



FACTORING  
POLYNOMIALS

example 1:

Factor  $\frac{2x}{2} + \frac{42y}{2}$

$$2(x + 21y)$$

example 2:

Factor  $\frac{4x^4}{4x^3} + \frac{24x^3}{4x^3}$

$$4x^3(x + 6)$$

example 24:

Factor  $x^3 + 2x^2 + 8x + 16$

$$(x^3 + 2x^2) + (8x + 16)$$

$$x^2(x + 2) + 8(x + 2)$$

$$(x+2)(x^2 + 8)$$

example 25:

Factor  $x^3 - 10 - 5x + 2x^2$

$$x^3 + 2x^2 - 5x - 10$$

$$(x^3 + 2x^2) + (-5x - 10)$$

$$x^2(x + 2) - 5(x + 2) = (x + 2)(x^2 - 5)$$

\*Use the commutative property to rewrite the polynomial so that you can group terms with a common factor!

summary: Can only use when you have four terms. 1st put in S.F., then look for GCF, finally group into 2 groups of 2, using parentheses. Factor out GCF of each (), parentheses MUST match. Write answer as 2 ( ) ( ).

four terms

example 20:

Factor  $\frac{5x(x-2)}{(x-2)} + \frac{7(x-2)}{(x-2)}$

$(x-2)(5x+7)$

\* Factor out the common binomial

example 21:

Factor  $\frac{-9m(m+3)}{(m+3)} - \frac{5(m+3)}{(m+3)}$

$(m+3)(-9m-5)$

example 22:

Factor  $3y^2(y-2) + 4(2-y)$

$\frac{3y^2(y-2)}{(y-2)} - \frac{4(y-2)}{(y-2)}$

$(y-2)(3y^2-4)$

example 23:

Factor  $2d(d-5) - 3(5-d)$

$\frac{2d(d-5)}{(d-5)} + \frac{3(d-5)}{(d-5)}$

$(d-5)(2d+3)$

example 3:

Factor  $\frac{8a^2b}{2ab} - \frac{6ab^2}{2ab}$

$2ab(4a-3b)$

example 4:

Factor  $\frac{20x^2y^2}{4xy} - \frac{4xy}{4xy}$

$4xy(5xy-1)$

summary: The GCF is the largest number with the largest variable that divides evenly into ALL terms. \*If the "LC" is negative the greatest common factor GCF must be negative!!!

example 5  
Factor  $x^2 + 11x + 18$

$(x + 2)(x + 9)$

Multiply to	Add to
18	11
1 x 18	19
2 x 9	11
3 x 6	18

example 6  
Factor  $m^2 + 9m + 14$

$(m + 2)(m + 7)$

Multiply to	Add to
14	9
1 x 14	15
2 x 7	9

algebra	examples
$a^2 + 2ab + b^2 = (a + b)^2$	example 16: Factor $x^2 + 6x + 9$ $(x + 3)^2$ example 17: Factor $4g^2 + 4gh + h^2$ $(2g + h)^2$
$a^2 - 2ab + b^2 = (a - b)^2$	example 18: Factor $x^2 - 10x + 25$ $(x - 5)^2$ example 19: Factor $n^2 - 12n + 36$ $(n - 6)^2$

summary: \_\_\_\_\_  
\_\_\_\_\_

“special” products  $(a^2 - b^2)$  &  $(a^2 \pm 2ab + b^2)$

algebra	examples:
$a^2 - b^2 = (a + b)(a - b)$ <p style="color: red; font-size: small;">*Don't forget to factor out the GCF first, if there is one!</p>	<p>example 13: Factor <math>9x^2 - 16</math> <math>(3x + 4)(3x - 4)</math></p> <p>example 14: Factor <math>25n^2 - 81</math> <math>(5n + 9)(5n - 9)</math></p> <p>example 15: Factor <math>8 - 18g^2</math> <math>2(4 - 9g^2) = 2(2 + 3g)(2 - 3g)</math></p>

<p>example 7: Factor <math>y^2 - 6y + 8</math></p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="border: none;"><math>(y - 2)(y - 4)</math></td> <td style="border: none; padding: 0 10px;">Multiply to</td> <td style="border: none; padding: 0 10px;">Add to</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">8</td> <td style="border: none; text-align: center;">-6</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">1 x 8</td> <td style="border: none; text-align: center;">9</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">2 x 4</td> <td style="border: none; text-align: center;">8</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">-1 x -8</td> <td style="border: none; text-align: center;">-9</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">-2 x -4</td> <td style="border: none; text-align: center;">-6</td> </tr> </table>	$(y - 2)(y - 4)$	Multiply to	Add to		8	-6		1 x 8	9		2 x 4	8		-1 x -8	-9		-2 x -4	-6	<p>example 8: Factor <math>w^2 + 2w - 15</math></p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="border: none;"><math>(w - 3)(w + 5)</math></td> <td style="border: none; padding: 0 10px;">Multiply to</td> <td style="border: none; padding: 0 10px;">Add to</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">-15</td> <td style="border: none; text-align: center;">2</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">1 x -15</td> <td style="border: none; text-align: center;">-14</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">-1 x 15</td> <td style="border: none; text-align: center;">14</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">3 x -5</td> <td style="border: none; text-align: center;">-2</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none; text-align: center;">-3 x 5</td> <td style="border: none; text-align: center;">2</td> </tr> </table>	$(w - 3)(w + 5)$	Multiply to	Add to		-15	2		1 x -15	-14		-1 x 15	14		3 x -5	-2		-3 x 5	2
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summary: Must be in S.F, then look for GCF, next

make "MA" chart, M=a·c, A=b. Find two numbers that multiply to give you "M" but,

trinomial factoring  $(x^2 + bx + c)$

example 9:

Factor  $3y^2 + 4y - 15$

$$3y^2 + 9y - 5y - 15$$

$$(3y^2 + 9y) + (-5y - 15)$$

$$3y(y + 3) - 5(y + 3)$$

$$(y + 3)(3y - 5)$$

Multiply to	Add to
-45	4
9 x -5	4

example 10:

Factor  $2x^2 - 7x + 3$

$$2x^2 - 1x - 6x + 3$$

$$(2x^2 - 1x) + (-6x + 3)$$

$$x(2x - 1) - 3(2x - 1)$$

$$(2x - 1)(x - 3)$$

Multiply to	Add to
6	-7
-1 x -6	-7

example 11:

Factor  $-5m^2 + 6m - 1$

$$-1(5m^2 - 6m + 1)$$

$$-1(5m^2 - 5m - 1m + 1)$$

$$-1[(5m^2 - 5m) + (-1m + 1)]$$

$$-1[5m(m - 1) - 1(m - 1)]$$

$$-1(m - 1)(5m - 1)$$

Multiply to	Add to
5	-6
-1 x -5	-6

example 12:

Factor  $-3k^2 - k + 2$

$$-1(3k^2 + k - 2)$$

$$-1[3k^2 + 3k - 2k - 2]$$

$$-1[(3k^2 + 3k) + (-2k - 2)]$$

$$-1[3k(k + 1) - 2(k + 1)]$$

$$-1(k + 1)(3k - 2)$$

Multiply to	Add to
-6	1
3 x -2	1

summary: add to give you "A". Use these two numbers to "replace" the middle term and create four terms. Finally factor by grouping.

trinomial factoring  $(ax^2 + bx + c)$

\*Must make "a" positive, even if it means factoring out a -1.