

# Factoring Polynomials

## A Supplement for Section 5-4

Number of Terms	FACTORING TECHNIQUE
Any number	<p><b><u>FIND THE GREATEST COMMON FACTOR</u></b></p> $3x^2 + 3x = 3x(x+1)$
Two	<p><b><u>DIFFERENCE OF TWO SQUARES</u></b></p> $A^2 - B^2 = (A + B)(A - B)$ $100x^2 - 25 = (10x)^2 - (5)^2 = (10x + 5)(10x - 5)$
	<p><b><u>SUM OF TWO CUBES</u></b></p> $A^3 + B^3 = (A + B)(A^2 - AB + B^2)$ $8x^3 + y^3 = (2x + y)(2x^2 - 2xy + y^2)$
	<p><b><u>DIFFERENCE OF TWO CUBES</u></b></p> $A^3 - B^3 = (A - B)(A^2 + AB + B^2)$ $27c^3 - d^3 = (3c - d)(3c^2 + 3cd + d^2)$
Three	<p><b><u>TRINOMIAL SQUARES</u></b></p> $16a^2 - 56ab + 49b^2 = (4a - 7b)^2$ $(4a)^2 \quad (7b)^2$
	<p><b><u>FACTORING <math>x^2 + bx + c</math> (coefficient of <math>x^2 = 1</math>)</u></b></p> $x^2 + bx + c$ $x^2 - 7x + 10 = (x - 5)(x - 2)$ <p>Note: the two end (last) numbers must:</p> <ol style="list-style-type: none"> <li>multiply to make c (+10)</li> <li>add to make b (-7)</li> </ol>
	<p><b><u>FACTORING <math>ax^2 + bx + c</math> (coefficient of <math>x^2 \neq 1</math>)</u></b></p> $ax^2 + bx + c$ $18x^2 + 33x - 6$ <p>Note: the factors of the a and the c must be combined to make the b.</p> <p>Your goal is to make ( + ) ( + )</p> <ul style="list-style-type: none"> <li><b>First:</b> factor out the common factor, if there is one: <math>3(6x^2 + 11x - 2)</math></li> <li><b>Second:</b> List factors of 6: 6 and 1, 3 and 2. One set of these must be the first terms.</li> <li><b>Third:</b> List factors of -2: 1 and -2, -1 and 2. One set of these must be the last terms.</li> <li><b>Fourth:</b> <u>Try different combinations until you get +11 as the middle term.</u></li> </ul> <p>In this case, 6 times 2 equals 12, and 1 times -1 equals -1. <math>12 + -1 = 11</math>. Therefore, <math>3(6x - 1)(x + 2)</math> is the answer. Multiply it out (FOIL) to check. <i>Notice that the answer also includes the original 3 that was factored out at the beginning.</i></p>
Four +	<p><b><u>FACTORING BY GROUPING</u></b></p> $6x^3 - 9x^2 + 4x - 6$ $(6x^3 - 9x^2) + (4x - 6)$ $3x^2(2x - 3) + 2(2x - 3)$ $(3x^2 + 2)(2x - 3)$ <ul style="list-style-type: none"> <li>Group the first two terms, then the last two terms.</li> <li>Now remove common factors.</li> <li>Notice that the "remaining" terms are the same!</li> <li>This is the final answer, using the distributive property to put it together.</li> </ul>