Factoring – "Bottoms Up" Method

If a Trinomial of the form $\boldsymbol{ax^2 + bx + c = 0}$ *is factorable, it can be completed using the Bottoms Up Method according to the following steps…*

Step 1. Make sure the trinomial is in standard form ($ax^2 + bx + c = 0$).

Step 2. Factor out a GCF (greatest common factor) if applicable.

Step 3. Multiply $a \cdot c$ and re-write the polynomial as: $1x^2 + bx + ac = 0$.

Step 4. Factor as normal, by finding the two factors (n_1, n_2) of $a \cdot c$ that add up to b.

Step 5. Write the binomial factors as $(x + n_1)(x + n_2) = 0$.

Step 6. Divide the constants $(n_1 \ and \ n_2)$ in each binomial factor by the original value of a.

Step 7. Simplify the resulting 2 fractions if applicable.

Step 8. If the simplified fraction has a denominator other than 1, move the denominator to become the coefficient in front of the variable *("bottoms up")*.

Step 9. Check the answer - Multiply the answers to verify that you get the original trinomial.

	Example 1		Example 2
Step 1:	$6x^2 + 5x - 4 = 0$		$6x^2 - 21x - 45 = 0$
Step 2:	No GCF		$3(2x^2 - 7x - 15) = 0$
Step 3:	$a \cdot c = (6)(-4) = -24$		$a \cdot c = (2)(-15) = -30$
Re-write →	$x^2 + 5x - 24 = 0$		*Re-write* → $x^2 - 21x - 30 = 0$
Step 4:	Find factors of -24 That add to b (5) Factors → (+8)(-3)		Find factors of -30 That add to b (-7) Factors → (-10)(3)
Step 5:	$(x + 8)(x - 3) = 0$		$3(x - 10)(x + 3) = 0$
Step 6:	$\left(x + \frac{8}{6}\right)\left(x - \frac{3}{6}\right) = 0$	Divide the constants by the original value of $\boldsymbol{a}$	$3\left(x - \frac{10}{2}\right)\left(x + \frac{3}{2}\right) = 0$
Step 7:	$\left(x + \frac{4}{3}\right)\left(x - \frac{1}{2}\right) = 0$	Reduce the resulting fractions	$3(x - 5)\left(x + \frac{3}{2}\right) = 0$
Step 8:	$(3x + 4)(2x - 1) = 0$	Move the denominator so that it becomes the coefficient in front of the variable – "bottoms up"	$3(x - 5)(2x + 3) = 0$

Step 9: $6x^2 + 5x - 4 = 0$ ✓ $6x^2 - 21x - 45 = 0$ ✓

"Bottoms Up" Factoring - Practice Problems

Directions - Factor the following trinomials by using the "bottoms up" factoring method.

	Problem	**Answer**
1.	$2x^2 - 9x - 18 = 0$	$(x-6)(2x+3) = 0$
2.	$8x^2 + 2x - 3 = 0$	$(2x-1)(4x+3) = 0$
3.	$3x^2 + 19\,x = 40$	$(x+8)(3x-5) = 0$
4.	$8x^2 - 12x - 8 = 0$	$4(2x+1)(x-2) = 0$
5.	$10x^2 - 25x = 125$	$5(2x+5)(x-5) = 0$
6.	$\frac{5}{2}x^2 - \frac{11}{2}x + 1 = 0$	$\frac{1}{2}(5x-1)(x-2) = 0$