9.6 Factor Quadratic Equations When the Leading Coefficient IS NOT 1

VOCABULARY:
- **Standard Form of a Quadratic Equation** $Ax^2 + Bx + C = 0$
  - Where $A, B, C$ are real numbers; and $A \neq 0$
- **Factoring** is a lot more work when $a \neq 1$

**Example 1** Factor when $a$ and $c$ are prime number other than 1

**Steps to Factor:** $2x^2 + 15x + 7 = \frac{2x+7}{x} \cdot \frac{1x}{1x} = \frac{14x + x}{15x + 7} = \frac{(2x+1)(x+7)}{(2x+1)}$

1) Identify $a$, $b$, and $c$. $a = 2$, $b = 15$, and $c = 7$
2) Write 2 sets of ( )'s. One for each factor.
3) What are the first terms in both factors? Why? $2x \cdot x = 2x^2$ (the 1st term)
4) What are the **signs** for each factor? Both positive since $B + C$ are positive
5) What are the factors of 2 and 7? Put them under the numbers
6) **Draw brackets** (multiply **inner** terms, **outer** terms, and their sum must be $B$)
7) **CHECK** by Multiplying the factors

$$(2x+1)(x+7) = 2x^2 + 14x + x + 7 = 2x^2 + 15x + 7$$

**CHECK POINT:** Factor and Check by mentally multiplying

<table>
<thead>
<tr>
<th></th>
<th>2) $2x^2 - 11x + 5$</th>
<th>3) $5x^2 + 2x - 3$</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$(2x - 1)(x - 5)$</td>
<td>$(5x - 3)(x + 1)$</td>
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<tr>
<td></td>
<td>$12$</td>
<td>$15$</td>
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<td></td>
<td>$1.5$</td>
<td>$1.3$</td>
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<thead>
<tr>
<th></th>
<th>4) $3x^2 - 8x - 3$</th>
<th>5) $5x^2 + 55x + 150$</th>
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<tbody>
<tr>
<td></td>
<td>$(3x + 1)(x - 3)$</td>
<td>$5(x^2 + 11x + 30)$</td>
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<td>$1.3$</td>
<td>$1.5$</td>
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**Tip: Factoring GCF**
- Keep Factors in GCF
- Must include THE GCF

$5(x + 5)(x + 10)$
Example 6  Factor "-1" when the leading coefficient is negative

Steps to Factor: \(-2x^2 - 11x - 5 = \)
\[
-1 \left( 2x^2 + 11x + 5 \right) \\
-1 \left( 2x + 1 \right) \left( x + 5 \right)
\]

1) Identify a, b, and c. \(a = -2\) \(b = -11\) and \(c = -5\)

2) Always factor out -1 when the leading coefficient is negative.

3) Factor (the final answer must include "-1")

4) Always CHECK by Mentally multiplying the factors !!!!!!!!!!!!!!!!!!

Example 7  Factor when \(a\) and \(c\) are NOT prime numbers

Steps to Factor: \(7x^2 - 25x + 12 = \)
\[
7x^2 - 21x - 4x + 12 = 7x(x - 4) - 3(x - 4) = (7x - 3)(x - 4)
\]

1) Write 2 sets of ( )'s. One for each factor.

2) What are the factors of 7 and 12? Put them under the numbers

3) Draw brackets

4) Factor by guess and check.

5) Always CHECK by Mentally multiplying the factors !!!!!!!!!!!!!!!!!!

Example 8  Solve Quadratic Equation by Factoring

1) Factor: \(5x^2 - 18x + 16 = \)
\[
(5x - 8)(x - 2) = 0
\]

2) Solve:
\[
5x - 8 = 0 \quad \text{and} \quad x - 2 = 0
\]
\[
x = \frac{8}{5} \quad \text{and} \quad x = 2
\]

3) Check: 

\[
\text{Use calc to check!}
\]
\[
C: 5 \left( \frac{8}{5} \right)^2 - 18 \left( \frac{8}{5} \right) + 16 = 0
\]
\[
= 0 \checkmark
\]

Revised apr2019