Name:

Factoring Trinomials

Remember expanding the following expression?

$$(2x + 3)(x - 4) = 2x^2 + 3x - 8x - 12$$

$$= \boxed{2x^2 - 5x - 12}$$

In this unit, we want to reverse that process. We want to do this:
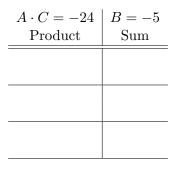
$$2x^2 - 5x - 12 = (2x + 3)(x - 4)$$

In order to do so, we'll use **factoring by grouping**. This means we'll need to find the right factors. We will do this by setting up a table. Before we do this, look at the coefficients. We'll call them A, B, and C.

$$\underbrace{2x^2}_{A} \underbrace{-5x}_{B} \underbrace{-12}_{C}$$

$A = 2$, $B = -5$, and $C = -12$.

Setting Up a Table

The first column of our table is the product of A and C. The second column is simply the value of B.

$A \cdot C = -24$	$B = -5$
Product	Sum

In the first column you want to put two numbers that multiply to give you -24. In the second column, you'll find their sum. When you get to two numbers that give you the sum of -5, you can stop.

Filling out the Table

Let's start filling out the table with two numbers that multiply to give me -24 and then finding their sum.

$A \cdot C = -24$ Product	$B = -5$ Sum
-2, 12	10
8, -3	5
-8, 3	-5

So -8 and 3 are the two numbers we are looking for. Next, we split up our middle term, B using the numbers we got:

$$2x^2 - 5x - 12 =$$
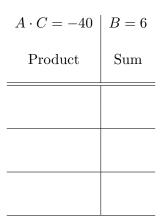
$$2x^2 - 8x + 3x - 12$$

Finally, we factor by grouping:

$$\underbrace{2x^2 - 8x}_{2x(x-4)} + \underbrace{3x - 12}_{3x(x-4)} = 2x(x-4) + 3(x-4)$$

$$2x(x-4) + 3(x-4) = \boxed{(2x+3)(x-4)}$$

Task: Factor $5x^2 + 6x - 8$

Solution: First, we find A, B, and C after our polynomial is in order from largest to smallest powers.

$$A = 5,\ B = 6,\ \text{and } C = -8.$$

Next, we set up the table. The product of A and C is in the first column. B is in the second.

$A \cdot C = -40$	$B = 6$
Product	Sum

So we need to find the two numbers that multiply to give us -40 and add up to give us 6.

After some trying, you'll find these numbers to be 10 and -4.

$$5x^2 + 6x - 8 = 5x^2 + 10x - 4x - 8$$

Finally, we factor by grouping:

$$\underbrace{5x^2 + 10x}_{5x(x+2)} - \underbrace{4x - 8}_{-4(x+2)} = 5x(x+2) - 4(x+2)$$

$$5x(x+2) - 4(x+2) = \boxed{(5x-4)(x+2)}$$

Problem Set

Factor the following:

1. $3p^2 - 2p - 5 =$

2. $2n^2 + 3n - 9 =$

3. $5n^2 + 19n + 12 =$

4. $2v^2 + 11v + 5 =$

5. $2n^2 + 5n + 2 =$

6. $3n^2 - 8n + 4 =$

7. $5x^2 - 18x + 9 =$

8. $4n^2 - 15n - 25 =$

9. $4n^2 - 17n + 4 =$

10. $6n^2 + 5n - 6 =$