Essential Question: How do we factor polynomials?

Do Now: Complete each statement.

a) $8m - 6 = 2(4m - \_\_\_\_\_\_)$ b) $36a^3 + 24a^2 + 12a = 12a(\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_ + 1)$

Factoring Polynomial Expressions

Think about this…

Factoring is the process of representing an expression as a product.

Example: $2 \times 3 = 6$ The numbers 2 and 3 are factors of 6

FACTORS

We can also find the factors of polynomial expressions.

Example: $2(y + 3) = 2y + 6$ The factors of $2y + 6$ are 2 and $y + 3$

Finding factors of a polynomial expression is like "undistributing".

The **factored form** of $2y + 6$ is $\mathbf{2(y + 3)}$.

Factoring Polynomials by factoring out the GCF (Greatest Common Factor)

- **Determine the GCF of all the terms**
- **Divide the polynomial by the GCF**
- **Write as a product: GCF(Quotient)**

Example: Factor $3y^2 + 12y$

1st: Find the GCF of $3y^2$ and $12y$:

2nd: Divide the polynomial by the GCF _______:

3rd: Write as a product:

4th: Check by distributing:

Factor each polynomial by factoring out the GCF.

1) $25a + 15$

2) $3x + 3y$

3) $18x^2 - 12x$

4) $12x^3 + 20x^2$

5) $8m^2 + 20m - 4$

6) $10x^3 + 40x^2 + 100x$

Factoring Trinomials using the AM Method

Simplify each polynomial expression.

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

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

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

d) $(x - 2)(x - 4)$

Factoring a trinomial whose leading coefficient is 1 ($ax^2 + bx + c$, where $a = 1$)

Step 1: Start with 2 sets of parentheses whose first term is ***x***.

Step 2: Identify all pairs of factors that multiply to the ***c*** value (last term).

Step 3: Determine which pair adds to the ***b*** value (middle term).

Step 4: Place the factors in the parentheses to create the binomials.

Step 5: Check by multiplying the factors (double distribute).

Factor the polynomials below.
Ask yourself, "What numbers MULTIPLY to the last term (c) *and* ADD to the middle term (b)?"

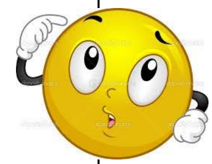
a) $x^2 + 6x + 8$

b) $x^2 - 2x - 8$

c) $x^2 + 2x - 8$

d) $x^2 - 6x + 8$

**Patterns to Notice:



1. If **b** and **c** are both positive, both of the binomials have __________signs.
2. If **c** is negative, one binomial has a _________sign and one has a __________ sign.
3. If **c** is positive and **b** is negative, both binomials have a ___________ sign.

Factor each trinomial.

1) $x^2 + 7x + 10$

2) $x^2 + 6x + 9$

3) $x^2 + x - 6$

4) $x^2 - 7x + 12$

5) $x^2 - 9x + 18$

6) $x^2 + 7x + 6$

7) $x^2 - 3x - 10$

8) $x^2 + 12x + 35$

9) $x^2 - 3x - 4$

Let's try some more challenging examples.

Helpful Hint: Look at the factored form of the polynomials in examples 1, 2 and 3.

10) $x^4 + 7x^2 + 10$

11) $x^4 + 6x^2 + 9$

12) $x^6 + x^3 - 6$

- To __________________ means to create a product.
- Factoring reverses the __________________ property.
- The AM method is used to factor trinomials in the form of $ax^2 + bx + c$ where a = _____.