Factoring Trinomials

Trinomials usually come about when we multiply two binomials:

$(x + 3)(x + 5)$

using ***FOILING*** we can evaluate the above as follows: $x^2 + 5x + 3x + 15$ and we simplify to $x^2 + 8x + 15$

But what if we started with $x^2 + 8x + 15$ and were asked factor it (bring it back to its beginnings)?
How could we return $x^2 + 8x + 15$ back to its original state of $(x + 3)(x + 5)$? This process is known as ***FACTORING***

Before we start let us look at the various forms a trinomial can be found in

A TRINOMIAL is in this basic form $ax^2 + bx + c$ ***examples:***

$x^2 + 8x + 15$
$x^2 + 5x + 6$
$x^2 + x - 6$
$3x^2$ $15x + 18$
$6x^2 + 13x - 5$

For each one of the above examples identify what a, b, and c are for each trinomial

We will use the same basic way to factor ***BUT*** how we proceed and finish will depend on whether $a = 1$ or whether $a \neq 1$

Factoring $ax^2 + bx + c$ where $a = 1$

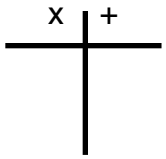
Method: Product / Sum (x and +)

Example: $x^2 + 8x + 15$

STEP 1: Determine what "a", "b", and "c" are.

a = 1, b = 8, and c = 15

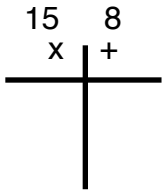
STEP 2: Create a product/sum table



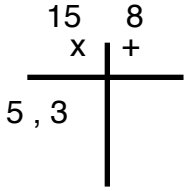
STEP 3: To determine what product / sum you are looking for you will do the following:

to get your product # multiply "a ***x*** c" and to find your sum # simply write in the value of "b"

therefore your product is 1 x 15 = ***15*** and your sum is ***8***



STEP 4: Determine two numbers that multiply to give you your product number and add up to give you your sum number



STEP 5: Take these two numbers and place them in brackets with an x at each start

(x + 5) (x + 3) is your answer

Step 6: Check. How? take answer (x + 5) (x + 3) and ***FOIL and SIMPLIFY***.

$(x + 5)(x + 3) = x^2 + 5x + 3x + 15$
$= x^2 + 8x + 15$

Factoring $ax^2 + bx + c$ where $a \neq 1$

Method: Product / Sum (x and +)

Example: $3x^2 + 15x + 18$

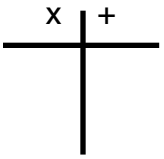
FIRST THOUGHT when $a \neq 1$, can "a" be factored out from all terms, if YES factor "a"out from all terms and proceed with product / sum just like you did when a = 1

STEP 1: $a \neq 1$ $3x^2 + 15x + 18$, factor 3 out because a = 3 from all terms $3(x^2 + 5x + 6)$

STEP 2: Determine what "a", "b", and "c" are.

a = 1, b = 5, and c = 6

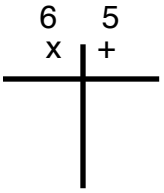
STEP 3: Create a product/sum table



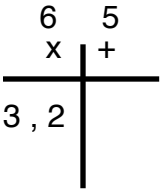
STEP 4: To determine what product / sum you are looking for you will do the following:

to get your product # multiply "a ***x*** c" and to find your sum # simply write in the value of "b"

therefore your product is 1 x 6 = ***6*** and your sum is ***5***



STEP 5: Determine two numbers that multiply to give you your product number and add up to give you your sum number



STEP 6: Take these two numbers and place them in brackets with an x at each start. ***MAKE CERTAIN TO INCLUDE THE NUMBER YOU FACTORED OUT IN YOUR FINAL ANSWER.***

3(x + 3) (x + 2) is your answer

Step 7: Check. How? take answer 3(x + 3) (x + 2) and ***FOIL and SIMPLIFY***.

$3(x + 3)(x + 2) = (3x + 9) + (x + 2)$
$= 3x^2 + 6x + 9x + 18$
$= 3x^2 + 15x + 18$

Factoring $ax^2 + bx + c$ where $a \neq 1$

Method: Product / Sum (x and +)

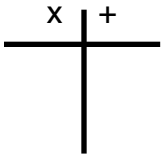
Example: $6x^2 + 13x - 5$

FIRST THOUGHT when $a \neq 1$, can it be factored out from all terms, if NO you still proceed with product / sum

STEP 1: Determine what "a", "b", and "c" are.

a = 6, b = 13, and c = -5

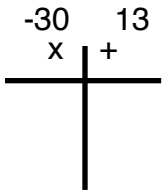
STEP 2: Create a product/sum table



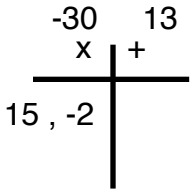
STEP 3: To determine what product / sum you are looking for you will do the following:

to get your product # multiply "a ***x*** c" and to find your sum # simply write in the value of "b"

therefore your product is 6 x (-5) = ***-30*** and your sum is ***13***



STEP 4: Determine two numbers that multiply to give you your product number and add up to give you your sum number



STEP 5: ***Because "a" does not equal 1, we cannot simply place the two numbers in the brackets and we are done.*** We need to do the following: Take these two numbers and place them in brackets BUT where you would normally place an x you would now have to place an x and whatever the "a" value is.

(6x + 15) (6x -2)

STEP 6: ***SIMPLIFY EACH BRACKET BY REDUCING EACH TO LOWEST TERMS***

(6x + 15) can be reduced by 3 and (6x -2) can be reduced by 2

Result (6x +15) (6x - 2) becomes ***(2x + 5) (3x -1)***

STEP 7: ***Check. How? take answer (3x - 1) (2x + 5) and FOIL and SIMPLIFY***.

$(3x - 1)(2x + 5) = 6x^2 + 15x - 2x - 5$

$= 6x^2 + 13x - 5$