = 1$, then move to step 3
3. Complete the square by adding $(b/2)^2$ to both sides
4. Factor the variable expression as a perfect square
5. Take the square root of both sides
6. Solve for the values of the variable

Find the roots of each quadratic equation.

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

$$x^2 + 12x + \frac{36}{1} = 2 + \frac{36}{1}$$

$$(x+6)^2 = 38$$

$$x+6 = \pm\sqrt{38}$$

$$x = -6 \pm \sqrt{38}$$

$$x^2 - 8x + 12 = 0$$

$$x^2 - 8x + \frac{16}{1} = -12 + \frac{16}{1}$$

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

$$x-4 = \pm 2$$

$$x = 4 \pm 2$$

$$x = 6 \text{ or } 2$$

$$x^2 + 16x - 12 = 0$$

$$x^2 + 16x + \frac{64}{1} = 12 + \frac{64}{1}$$

$$(x+8)^2 = 76$$

$$x+8 = \pm\sqrt{76}$$

$$x+8 = \pm 2\sqrt{19}$$

$$x = -8 \pm 2\sqrt{19}$$

Find the x-intercepts of each quadratic equation.

$$2x^2 + 8x = 12$$

$$x^2 + 4x + \frac{4}{2} = 6 + \frac{4}{2}$$

$$(x+2)^2 = 10$$

$$x+2 = \pm\sqrt{10}$$

$$x = -2 \pm \sqrt{10}$$

$$3x^2 - 24x = 27$$

$$18x + 3x^2 = 45$$

$$6x + x^2 = 15$$

$$x^2 + 6x + \frac{9}{3} = 15 + \frac{9}{3}$$

$$(x+3)^2 = 24$$

$$x+3 = \pm 2\sqrt{6}$$

$$x = -3 \pm 2\sqrt{6}$$

$$x^2 - 8x + \frac{16}{2} = 9 + \frac{16}{2}$$

$$(x-4)^2 = 25$$

$$x-4 = \pm 5$$

$$x = 4 \pm 5$$

$$x = 9 \text{ or } -1$$

Solve each by completing the square.

$$1. x^2 - 16x = -15$$

$$x^2 - 16x + \frac{64}{2} = -15 + \frac{64}{2}$$

$$(x-8)^2 = 49$$

$$x-8 = \pm 7$$

$$x = 8 \pm 7$$

$$\rightarrow x = 15 \text{ or } 1$$

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

$$3. x^2 - 2x = 3$$

$$x^2 - 2x + \frac{1}{2} = 3 + \frac{1}{2}$$

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

$$x-1 = \pm 2$$

$$x = 1 \pm 2$$

$$x = 3 \text{ or } -1$$

$$x^2 + 10x + \frac{25}{2} = 8 + \frac{25}{2}$$

$$(x+5)^2 = 33$$

$$x+5 = \pm\sqrt{33}$$

$$x = -5 \pm \sqrt{33}$$

~~Solve each by completing the square.~~

~~4. $x^2 + 12x = -8$~~

~~5. $3x^2 - 24x + 27 = 0$~~

Homework:

WS 10.7 Completing the Square