Lesson #6 - Factoring Trinomials \((ax^2 + bx + c)\), where \(a = 1\)

**Type I: \(x^2 + bx + c\)**

1. \(x^2 + 7x + 12\) = \((x + \underline{3})(x + \underline{4})\)
   - Have a binomial answer.
   - A pair of numbers that multiply to \(c\) = \(12\).
   - Same 2 numbers must add to \(b\) = \(7\).
   - \(2\times 6 = 12\) \(2 + 6 = 7\).

2. \(x^2 + 9x + 20\) = \((x + \underline{4})(x + \underline{5})\)
   - \(10 \times 2 = 20\).
   - \(2\times 10 = 20\) \(2 + 10 = 12\).

3. \(3x^2 + 22x + 60\) = \(2(x + \underline{5})(x + \underline{6})\)
   - \(3x = 18\) \(x = 6\).
   - \(\frac{18}{2} = 3\), \(3 + 6 = 9\).
   - \(5\times 6 = 30\) \(5 + 6 = 11\).
   - \(\frac{30}{3} = 10\) \(\frac{60}{3} = 20\).

**Type II: \(x^2 + bx + c\)**

1. \(x^2 - 8x + 12\) = \((x - \underline{6})(x - \underline{2})\)
   - \(12 \times -1 = -12\) \(-6 \times -2 = -12\).
   - \(\frac{-12}{-6} = 2\).

2. \(x^2 + 11x + 30\) = \((x + \underline{5})(x + \underline{6})\)
   - \(30 \times 1 = 30\) \(3 + 6 = 11\).
   - \(\frac{30}{3} = 10\) \(\frac{60}{6} = 10\).

3. \(3x^2 - 18x + 27\) = \(3(x - \underline{3})(x - \underline{3})\)
   - \(27 \times -9 = -243\) \(-9 \times -3 = -27\).
   - \(\frac{-243}{-9} = 27\) \(-3 \times -3 = -9\).

4. \(x^2 + 24x + 44y^2\) = \((x + \underline{4x})(x + \underline{11y})\)
   - \(44 \times 1 = 44\) \(4 \times 11 = 44\).
   - \(\frac{44}{4} = 11\).

5. \(x^2 + 20xy + 44y^2\) = \((x + \underline{4xy})(x + \underline{11y})\)
   - \(44 \times 1 = 44\) \(4 \times 11 = 44\).
   - \(\frac{44}{4} = 11\).
Type III: \( x^2 + bx + c \)

1. \( x^2 + 2x - 24 \)
   - Add \( +6 \) to both sides
   - Factor: \( (x + 4)(x - 6) \)

2. \( x^2 - 2x - 35 \)
   - Add \( +10 \) to both sides
   - Factor: \( (x - 7)(x + 5) \)

3. \( x^2 + x^2 - 30 \)
   - Add \( 10 \) to both sides
   - Factor: \( (x^2 - 5)(x^2 + 6) \)

4. \( 2x^3 - 6x^2 - 20x \)
   - Factor out GCF: \( 2x(x^2 - 3x - 10) \)
   - Factor: \( 2x(x - 5)(x + 2) \)

5. \( x^2 - x - 90 \)
   - Add \( +1 \) to both sides
   - Factor: \( (x + 9)(x - 10) \)

**Homework**

Assignment #6
pages 35-38 Questions #189-216
Factoring: $ax^2 + bx + c$ (where $a=1$) with tiles.

Hint: 3 terms, no common factor, leading coefficient is 1.

Eg.1. Consider $x^2 + 3x + 2$. The trinomial can be represented by the rectangle below.

Recall, the side lengths will give us the "factors".

\[ x^2 + 3x + 2 = (x + 1)(x + 2) \]

Eg.2. Factor $x^2 - 5x - 6$

\[ x^2 - 5x - 6 = (x + 1)(x - 6) \]

Start by placing the "x" tile and the six "-1" tiles at the corner. Then you can fill in the "x" tiles. You’ll need one x tile and six -x tiles.

Factor the following trinomials using algebra tiles.

189. $x^2 + 6x + 8$  
190. $x^2 + 9x + 14$

191. $x^2 - 7x + 6$  
192. $x^2 + 9x - 10$
**Factoring:** \( ax^2 + bx + c \) (where \( a = 1 \)) without tiles.

Did you see the pattern with the tiles?

If a trinomial in the form \( x^2 + bx + c \) can be factored, it will end up as \((x + \_)(x + \_)\).

The trick is to find the numbers that fill the spaces in the brackets.

The Method...
If the trinomial is in the form \( x^2 + bx + c \), look for two numbers that multiply to \( c \), and add to \( b \).

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**Eg.1.**
Factor \( x^2 + 6x + 8 \)

\[(x + \_)(x + \_)\] What two numbers multiply to +8 but add to +6? 2 and 4

\[= (x + 2)(x + 4)\] The numbers 2 and 4 fill the spaces inside the brackets.

**Eg.2.** Factor \( x^2 - 11x + 18 \)

\[(x + \_)(x + \_)\] What two numbers multiply to +18 but add to -11? -2 and -9

\[= (x - 2)(x - 9)\] The numbers -2 and -9 fill the spaces inside the brackets.

**Eg.3.** Factor \( x^2 - 7xy - 60y^2 \)
The \( y \)'s can be ignored temporarily to find the two numbers. Just write them in at the end of each bracket.

\[(x + \_y)(x + \_y)\] What two numbers multiply to -60 but add to -7? -12 and -5

\[= (x - 12y)(x + 5y)\] The numbers -12 and +5 fill the spaces in front of the \( y \)'s.

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**Factor the trinomials if possible.**

<table>
<thead>
<tr>
<th>( x^2 + 6x + 5 )</th>
<th>( n^2 + 7n + 10 )</th>
<th>( x^2 - x - 30 )</th>
</tr>
</thead>
</table>

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Factor the trinomials if possible.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>196. $q^2 + 2q - 15$</td>
<td>197. $k^2 + k - 36$</td>
<td>198. $t^2 + 11t + 24$</td>
</tr>
<tr>
<td>200. $g^2 - 11g + 10$</td>
<td>201. $s^2 - 2s - 30$</td>
<td></td>
</tr>
<tr>
<td>202. $m^2 - 12m + 27$</td>
<td>203. $x^2 - 27 - 6x$</td>
<td>204. $p^2 + 3p - 54$</td>
</tr>
<tr>
<td>206. $a^2 - 14a + 45$</td>
<td>207. $6x + 2x^2 - 20$</td>
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</tr>
<tr>
<td>205. $2x^2 - 16x + 32$</td>
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<tr>
<td>Exercise</td>
<td>Expression</td>
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<tr>
<td>208.</td>
<td>$x^4 - 3x^2 - 10$</td>
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<tr>
<td>209.</td>
<td>$w^6 + 7w^3 + 12$</td>
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<tr>
<td>210.</td>
<td>$p^3 - 4p^2 - 21$</td>
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<tr>
<td>211.</td>
<td>$5ax + x^2 - x^3$</td>
<td></td>
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<tr>
<td>212.</td>
<td>$x^3 + 11x^2 - 80$</td>
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<tr>
<td>213.</td>
<td>$x^2 - 3x + 7$</td>
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<tr>
<td>214.</td>
<td>$x^2 - 6xy + 5y^2$</td>
<td></td>
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<tr>
<td>215.</td>
<td>$x^2 + 5xy - 36y^2$</td>
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</tr>
<tr>
<td>216.</td>
<td>$a^2b^2 - 5ab + 6$</td>
<td></td>
</tr>
</tbody>
</table>

**Challenge Question**

Factor $2x^2 + 7x + 6$. 

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