Warm ups

Simplify

1. $-5(x-4)$

   $-5x+20$

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

   x^2+2x-8

3. $(2x-1)(5x+6)$

   $10x^2+7x-6$

4. $(3x-2)^2$

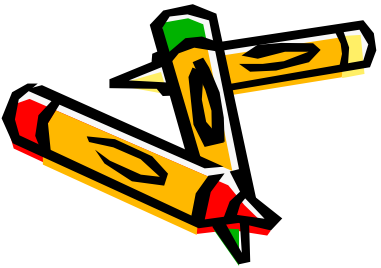
   $9x^2-12x+4$

P5A: Factoring

- Factor out the greatest common factor of a polynomial
- Factor trinomials

Factoring is the opposite of the distributive property.

We are going to undo multiplication.



The first step in factoring is to look for the GREATEST COMMON FACTOR in all of the terms.

The GCF is the largest number that divides into ALL terms evenly.

$2x + 6$

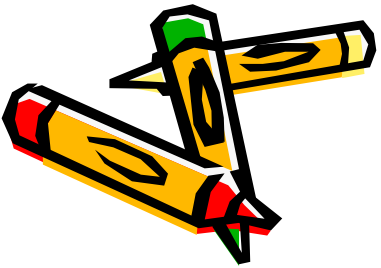
What is the Greatest Common Factor between 2 and 6?

$2(\quad)$

If you answered 2 you are correct! Place that number OUTSIDE the ( )

$2(x + 3)$

Now divide both terms by 2 and place the remainder in the ( ).



Let's look at one more…

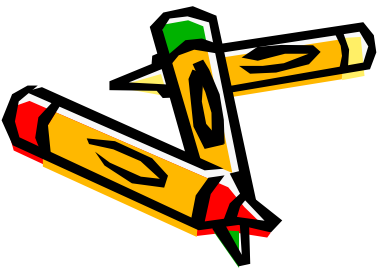
$$3a^4 + 6a^3 - 15a^2$$

What is the GCF for this problem? $3a^2$

Remember that the GCF is in EVERY term and we can include variables!

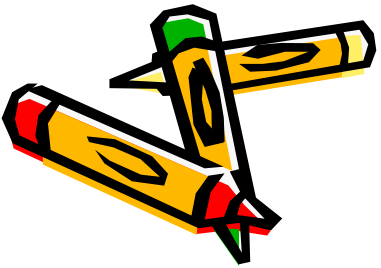
$3a^2($ $)$

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



Steps for Factoring trinomials:

1: Set equation equal to zero
2: Factor out GCF if possible
3: List factor pairs of the leading coefficient
4: List factor pairs of the constant
5: Determine which combination of factor pairs add up to the linear(middle term) coefficient
6: Write 2 binomials with the factors in each ( )
7: Check with FOIL



Factoring trinomials:

$$Ex1: \quad x^2 + 5x + 4$$

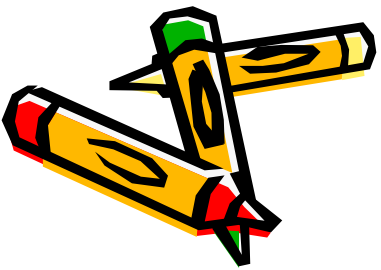
1. List factor pairs of leading coefficient

2. List factor pairs of the constant

$$x^2 + 5x + 4$$

(x +4)(x +1)

3. Check with FOIL



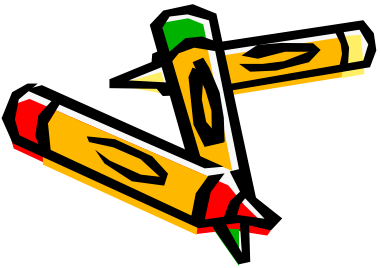
Ex 3: $x^2 - 12x + 27$

$X^2 - 12x + 27$

(x)(x)

What are the factors of 27?
Will they be the same sign
or different? How do we tell?

$$(x-3)(x-9)$$



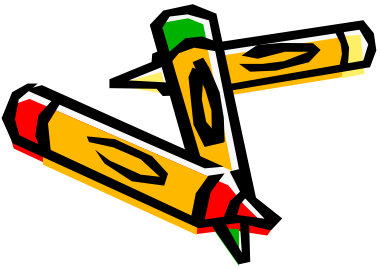
Ex 4: $2x^2-18x-20$

$$2(x^2-9x-10)$$

$$2(x-10)(x+1)$$

-9

Try Ex 5-8 on your own:



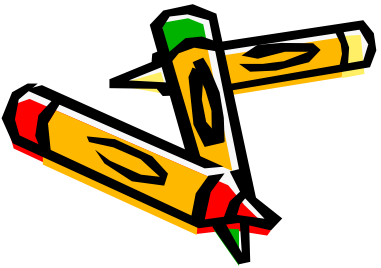
Practice Ex. 5 - 8

5. $2x^2 + 14x$ $2x(x+7)$

6. $3x^2 + 75x + 72$ $3(x+24)(x+1)$

7. $2x^3 - 4x^2 - 48x$ $2x(x-6)(x+4)$

8. $x^2 - 81$ $(x-9)(x+9)$



Example 9:

List the factors of 12:

List the factors of 6:

Same or different signs?

$$12x^2 + x - 6$$

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

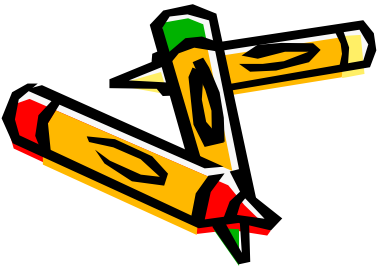
$$(4x+3)(3x-2)$$

Example 10:

$$10x^2 + 21x - 10$$

$$(5x \quad - 2 \;)(\; 2x \quad + 5 \quad)$$

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



P5 B – Factoring

- Factor by grouping
- Factor the difference of squares
- Factor perfect square trinomials
- Factor sum and difference of two cubes
- Use general strategies for factoring polynomials

Factor by Grouping

Example 12: $5x^2 + 15x + 3x + 9$

Step 1: Break the terms into 2 parts – group 1st 2 together and last 2 together

$(5x^2 + 15x) + (3x + 9)$

Step 2: factor each part separately

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

Hint: What's inside the parenthesis should match.

Step 3: Write your answer

$$\boxed{(5x + 3)(x + 3)}$$

Step 4: Check your answer – multiply it out.

$5x^2 + 15x + 3x + 9$

Factor by Grouping

Example 13: $4x^3 - 12x^2 + 7x - 21$

Step 1:

2 groups

$$(4x^3 - 12x^2) + (7x - 21)$$

Step 2:

Factor each group

$$4x^2(x - 3) + 7(x - 3)$$

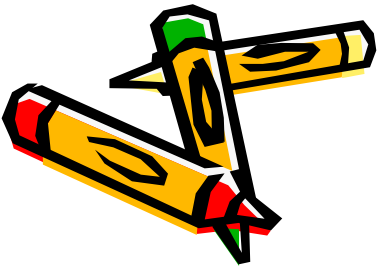
Step 3:

Write answer

$$\boxed{(4x^2 + 7)(x - 3)}$$

Step 4:

Check answer



$$4x^3 - 12x^2 + 7x - 21$$

Special Cases: Factoring a Difference of Squares

Factoring a difference of squares follows the same process as before. Just remember that the middle term is 0x.

$$x^2 - 1$$

$$x^2 + 0x - 1$$

$$(x \quad)(x \quad)$$

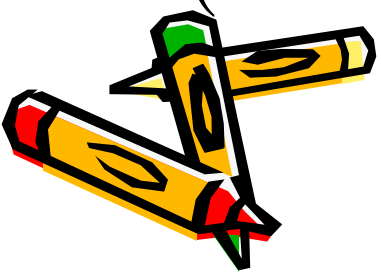
$$(x+1)(x-1)$$

$$x^2 - 9$$

$$x^2 + 0x - 9$$

$$(x \quad)(x \quad)$$

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



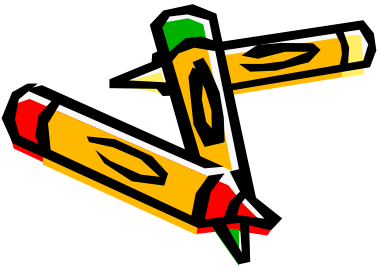
Special Cases: Perfect Square Trinomials

Factoring perfect square trinomials follows the same steps as before.

$$4x^2 - 24x + 36$$

(2x)(2x)

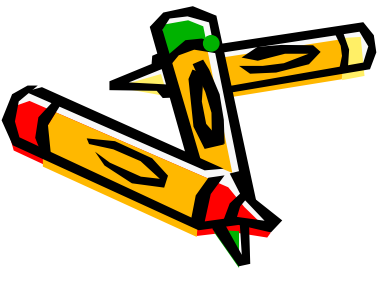
(2x - 6)(2x-6)



Perfect Cubes

- Just like there is a factoring pattern for factoring the difference of 2 squares, there is also a pattern we use to factor the sum or the difference of 2 cubes.
- Sum of 2 cubes
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
- Difference of 2 cubes

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



Sum and Difference of Cubes

- Ex 14 $x^3 - 8$
- Step 1 – find the cube root of the first term which is x ("a" in the pattern) a= x
- Step 2 – find the cube root of the second term which is 2 ("b" in the pattern) b= 2
- Step 3 – plug the "a" and "b" you found into the correct pattern above.

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

- Step 4 – Simplify

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

- Ex 15 $125x^3 - 64y^3$
- Step 1 – find the cube root of the first term ("a" in the pattern)

  $a = 5x$
- Step 2 – find the cube root of the second term ("b" in the pattern)

  $b = 4y$
- Step 3 – plug the "a" and "b" you found into the correct pattern above.
- $(5x)^3 - (4y)^3 = (5x - 4y)((5x)^2 + (5x)(4y) + (4y)^2)$
- Step 4 – Simplify

$$(5x - 4y)(25x^2 + 20xy + 16y^2)$$