

A trinomial is in the form $ax^2 + bx + c$. Do you remember how to factor a trinomial?

Example 1

Factor $x^2 + 12x + 27$

Step 1- Set up () ()

Look at the second operator.

$$\begin{array}{ccc}
 & x^2 + 12x + 27 & \\
 \swarrow & & \nwarrow \\
 \boxed{\text{1}^{\text{st}} \text{ operator}} & & \boxed{\text{2}^{\text{nd}} \text{ operator}}
 \end{array}$$

The second operator is $+$, so we will need will put the first operator (which is $+$) in the middle of both () ().

$$(\quad + \quad)(\quad + \quad)$$

Step 2- Fill in the first spots in both () ()

This one is pretty easy. They will both be x .

$$(\quad x + \quad)(\quad x + \quad)$$

Step 3- Fill in the second spots in both () ()

We need two numbers that multiply to equal 27 and will add up (since the operators in our parentheses are the same) to equal 12.

Our choices appear to be 1 & 27 or 3 & 9. The winner is... 3 & 9!

$$(\quad x + \quad 3 \quad)(\quad x + \quad 9 \quad)$$

Step 4 (Optional)- Use FOIL to check your answer

$$x^2 + 9x + 3x + 27 = x^2 + 12x + 27$$

$$(\quad x + \quad 3 \quad)(\quad x + \quad 9 \quad)$$

Example 2Factor $x^2 - 17x + 42$ **Step 1-** Set up () ()

Look at the second operator.

$$x^2 - 17x + 42$$

The second operator is +, so we will need will put the first operator (which is -) in the middle of both () ().

$$(-)(-)$$

Step 2- Fill in the first spots in both () ()Again, this is pretty easy. They will both be x .

$$(x -)(x -)$$

Step 3- Fill in the second spots in both () ()

We need two numbers that multiply to equal 42 and will add up (since the operators in our parentheses are the same) to equal 17.

Our choices appear to be 1 & 42 or 3 & 14 or 6 & 7. The winner is... 3 & 14!

$$(x - 3)(x - 14)$$

Step 4 (Optional)- Use FOIL to check your answer

$$x^2 - 3x - 14x + 42 = x^2 - 17x + 42$$

$$(x - 3)(x - 14)$$

Example 3Factor $x^2 + 5x - 24$ **Step 1-** Set up () ()

Look at the second operator.

$$x^2 + 5x - 24$$

The second operator is $-$, so we will need will put a $+$ in the middle of one () and a $-$ in the middle of the other (). Right now, we don't care about the first operator.

$$(+)(-)$$

Step 2- Fill in the first spots in both () ()Once more, this is pretty easy. They will both be x .

$$(x +)(x -)$$

Step 3- Fill in the second spots in both () ()

We need two numbers that multiply to equal 42 and will subtract (since the operators in our parentheses are different) to equal 5.

Our choices appear to be 1 & 24 or 2 & 12 or 3 & 8 or 4 & 6. The winner is... 3 & 8! But this time it matters which one goes by the $+$ sign and which one is by the $-$ sign. **TIP-** Put the bigger number by the sign that is the same as the first operator. In our problem, the first operator is $+$, so we'll put the 8 beside it.

$$(x + 8)(x - 3)$$

Step 4 (Optional)- Use FOIL to check your answer

$$x^2 - 3x + 8x - 24 = x^2 + 5x - 24$$

$$(x + 8)(x - 3)$$

Example 4Factor $3x^2 - 11x - 14$ **Step 1-** Set up () ()

Look at the second operator.

$$3x^2 - 11x - 14$$

The second operator is $-$, so we will need will put a $+$ in the middle of one () and a $-$ in the middle of the other (). Right now, we don't care about the first operator.

$$(+) (-)$$

Step 2- Fill in the first spots in both () ()The only choice this time is x and $3x$.

$$(x +) (3x -)$$

Step 3- Fill in the second spots in both () ()

We need two numbers that multiply to equal 14 and will work with the numbers we already have to subtract equal 11.

Our choices appear to be 1 & 14 or 2 & 7. We'll have to try them out to see what happens. We use the O and I parts of FOIL.

$$\begin{aligned} (x + 2) (3x - 7) & \quad -7x + 6x = -x \quad \text{NO} \\ (x + 7) (3x - 2) & \quad -2x + 21x = 19x \quad \text{NO} \\ (x + 14) (3x - 1) & \quad 42x - x = 41x \quad \text{NO} \\ (x + 1) (3x - 14) & \quad -14x + 3x = -11x \quad \text{YES!} \end{aligned}$$

TIP- If you ever get the opposite of what you want, just switch the operators.

$$(x - 1) (3x + 14) \quad 14x - 3x = 11x \quad \text{NO, but it's the opposite!}$$

Switch these operators

$$(x + 1) (3x - 14)$$