Factoring Trinomials 2

Math Objectives

- Students will factor trinomials of the form $x^2 + bx + c$ where the linear term, b, has a negative integer coefficient and the constant term, c, is a positive integer.
- Students will use an area model to factor trinomials of this form.
- Students will generalize the process for factoring trinomials of this form.

Vocabulary

- factor trinomials

About the Lesson

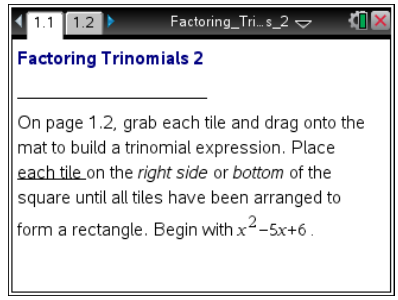
- This lesson involves factoring trinomials using a dynamic area model. As such, it is implicit that x is a positive quantity, and therefore $-x$ is a negative number and is represented by a darker tile. As a result students will factor trinomials of the form $x^2 + bx + c$ by recognizing that the factors of c must add up to b when the trinomial is factored.
- In the process, students may encounter the notion of subtraction as "adding the opposite."

Lesson Setup

- This lesson should follow Factoring Trinomials Part 1, where students have become familiar with the approach in the .tns file.
- A classroom demonstration may be helpful.

TI-Nspire™ Navigator™ System

- Use Quick Poll to check student understanding.
- Use Screen Capture to examine patterns that emerge.
- Use Live Presenter to engage and focus students.



TI–Nspire Technical Skills:

- Open a document
- Move from one page to another
- Grab and drag an object

Tech Tips:

- Download a TI-Nspire document.
- Make sure the font size on your TI-Nspire handheld is set to Medium.

Lesson Materials:

Student Activity

- Factoring_Trinomials_2_Student.pdf
- Factoring_Trinomials_2_Student.doc

TI–Nspire document

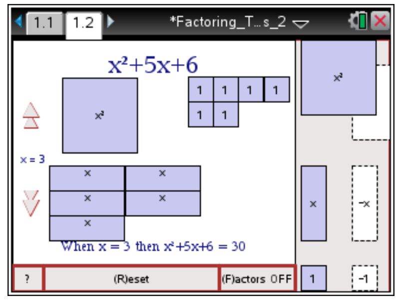
- Factoring_Trinomials_2.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Move to page 1.2.

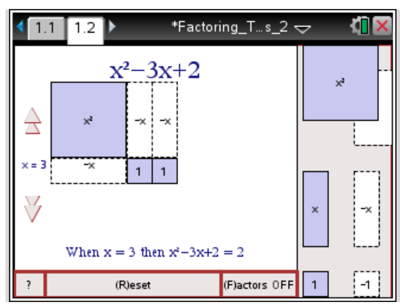
Follow along as your teacher shows how to move the tiles to factor the trinomial $x^2 - 5x + 6$. The white tiles represent negative numbers. The darker tiles represent positive numbers.



Tech Tip: This approach is unique to the TI-Nspire. The white tiles represent negative numbers, and the darker tiles represent positive numbers. As the tiles are placed on top of each other, the areas of the white and dark tiles cancel each other out. This is illustrated removing both the positive and negative numbers.

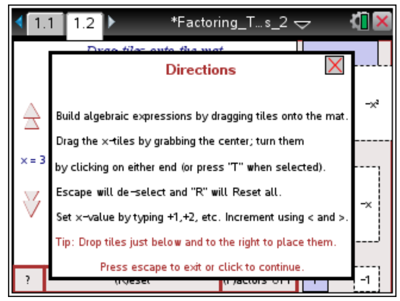
If students experience difficulty dragging a tile, check to make sure that they have moved the cursor arrow close to the tile. The arrow should become a hand ( ) getting ready to grab the point. They should press ctrl to grab the tile and the hand will close. After the tile has been moved, press they press esc to release the point.

Teacher Tip: Students will need to understand how the white tiles are used. Each time white tiles are placed both horizontally and vertically, the intersection of those two tiles has been subtracted two times, so needs to be "filled in" with a small dark color square. If students have completed Factoring Trinomials Part 1, remind them of the relationships between the factors and the values of *b* and *c*. Encourage discussion, and see if students can build from the prior activity to make sense of this related but new setting.



Teacher Tip: Begin by demonstrating how to factor the trinomial $x^2 - 5x + 6$ with the tiles using Live Presenter. When you position the $-x$ tiles on the x^2 tile, the overlapping area of the x^2 tile disappears, leaving a dotted outline of the lost area. Similarly, a dark unit tile will cancel a white unit tile. Discuss why the dimensions of the rectangle correspond to the factors of the trinomial. Students might complete a rectangle with pieces left over—for example, $(x - 1)(x - 3) + -x + 1$.

Arrange the tiles to construct the trinomial $x^2 - 3x + 2$.

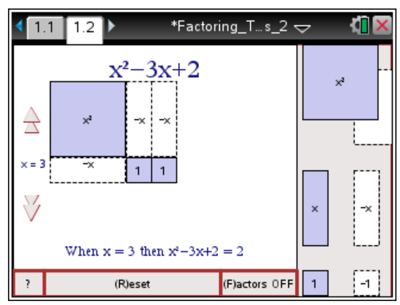


TI-Nspire Navigator Opportunities

Select a student to be the *Live Presenter* to illustrate how to do parts 1a and 1b.

1. a. Arrange the tiles to form a rectangle with area $x^2 - 3x + 2$.

   <u>Answer:</u> The correct answer appears on the screen once the correct factors are identified.



   b. What are the dimensions of the rectangle?

   <u>Answer:</u> The dimensions of the rectangle are $x - 1$ and $x - 2$. (The order of the dimensions—factors—is irrelevant.)

Click the Reset box in the lower left portion of the screen.

TI-Nspire Navigator Opportunities

Select a student to be the *Live Presenter* to illustrate how to do part 2a.

2. For each of the following, move the correct tiles to the mat.

   a. Factor the trinomial $x^2 - 7x + 6$ by arranging the tiles to make a rectangle. Verify that your answer is correct by finding the product of the factors.

   Answer: $(x-6)(x-1) = x^2 - 6x - x + 6$
   $= x^2 - 7x + 6$

TI-Nspire Navigator Opportunities

Take a *Screen Capture* of all students' work and show the different answers to part 2b. Hopefully, each of the three correct solutions is illustrated. Discuss these.

   b. Three trinomials have the form $x^2 + bx + c$ where $-9 \le b \le -1$ and $1 \le c \le 12$. The large rectangle is a square. Find one of these trinomials. Show that the product of the sides of the square will produce this trinomial.

   Sample Answers: $x^2 - 2x + 1 = (x - 1)(x - 1)$
   $x^2 - 4x + 4 = (x - 2)(x - 2)$
   $x^2 - 6x + 9 = (x - 3)(x - 3)$

   Students should multiply the factors to produce the trinomial they have selected.

3. Sali factored the trinomial $x^2 - 6x + 6$. His answer was $(x - 4)(x - 2)$. Tell whether he was correct or incorrect and why.

   Answer: He was not correct. You only have 6 unit tiles and you need 8, as becomes clear when you use the tiles. He created the expression $(x - 4)(x - 2) - 2$.

TI-Nspire Navigator Opportunities

Have students submit their answers to factoring each of the trinomials in part 4a, one at a time. Discuss the solutions as necessary. Assess how students are doing.

4. a. Find the factors of each of the following trinomials.

Answers:

Trinomial	Factored Form
$x^2 - 8x + 7$	$(x - 7)\ (x - 1)$
$x^2 - 11x + 18$	$(x - 9)(x - 2)$
$x^2 - 14x + 40$	$(x - 10)(x - 4)$
$x^2 - 26x + 48$	$(x - 2)(x - 24)$

b. How can tell whether you have factored each trinomial correctly?

Answer: You can multiply or demonstrate using the tiles on the handheld.

5. Suppose $x^2 - bx + c = (x - m)(x - n)$. How are m and n related to b? How are they related to c?

Answer: $m + n = b$ and $m \times n = c$

Teacher Tip: During the wrap up, draw attention to this question to ensure the students have learned and understand the procedure for factoring this type of trinomial.

6. Compare the method used in this lesson with the one used to factor trinomials with all positive terms. Would the method from this lesson work on the trinomial $x^2 + 2x - 8$? Explain.

Answer: The two methods are the same. The only difference between this trinomial and others encountered earlier is that the linear term is negative. Thus, the factors of –8 need to “add up” to +2. The possible factors would appear to be –1 and +8; +1 and –8; –2 and +4; and +2 and –4. However, only one pair of factors, –2 and +4, would yield the trinomial $x^2 + 2x - 8 = (x + 4)(x - 2)$.

Teacher Tip: Although the methods are the same, attention should be given to the fact that the factors of the constant term will need to yield a negative sum to satisfy the coefficient of the linear term.

Wrap Up

Upon completion of the discussion ensure that students understand:

- How to factor trinomials of the form $x^2 + bx + c$ where b is a negative integer and c is a positive integer.
- The relationship between an area model and factoring trinomials.
- The relationship between b and c and the constant terms in the factors of the trinomial.