Factoring

<u>Factoring by GCF</u>: Pull out the largest factor that evenly divides into every term.

$5x^2 - 10x$

$5x(x - 2)$

$6y^5 - 4y^3 + 10y^2$

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

Difference of Squares: When you have two terms that are both perfect squares. There must be subtraction.

$x^2 - 16$ $t^2 - 81$ $16t^2 - 49$

$(x + 4)(x - 4)$ $(t + 9)(t - 9)$ $(4t + 7)(4t - 7)$

When you FOIL $(x + 4)(x - 4)$ you get: $x^2 + 4x - 4x - 16$. The +4x and -4x cancel out. That is why one parenthesis has a positive and the other has a negative.

Factoring a trinomial with a = 1: Look for two numbers that multiply to be the last number, c, and add to be the middle number, b.

$x^2 - 7x + 12$

Two numbers that:
Multiply to equal 12,
and add to equal -7
are -4 and -3.

$(x - 4)(x - 3)$

$w^2 + w - 6$

Two numbers that:
Multiply to equal -6,
and add to equal 1
are +3 and -2.

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

$3x^2 + 9x + 6$

Factor the GCF first:

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

Two numbers that:
Multiply to equal 2,
and add to equal 3
are +2 and +1.

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

Factoring with a ≠ 1

If the leading coefficient after factoring the GCF (if possible) is a ≠ 1, then use the "bottoms up" method.

"Bottoms Up" Factoring

Multiply a and c (the first and last numbers).

Re-write the equation with $1x^2$ and ac in place of c..

Factor like normal.

Divide the number in each factor by the value of a in the original problem. Reduce where possible.

If a fraction remains after reducing the fraction, bring the bottom of the fraction up to become the coefficient in front of the x.

$f(x) = 2x^2 - 11x + 12$

$x^2 - 11x + 24$ Multiply a and c: 2×12=24

$(x - 3)(x - 8)$ What multiplies to be +24 and adds to be -11? -3 and -8

$(x - \frac{3}{2})(x - \frac{8}{2})$ Divide both -3 and -8 by a (which is 2)

$(x - \frac{3}{2})(x - 4)$ Reduce the fractions

$(2x - 3)(x - 4)$ Move the remaining denominator up to be the coefficient of the x

$f(x) = 6x^2 + 16x + 8$

$2(3x^2 + 8x + 4)$ Factor the GCF first.

$2(x^2 + 8x + 12)$ Multiply a and c: $3 \times 4 = 12$

$2(x + 2)(x + 6)$ What multiplies to be +12 and adds to be +8? +6 and +2

$2(x + \frac{2}{3})(x + \frac{6}{3})$ Divide both +2 and +6 by a (which is 3)

$2(x + \frac{2}{3})(x + 2)$ Reduce the fractions

$2(3x + 2)(x + 2)$ Move the remaining denominator up to be the coefficient of the x