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CRMA 0372
College Readiness Algebra II
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Factoring Greatest common factors out and factoring by grouping

Multiplying polynomials

Ex. $2x(x+3) = 2x^2+6x$

Factor $2x^2+6x = 2x\left(\frac{2x^2}{2x} + \frac{6x}{2x}\right)$

$= 2x(x+3)$

Factoring tips

- 1st rule in factoring - always check for a GCF
- when you have a variable in common, always factor out the variable raised to the smallest power.
- check multiplying back
- Factor out the GCF

$7x^3+14x^2-21x$

$= 7x(x^2+14x-21)$ — this might factor farther

$9a^4b - 18a^5b + 27a^6b$

$= 9a^4b(1-2a+3a^2)$

$= 9a^4b(3a^2-2a+1)$ — this might factor farther

- Then see if the factors will factor any farther.
  How many terms? 4 terms - try to factor by grouping.

Factor out GCF

$-3x^2 + 6x - 33$

$= -3(x^2 - 2x + 11)$

leading coefficient

or

$= 3(-x^2 + 2x - 11)$

Factor out the GCF

$2w(x+3) - 5(x+3)$

$(x+3)(2w-5)$

Factor out the GCF

$8y(a+5) + 9(a+5)$

$= (a+5)(8y+9)$

Factor

$3ax + 12a + 2bx + 8b$

$= 3a(x+4) + 2b(x+4)$

$= (x+4)(3a+2b)$

check:

$(x+4)(3a+2b)$

$= 3ax + 2bx + 12a + 8b$

- Steps to factoring by grouping - look for GCF first.

(i) Collect the terms into groups so that each group has a common factor.

(ii) Factor out common factor from each group if there is one, otherwise, try to rearrange the terms.

(iii) Now if there is a common factor, factor it out.

Factor

$(xy - xz) + (7y - 7z)$

$= x(y - z) + 7(y - z)$

$= (y - z)(x + 7)$

$b^4 + b^3 - 4b - 4$

$= (b^4 + b^3) + (-4b - 4)$

$= b^3(b + 1) - 4(b + 1)$

$= (b + 1)(b^3 - 4)$

Factor

$ay + bx + by + ax$

Rearrange this

$= (ay + by) + (bx + ax)$

$= y(a + b) + x(b + a)$

$= y(a + b) + x(a + b)$

$= (a + b)(y + x)$

Factor

$15x^4 + 15x^2y^2 + 10x^3y + 10xy^3$

$= 5x[(3x^3 + 3xy^2) + (2x^2y + 2y^3)]$

$= 5x[3x(x^2 + y^2) + 2y(x^2 + y^2)]$

$= 5x(x^2 + y^2)(3x + 2y)$

- 3 terms x^2+bx+c

looking coefficient of 1

Factoring trinomials in the form

x^2+bx+c

Multiply

$(x+5)(x-3)$

$= x^2-3x+5x-15$

$= x^2+2x-15$

$= x^2+bx+c$

$(x-3)(x+5)$

Factor

$x^2+2x-15$

$c=-15$
$1(-15)$
$-1(15)$
$3(-5)$
$-3(5)$

① list all pairs whose product is "c"

② Now find the one pair whose sum is b

$(x\ \square)(x\ \square)$

Factor

$x^2+10x+21$

$=(x+3)(x+7)$

Add	Mult
$b=10$	$c=21$
	$1, 21$
$3+7$	$\leftarrow 3, 7$
	$(-1)(-21)$
	$(-3)(-7)$

Check by FOIL

$(x+3)(x+7)$

$= x^2+7x+3x+21$

$= x^2+10x+21$

Factor

$x^2 + 4x - 45$

$= (x+9)(x-5)$

OR

$(x-5)(x+9)$

Factor

$x^2 - 5x - 14$

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

Factor

$-a^2 + 6a - 8$

$= -(a^2 - 6a + 8)$

$= -(a-4)(a-2)$

check:

$-(a-4)(a-2)$

$= -(a^2 - 2a - 4a + 8)$

$= -(a^2 - 6a + 8)$

$= -a^2 + 6a - 8$

$-3a^2 + 15ab - 12b^2$

$= -3(a^2 - 5ab + 4b^2)$

$= -3(a-4b)(a-b)$