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:** \( 2x^2 + 15x + 7 = (2x+1)(x+7) \)

1) Identify \( a, b, \) and \( c \): \( a = 2 \quad b = 15 \quad c = 7 \)
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

\[
(2x+1)(x+7) = 2x^2 + 14x + x + 7 = 2x^2 + 15x + 7 \checkmark
\]

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

<table>
<thead>
<tr>
<th>Equation</th>
<th>Factored Form</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) ( 2x^2 - 11x + 5 )</td>
<td>( (2x-1)(x-5) )</td>
<td>+1-</td>
</tr>
<tr>
<td>3) ( 5x^2 + 2x - 3 )</td>
<td>( (5x-3)(x+1) )</td>
<td>-1+</td>
</tr>
<tr>
<td>4) ( 3x^2 - 8x - 3 )</td>
<td>( (3x+1)(x-3) )</td>
<td>-1+</td>
</tr>
<tr>
<td>5) ( 5x^2 + 75x + 150 )</td>
<td>( 5(x^2 + 15x + 30) )</td>
<td>KEEP FACTORING</td>
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</tbody>
</table>

**Tip:** FACTOR GCF

\( 5(x+5)(x+6) \)

- **MUST INCLUDE** THE GCF(5)
Example 6  
*Factor when the leading coefficient is negative* (-a)

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

1) Identify a, b, and c. 
   \[a = -2 \quad b = -11 \quad c = -5\]

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

3) Factor

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

   \[(x+5)(2x+1) = (2x^2 + 11x + 5) - 1 = -2x^2 - 11x - 5\]

Example 7  
*Factor when a and c are NOT prime numbers*

**Steps to Factor:** 
\[10x^2 + 19x + 6 = \frac{10}{2 \cdot 5} x^2 + \frac{19}{2 \cdot 3} x + \frac{6}{2 \cdot 3}\]

1) Write 2 sets of ()'s. One for each factor. **Fill in what you know**

2) What are the factors of 10 and 6? 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*

**Factor:** 
\[5x^2 - 6x - 8 = \frac{5x^2 - 2x = -10x}{4x} \]

\[(5x + 4)(x - 2)\]

**Solve:**

\[5x + 4 = 0 \quad x - 2 = 0\]

\[\frac{5x = -4}{x = \frac{-4}{5}} \quad \frac{x = 2}{x = 2} \]

**Check:**

\[C: 5\left(-\frac{4}{5}\right)^2 - 6\left(-\frac{4}{5}\right) - 8 = 0 \quad 20 - 12 - 8 = 0 \quad 0 = 0\]