

STEPS IN FACTORING

1. Factor out the greatest common factor (GCF). (There will **not** always be one).
2. Count the number of terms.

Two terms : Look to see if you have a difference of squares or a sum or difference of cubes.

Difference of squares:

$$X^2 - Y^2 \Rightarrow (X+Y)(X-Y)$$

$$X^2 + Y^2 \Rightarrow \text{PRIME}$$

Difference of cubes:

$$X^3 - Y^3 \Rightarrow (X-Y)(X^2 + XY + Y^2)$$

Sum of cubes:

$$X^3 + Y^3 \Rightarrow (X+Y)(X^2 - XY + Y^2)$$

Three terms : Look for two binomials.

A. Trial and error method:

$$2x^2 - x - 10$$

*Remember! $(A-C)(B+D) = AB+AD-BC-CD$.

The factors of 10 take the place of C and D. The factors of $2x^2$ ($2x$ and x) take the place of A and B.

Try: $(2x - 5)(x - 2)$ or $(2x - 10)(x - 1)$

At this point, you must use trial and error to arrange the factors and signs so that the original trinomial can be obtained by combining the binomials in the FOIL manner.

$$(2x-5)(x+2) = 2x^2 + 4x - 5x - 10 \text{ combine like terms to get } = 2x^2 - x - 10$$

Clues for factoring trinomials by trial and error.

If the sign of the last term is +, the middle sign of the binomials will have the same sign as the second term in the trinomial.

$$\text{Example: } x^2 - 3x + 2 = (x-2)(x-1) \text{ or } x^2 + 5x + 6 = (x+3)(x+2)$$

If the sign of the last term is -, the middle sign of the binomials will be + and-.

$$\text{Example: } x^2 - 5x - 6 = (x-6)(x+1) \text{ or } x^2 + x - 56 = (x+8)(x-7)$$

B. Grouping number method:

$3x^2 - 10x + 8$ 1. Multiply the a term of the coefficient x^2 with the constant c term. You are looking for two numbers that multiply together to get 24 and add together to get 10 in this case.

24	24	24	24	
/\	/\	/\	/\	(-4)(6)=24
1 24	2 12	3 8	<u>-4 6</u>	-4+-6=-10

over...

$3x^2 - 4x - 6x + 8$ 2. Rewrite the problem. Replace the middle term (bx) with $-4x$ and $-6x$.

$3x^2 - 4x - 6x + 8$ 3. Solve by grouping.
a. Pull out a GCF from each group.
 $x(3x-4) - 2(3x-4)$
b. Collect like groups and combine remaining terms.
 $(x-2)(3x-4)$

$3x^2 - 4x - 6x + 8$ 3. Solve by grouping.
a. Pull out a GCF out of each group.
 $x(3x-4) - 2(3x-4)$
b. Collect like groups and combine remaining terms.
 $(x-2)(3x-4)$

Four terms : Factor by grouping method.

A. Grouping Method

$am+an+bm+bn$ 1. Count the terms. Group the first two terms and the last two terms together.
 $(am+an)+(bm+bn)$

$a(m+n)+b(m+n)$ 2. Take out the common factor in the first group and the common factor in the second group.

$(m+n)(a+b)$ 3. Factor out the common factor.

3. Check to be sure each factor is prime, if not, repeat 1-3.

4. Check by multiplying the factors out to see if you get the original polynomial.

REMEMBER!! FACTORING IS UNMULTIPLYING!!