

To Factor an expression means to rewrite it as a product

e.g.

$$(x+2)(x+3) = x^2 + 5x + 6$$

MULTIPLY

FACTOR

Common Factors

ex. $15x^6 - 20x^4 = 5x^4(3x^2 - 4)$

GCF OF COEFFICIENTS

COMMON VARIABLE(S)

RAISED TO LOWEST POWER

ex. $8x^6y^2 + 10x^5y^3 - 6x^4y^6$

(You can check your answers!)

ex. $12x^2(y-1) - 8x(y-1)^2$

ex. $3x(x+1) - (x+1)$

Factoring Trinomials (Quadratics)

Note: $(x+a)(x+b) = x^2 + ax + bx + ab = x^2 + (a+b)x + ab$

$$\Rightarrow x^2 + (a+b)x + ab = (x+a)(x+b)$$

e.g. $x^2 + 7x + 10$ Trial & Error: Find a, b such that

$$a+b=7, \quad ab=10$$

$$= x^2 + (5+2)x + 5 \cdot 2 = (x+5)(x+2)$$

(check!)

ex. $x^2 + x - 6$

ex. $x^2 - 8x - 15$

IF THE COEFFICIENT OF x^2 IS NOT 1:

NOTE: $(px+a)(qx+b) = pqx^2 + agx + bpx + ab = pqx^2 + (ag + bp)x + ab$

$$\Rightarrow pqx^2 + (ag + bp)x + ab = (px+a)(qx+b)$$

e.g. $6x^2 + 7x - 5$

$p = \pm 1 \quad q = \pm 6 \quad a = \pm 1 \quad b = \mp 5$

$p = \pm 2 \quad q = \pm 3 \quad (\text{OR VICE VERSA})$

(OR VICE VERSA)

$$(x+1)(6x-5)$$

$$(x-1)(6x+5)$$

$$(2x+1)(3x-5)$$

$$(2x-1)(3x+5)$$

ex. $12x^2 - x - 6$

$\swarrow \quad \searrow$
 -72
 $\swarrow \quad \searrow$
 $8 \quad -9 = -1$

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

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

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

SPECIAL FACTORING FORMULAS

FACTORING FORMULAS

Formula

$$1. A^2 - B^2 = (A - B)(A + B)$$

$$2. A^2 + 2AB + B^2 = (A + B)^2$$

$$3. A^2 - 2AB + B^2 = (A - B)^2$$

$$4. A^3 - B^3 = (A - B)(A^2 + AB + B^2)$$

$$5. A^3 + B^3 = (A + B)(A^2 - AB + B^2)$$

Name

Difference of squares

Perfect square

Perfect square

Difference of cubes

Sum of cubes

ex. $81x^4 - 16y^8 = (9x^2)^2 - (4y^4)^2 = (9x^2 + 4y^4)(9x^2 - 4y^4)$

$$= (9x^2 + 4y^4)(3x + 2y^2)(3x - 2y^2)$$

ex. $4x^2 + 12xy + 9y^2 = (2x)^2 + 2(2x)(3y) + (3y)^2 = (2x + 3y)^2$