

Math 1320: Factoring Trinomials

Example 1. Factor to get Prime Factors

$$8x^3 - 8$$

1. Do the terms have a common factor?
2. Can the factors be factored anymore? Let's repeat the process:
 - (a) There are two terms in $x^3 - 1$.
 - i. Is it a difference of squares?
 - ii. Is it a sum of two cubes?
 - iii. Is it a difference of two cubes?

3. Can the factors be factored anymore?

Example 2. Factoring Trinomials: Trial and Error

$$x^2 + 5x + 6$$

1. Find the first two terms in the parentheses:
2. Find the last two terms in the parentheses:
3. Try different combinations of these factors. The sum of the outer and inner products must equal $5x$.

Possible Factorizations

Sum of Outer and Inner Products

Example 3. Box Method

$$3x^2 - 2x - 5$$

1. Factor out any GCF:
2. Multiply the leading coefficient by the constant:
3. Find two numbers (n, m) such that the product is equal to the product found in step 2 and the sum is equal to the coefficient of our x term.

4. Create a 2x2 grid and fill in the boxes as follows:
 - (a) Upper left: leading term of the polynomial
 - (b) Upper right: mx term
 - (c) Lower left: nx term
 - (d) Lower right: constant term of the polynomial

5. Find the greatest common factor of each row and column. Place them outside the grid.

6. The factors of the trinomial are made up of the terms outside of the grid.

Example 4. Diamond Method

$$2x^2 + 11x + 15$$

1. Factor out any GCF:
2. Draw a large diamond (X)
3. Multiply the leading coefficient by the constant:
Place this product in the top quadrant and the coefficient of the x term in the bottom quadrant of the diamond.
4. List all factors of the value found in Step 3:
5. Find the two factors (call them n, m) in step 4, whose sum is equal to the value at the bottom of the diamond (in this example, 11). Place these values in the left and right quadrants of the diamond.
6. Rewrite the original trinomial replacing the x term with the sum $nx + mx$:
7. Factor by grouping:

Practice Problems

Try factoring these polynomials using the methods above. Answers are provided.

1. $9x^3 + 3x^2 + 15x + 5 = (3x^2 + 5)(3x + 1)$

2. $3x^2 - 13x - 10 = (3x + 2)(x - 5)$

3. $2x^2 + 11x - 6 = (x + 6)(2x - 1)$