

Lesson #14

Factoring a Polynomial

A Brief Overview:

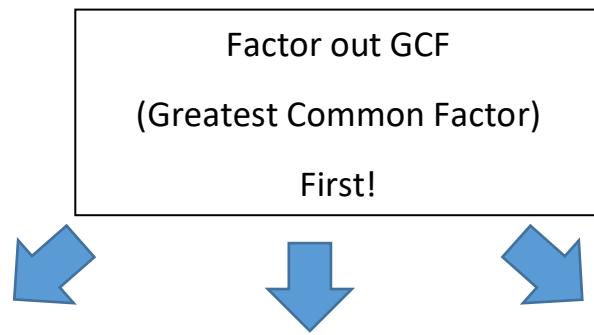
FACTORING refers to the process of rewriting a polynomial expression in a different order or combination, usually to make the expression more compact

- A full explanation of factoring could take weeks (or at least hours!), so this Lesson will present the basics as well as point you to some other resources for further exploration
 - We will then show you how the calculator program “QUAD” can be used to check your solutions
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For More Information, Visit:

- <http://www.coolmath.com/algebra/04-factoring/index.html>
- <http://www.purplemath.com/modules/factquad.htm>
- <http://Lesson.math.lamar.edu/Classes/Alg/Factoring.aspx>
- <https://www.mathwarehouse.com/algebra/factor/how-to-factor-trinomials-step-by-step.php>

FACTORING FLOWCHART



2 Terms	3 Terms	4 Terms
<u>Difference of 2 Squares</u> $a^2 - b^2 = (a-b)(a+b)$	$X^2 + BX + C$ $(x + \underline{\quad})(x + \underline{\quad})$ Find 2 numbers which add to B and multiply to C .	<u>Factoring By Grouping</u> If necessary, rewrite the expression so that the first 2 terms share a common factor and the last 2 terms share a common factor. Example: $8x^3 - 12x + 2x^2 - 3$ $8x^3 + 2x^2 - 12x - 3$ $2x^2(4x + 1) - 3(4x + 1)$ $(2x^2 - 3)(4x + 1)$
<u>Sum of 2 Cubes</u> $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$	$AX^2 + BX + C$ $(\underline{\quad}x + \underline{\quad})(\underline{\quad}x + \underline{\quad})$ When leading coefficient is <u>not</u> 1, use GUESS & CHECK. Find 2 numbers which multiply to A and 2 numbers which multiply to C and then use FOIL to check. First Outer Inner Last	
<u>Difference of 2 Cubes</u> $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$		

Now For Some Practice...

Sample Question: What is the correct factorization for the polynomial $x^2 - 11x - 60$?

Solution: First ask if there is a GCF for this problem? NO, so we proceed...

We need 2 numbers which multiply to -60 and add to -11: They are -15 and 4

The correct factorization is:

$$(x - 15)(x + 4)$$

Note that $(x + 4)(x - 15)$ is also a correct answer!

What If the Polynomial Is Not Factorable?

- There will sometimes be polynomials that cannot be factored
- An example is: $x^2 + 4x + 5$
- There is no GCF
- And, try as you might, you will not be able to come up with 2 real numbers that multiply to 5 and add to 4!
- In this case, there is nothing you can do
- Simply choose the same polynomial as the answer choice (or sometimes you may see the words *Not Factorable*)

One Other Possibility...

- Sometimes a polynomial will have a GCF but that is all....
- An example is $5x^2 - 30x - 20$
- The GCF is 5 and factoring it out gives:

$$5(x^2 - 6x - 4)$$

- At this point, you will always try to factor the remaining polynomial
- But there are no 2 real numbers that multiply to -4 and add to -6!
- $5(x^2 - 6x - 4)$ is our final answer. The polynomial can't be factored further