# Student Instruction Sheet: Unit 1, Lesson 4

## Factoring Trinomials and the Difference of Squares

Suggested Time: 75 minutes

**What's important in this lesson:**

In this lesson, you will learn how to factor trinomials and the difference of squares.

**Complete these steps:**

1. Read through the lesson portion of the package on your own.
2. Complete the exercises.
3. Check your answers with the Answer Key that your teacher has.
4. Seek assistance from the teacher as needed.
5. Complete the Assessment and Evaluation and hand it in. Be sure to ask for assistance if you need it.

**Hand in the following:**

1. Student Handout
2. Assessment and Evaluation sheet

**Questions for the teacher:**

# Student Handout: Unit 1, Lesson 4

## Topic 1: Factoring Trinomials

A **simple trinomial** begins with "$x^2$" and is followed by a term containing "$x$" and then a constant. A trinomial can be rewritten as the product of two binomials **if you find:**

**Two numbers** that **add** to the coefficient of the $x$ term, and **multiply** to the constant.

Example: $x^2 + 3x + 2 = (x + 2)(x + 1)$ where 2**+**1=coefficient, and 2**x**1=constant

Before trying to **factor** simple trinomials, look for patterns that occur when two binomials are multiplied together.

Example 1: $(x + 3)(x + 5)$
$= x^2 + 5x + 3x + 15$
$= x^2 + 8x + 15$

Example 2: $(x - 3)(x - 5)$
$= x^2 - 5x - 3x + 15$
$= x^2 - 8x + 15$

Notice that in the first example, the + 3 and + 5 are **added together** to make the + 8 for the coefficient in the middle term, and are **multiplied together** to make the + 15 for the constant term.

In the second example, the – 3 and – 5 are **added** together to make the – 8 for the coefficient of the middle term and are **multiplied** together to make the + 15 for the constant term.

Example 3: $(x + 3)(x - 5)$
$= x^2 - 5x + 3x - 15$
$= x^2 - 2x - 15$

Example 4: $(x - 3)(x + 5)$
$= x^2 + 5x - 3x - 15$
$= x^2 + 2x - 15$

Once again, in the last two examples, the last numbers from each binomial are **added** together to get the coefficient of the middle term in the trinomial and are **multiplied** together to get the constant term. As long as the first term in each binomial is just $x$, we will always get $x^2$ as the first term in the trinomial.

**You try: Practice** finding pairs of numbers that have the correct sum and product.

**[a]** Find two integers that add to 8 and have a product of 12:

| + 8 | x 12 | |
|---|---|---|
| 1 + 7 = 8, | but 1 x 7 = 7 | no |
| 3 + 5 = 8, | but 3 x 5 = 15 | no |
| 4 + 4 = 8, | but 4 x 4 = 16 | no |
| 2 + 6 = 8, | and 2 x 6 = 12 | yes |

The two integers are 2 and 6.

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**Practice:**
**[b]** Find two integers that add to +2 and multiply to -15.

To get the negative product, we need one positive and one negative integer.

| +2 | x -15 | | |
|---|---|---|---|
| 3 + (-1) = 2, | but 3 x (-1) = -3 | no | |
| 4 + (-2) = 2, | but 4 x (-2) = -8 | no | |
| 5 + (-3) = 2, | and 5 x (-3) = -15 | yes | The two integers are 5 and -3. |

When we are asked to **factor** a simple trinomial, we have to rewrite the expression as the product of two binomials.

Example 5: Factor $x^2 + 7x + 10$.

We need to find two integers that add to 7 and multiply to 10.
The integers are 2 and 5.

$x^2 + 7x + 10$
$= (x + 2)(x + 5)$

The two integers are placed in the brackets to create the factors.

Example 6: Rewrite $x^2 - 12x + 20$ as the product of two binomials.

We need to find two integers that add to -12 and multiply to 20.
(Both numbers have to be negative when the middle number is negative!)

$x^2 - 12x + 20$
$= (x - 2)(x - 10)$

Example 7: Factor $x^2 + 3x - 28$.

$x^2 + 3x - 28$
$= (x + 7)(x - 4)$

Example 8: Rewrite $x^2 - x - 30$ as the product of two binomials.

$x^2 - x - 30$
$= (x - 6)(x + 5)$

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## Topic 2: Factoring a Difference of Squares

A Difference of Squares is a binomial that begins with $x^2$ and is followed by a minus sign and a number that is a perfect square. (e.g., $x^2 - 16$).

Perfect squares are 1(1 times 1), 4(2 times 2), 9(3 times 3), 16, 25, 36, 49, etc.
Difference of Squares are special cases of a product of two **binomials**. When we multiply two binomials that have *opposite* integers in their brackets, we find that the middle terms add together to make 0.

Example 1: $(x + 3)(x - 3)$
$= x^2 - 3x + 3x - 9$
$= x^2 - 9$

If we are asked to factor a Difference of Squares, we can think of it as trying to find two integers that add to 0 and multiply to a negative number.

If two integers add up to 0, they must be opposite integers (+3 and -3, or +7 and -7).
We can find the numbers we need by taking the **square root** of their product.

Example 2: Factor $x^2 - 16$.

We need two integers that add to 0 and multiply to -16.

$x^2 - 16$
$= (x + 4)(x - 4)$

The square root of 16 is 4, and its opposite -4.

Example 3: Rewrite $m^2 - 49$ as the product of two binomials.

$m^2 - 49$
$= (m + 7)(m - 7)$

The square root of 49 is 7, and its opposite -7.

Whenever you are given a question that asks you to factor an expression, you should always check:
1. See if there are any common factors for all the terms. If there are, you should common factor the expression.
2. Then look inside the bracket to see if what's left can be factored as a trinomial or difference of squares.
3. If the expression doesn't have a common factor, just use one of the skills from this lesson.

# Assessment and Evaluation: Unit 1, Lesson 4:

1. Find two numbers that will follow the rule for each.

[a] add to 11 and multiply to 24
+11 x24

: ____ , _____

[b] add to 3 and multiply to -40

: ____ , _____

[c] add to -7 and multiply to -18

: ____ , _____

[d] add to -10 and multiply to 24

: ____ , _____

2. Rewrite each simple trinomial as the product of two binomials.

[a] $x^2 + 6x + 5$ [b] $x^2 - 7x + 12$ [c] $x^2 + x - 20$

[d] $x^2 - 10x + 25$ [e] $x^2 - 3x - 10$ [f] $x^2 + 7x - 30$

[g] $x^2 + 12x + 36$ [h] $x^2 - 10x + 16$ [i] $x^2 - 11x - 60$

3. Rewrite each difference of squares as the product of two binomials.

[a] $x^2 - 4$ [b] $x^2 - 64$ [c] $x^2 - 81$

[d] $x^2 - 25$ [e] $x^2 - 100$ [f] $x^2 - 1$

4. Factor each expression.

[a] $x^2 - 4x + 3$ [b] $x^2 - 121$ [c] $x^2 + 22x + 121$