|  |  |
| --- | --- |
| ***Factoring Trinomials***  **Handout- KEY** | **Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

**Objective: To study how to factor a quadratic trinomial of the form .**

**Segment 1**: Factor Trinomials of the form **, .**

**Factoring is a process of writing an expression in terms of multiplication. To factor a polynomial means to rewrite the polynomial as a product of two or more polynomials.**

**Steps to factor a trinomial of the form**

**Step 1**: Find pair of integers whose product is *c* and whose sum is *b*. That is, determine *m* and *n* such that and .

**Step 2**: Write .

**Step 3**: Check your work by multiplying the binomials.

Note: If you can’t find integer factors it means the polynomial is PRIME (unfactorable).

Example 1: Factor

|  |  |
| --- | --- |
| Integers whose product is 5 | Sum ( -6 ) |
| 1 , 5 | 6 |
| -1, -5 | * -6 |

Answer:

Example 2: Factor = ( )( )

|  |  |
| --- | --- |
| Integers whose product is -9 | Sum (-8 ) |
|  |  |
|  |  |

Answer:

Example 3: Factor

Answer:

Example 4: Factor

Answer: PRIME

Example 5: Factor

**Note:** *Always factor out the* ***Greatest Common Factor*** *first.*

*Also, when a polynomial has a negative leading coefficient, begin by factoring our -1.*

**Segment 2**: Factor Trinomials of the form **, .**

We can think of factoring a trinomial as the opposite of multiplying binomials.

-The product of the **first** terms of the factors equal the first term of the trinomial.

- The product of the **last** terms of the factors equal the last term of the trinomial.

-The sum of the outer and inner products of the factors must equal the **middle** term of the trinomial.

To factor trinomials of this form, we have three methods in this segment that can be used. Read through all the methods and find the method that you think is easiest for you and start applying it.

1. Trial and Error
2. Factoring by grouping
3. Factoring using “Rectangle” method

**Steps to factor a trinomial of the form using Trial and Error**

**Step 1:**  List all possibilities for the first term of each binomial whose product is **.**

**Step 2:** List all possibilities for the last term of each binomial whose product is ***c****.*

**Step 3:** Multiply all the different possibilities until the sum of the outer and inner products of the factors equals the middle term of the trinomial.

**Steps to factor a trinomial of the form using Grouping**

**Step 1**: Multiply the coefficients of the first and last terms: i.e. multiple .

**Step 2**: At the same time, pay attention to the middle term---the sum of the two factors must yield the middle term: i.e. find two integers whose product is *ac* and sum is *b.*

**Step 3**: Rewrite the polynomial by changing the middle term into two separate terms, but leave the first and last terms alone: i. e. replace the middle term *bx* with the sum of difference using the two integers.

**Step 4**: Factor by grouping.

**Step 5**: Check your answer by multiplying the binomials.

**Steps to factor a trinomial of the form using “Rectangle” Method**

-Prepare the “grid rectangle” that will hold the terms. (It consists of 4 smaller rectangles that hold the areas).

First term

-Place first and last terms diagonal from each other

Last Term

- Find factors of that sum up to *b.*

*-*Place those factors in the two empty rectangles as a coefficient of *x.(*Order is not important).

*-*Find the common factors in each row and in each column.

-Answer is found by taking the dimensions of the rectangle.

**Note**: The trinomial represents the area of the rectangle and the factors of the trinomial are the dimensions of the rectangle.

Now, let’s find the dimensions of the rectangle with given area.

Example: Find the dimensions of the rectangle with given area (i.e. factor the trinomial).

Area = 

-Prepare the grid and place the first and last terms diagonal from each other





-Find factors of that sum up to *17* and place those factors in two empty rectangles*.*

The factors go as coefficients of *x* and the order is not important.









or









-Find the common factors in each row and in each column.









- Answer is found by taking the dimensions of the rectangle.





- Answer is .

**Note:** Before you start factoring trinomials with one of the methods discussed in Segment 2, *always factor out the* ***Greatest Common Factor*** *first.*

*Also, when a polynomial has a negative leading coefficient, begin by factoring our -1.*

Example 6: Factor Answer:

Example7: Factor Answer:

Example 8: Factor Answer:

Example 9: Factor Answer: PRIME