

Factoring Polynomials

Of the form $ax^2 + bx + c$ with $a \neq 1$

Example: How to Completely Factor $24x^2 + 2x - 12$

Method 1 - Regrouping

Step 1 – Factor anything common to all three terms (in this case 2 goes into all three terms):

$$2(12x^2 + 1x - 6)$$

Step 2 – Now (looking at just the stuff in the parentheses) multiply the first and last terms together:

$$12x^2 \cdot (-6) = -72x^2$$

Step 3 – Find two terms (each with an x) that multiply to make the product in step 2 and add up to equal the middle term in the trinomial you are factoring (in this case 1x):

$$-8x \cdot 9x = -72x^2 \quad \text{and} \quad -8x + 9x = 1x$$

Step 4 – Rewrite the polynomial with the middle term (1x) rewritten as the sum of the two terms you just found:

$$12x^2 - 8x + 9x - 6$$

Step 5 – Regroup with parentheses:

$$(12x^2 - 8x)(+9x - 6)$$

Step 6 – Factor what you can out of each of the parentheses:

$$4x(3x - 2) + 3(3x - 2)$$

Step 7 – The stuff outside the parentheses becomes one factor and the stuff inside the parentheses (which should each be identical) becomes a second factor. Rewrite the polynomial in factored form as shown:

$$(4x + 3)(3x - 2)$$

Step 8 – Don't forget to add back in any factor you may have found in step 1:

$$2(4x + 3)(3x - 2)$$

Step 9 – JK...you're done

Method 2 - Box

Steps 1, 2, and 3 are identical to those above

Step 4 – Put the first term and the last term in the box as shown:

$12x^2$	
	-6

Step 5 – Put the terms you found in step 3 into the box as shown:

$12x^2$	$-8x$
$+9x$	-6

Step 6 – Factor what you can out of each row and column:

	$3x$	-2
$4x$	$12x^2$	$-8x$
$+3$	$+9x$	-6

Step 7 – The stuff on the left side of the box becomes one factor and the stuff on the top of the box becomes the second factor. Write the polynomial in factored form.

$$(4x + 3)(3x - 2)$$

Step 8 – Don't forget to add back in any factor you may have found in step 1:

$$2(4x + 3)(3x - 2)$$