9.6: Factor Trinomials in the form $ax^2 + bx + c$:

Goals: *Factor quadratics when *a* does not equal 1
*Solve quadratics by factoring

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*Remember that when factoring trinomials you are essentially **un-F.O.I.L.ing**
Recall that when you foil:
· The **first** term of the final answer is obtained by:
· The **last** term of the final answer is obtained by:
· The **second/middle** term of the final answer is obtained by:

$$(d + e)(f + g) = ax^2 + bx + c$$

Factor each trinomial into the product of two binomials:

Ex: $2x^2 - 7x + 3$

$(2x - 1)(2x - 3)$

Ex: $3n^2 + 14n - 5$

$(3n - 1)(n + 5)$

Ex: $3t^2 + 8t + 4$

$(3t + 2)(t + 2)$

Ex: $4s^2 - 9s + 5$

$(4s - 5)(s - 1)$

Ex: $2n^2 + 13n - 7$

$(2n - 1)(n + 7)$

Ex: $2x^2 - 13x + 6$

$(2x - 1)(x - 6)$

Factor:

Ex: $-4x^2 + 12x + 7$

$-(2x + 1)(2x - 7)$

Ex: $-2y^2 - 5y - 3$

$-(2y + 3)(y + 1)$

Ex: $-5m^2 + 6m - 1$

$-(5m - 1)(m - 1)$

Ex: $-3x^2 - x + 2$

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

Ex: $-3x^2 - 13x - 4$

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

Ex: An athlete throws a discus from an initial height of 6 feet and with an initial vertical velocity of 46 ft/s.

a. Write an equation that gives the height of the discuss as a function of time (in seconds) since it left the athlete's hand.

$h = -16t^2 + 46t + 6$

b. After how many seconds does it hit the ground?

The discuss will hit the ground when $h = 0$ so replace h with 0 and solve by factoring

$0 = -16t^2 + 46t + 6$
$0 = -2(8t + 1)(t - 3)$
t cannot be negative since its time so it must be 3

Ex: A soccer goalie throws the ball into the air with an initial vertical velocity of 28 ft/s, from an initial height of 8 feet.

a. Write an equation that gives the height of the soccer ball as a function of time.

$h = -16t^2 + 28t + 8$

b. How long does it take for the ball to reach the ground?

$0 = -(4t + 1)(t - 2)$ $t = 2$ seconds

Ex: A rectangle's length is 13 meters more than 3 times its width. The area is 10 square meters. What is the width?

$l \cdot w$
$w(13 + 3w) = 10$
$13w + 3w^2 = 10$
$3w^2 + 13w - 10 = 0$
$(3w - 2)(w + 5) = 0$ w cannot be negative since it is a dimension so $w = 2/3$

Ex: A rectangles length is 5 feet more than 4 times the width. The area is 6 square feet. What is the width?

$w(5 + 4w) = 6$
$4w^2 + 5w - 6 = 0$
$(4w - 3)(w + 2) = 0$
$w = ¾$

Factoring $ax^2 + bx + c$ FORMULA: You still must check your answer by FOILing…even if using the steps below.

Ex: Factor $2x^2 - 7x + 3$ using the following steps:

1. Multiply $a \cdot c$

$a = 2$ $c = 3$

$a \cdot c = 6$

2. Find the factors of $a \cdot c$ whose sum is b

Find the factors of 6 that add up to –7

$m = -6, n = -1$

3. Call these factors m and n and plug into the formula: $ax^2 + mx + nx + c$

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

4. Separate into two binomials
**Not changing the value, just creating two groups

$(2x^2 + -6x) + (-1x + 3)$

5. Find the GCF in each set of parenthesis **separately.** You want the leftover binomial (the stuff in parenthesis) to match.

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

6. The matching binomial is a **common factor** so factor it out, just like you would a **GCF.**

$(x - 3)(2x - 1)$

7. Check your answer by FOILing.

Factor the following examples using the formula:

Ex: $3x^2 + 10x + 3$

$(3x^2 + 9x) + (1x + 3)$
$3x(x + 3) + 1(x + 3)$
$(3x + 1)(x + 3)$

Ex: $2x^2 + 5x - 63$

$(2x^2 + 14x) + (-9x - 63)$
$2x(x + 7) + -9(x + 7)$
$(2x - 9)(x + 7)$

Ex: $2x^2 - 7x + 3$

$(2x - 1)(x - 3)$

Ex: $3x^2 - 17x + 10$

$(3x - 15)(x - 2)$

Ex: $4x^2 + 16x + 15$

$(2x + 5)(2x + 3)$

Ex: $8x^2 - 2x - 3$

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