Algebra I

Lesson 8.4: Factoring $ax^2 + bx + c$, $(where\ a \neq 1)$

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Now what do we do when we have a leading coefficient that is not equal to 1? No, that is not what we do!!! The textbook suggests to start guessing and checking for possible factor combinations, but if you closely follow the slick little method presented below you will never need to guess and check!

When $ax^2 + bx + c$, $(where\ a \neq 1)$

Factor:

$\boldsymbol{ax^2 + bx + c}$

$4x^2 + 16x + 15$

$4x^2 + 6x + 10x + 15$

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

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

Check:

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

$4x^2 + 10x$

$+6x + 15 =$

$4x^2 + 16x + 15$ ☑

1. Multiply $a\ and\ c$
2. Make a table of the factor pairs of ac
3. Which factor pair when added is equal to the coefficient *b?*
4. Rewrite the linear term using the factor pairs of $a\ and\ c$.
5. Now cut the quadratic in half
6. Factor the left side and factor the right side separately.
7. WHEN FACTORED, YOU MUST HAVE THE SAME BINOMIALS!!
8. Factor both: factor out the common binomial.
9. You have a factored quadratic!
10. AND check your work!

Remember: factor the left, factor the right, and factor both sides!

$a = 4, c = 15, and\ b = 16$

$ac = 4(15) = 60$

Factor pairs:

$a \times c = 60$	$a + c = 15$
$1 \cdot 60$	sum=61
$2 \cdot 30$	sum=32
$3 \cdot 20$	sum=23
$4 \cdot 15$	sum=19
$5 \cdot 12$	sum=17
$6 \cdot 10$	$\mathbf{6 + 10 = 16}$

Getting closer!!

Factoring Flow Chart for: $ax^2 + bx + c$

$+ac$

$+b$ $(+)(+)$ | $-b$ $(-)(-)$

$(4)(5) = 20,\quad 4 + 5 = 9$

$\mathbf{2x^2 + 9x + 10}$

$\mathbf{2x^2 + 4x + 5x + 10}$

$\mathbf{2x(x + 2) + 5(x + 2)}$

$\mathbf{(x + 2)(2x + 5)}$

$(-5)(-12) = 60,\quad (-5) + (-12) = -17$

$\mathbf{4x^2 - 17x + 15}$

$\mathbf{4x^2 - 5x - 12x + 15}$

$\mathbf{x(4x - 5) - 3(4x - 5)}$

$\mathbf{(4x - 5)(x - 3)}$

$-ac$

$+b$ $(+big)(-small)$ | $-b$ $(-big)(+small)$

$(-3)(10) = -30,\quad (-3) + (10) = 7$

$\mathbf{5x^2 + 7x - 6}$

$\mathbf{5x^2 - 3x + 10x - 6}$

$\mathbf{x(5x - 3) + 2(5x - 3)}$

$\mathbf{(5x - 3)(x + 2)}$

$(1)(-8) = -8,\quad (1) + (-8) = -7$

$\mathbf{2x^2 - 7x - 4}$

$\mathbf{2x^2 + 1x - 8x - 4}$

$\mathbf{x(2x + 1) - 4(2x + 1)}$

$\mathbf{(2x + 1)(x - 4)}$

Factor:

$9x^2 + 9x + 2$ $6x^2 + 14x + 4$ $10n^2 - 17n + 7$

.

When "c" is negative we follow the same process, simply watch your signs: $product\ \ a(c) = \pm$?

$5x^2 + 9x - 18$ $3x^2 - 4x - 15$ $-4x^2 - 4x + 15$