

The Box Method

ID: 12511

Time required
15–20 minutes

Activity Overview

Students will discover how to factor a quadratic function using the Box Method. This activity is an advanced concept for beginning algebra students, and should not be taught as the only way to factor quadratics.

Topic: Factoring by the Box Method

- Organizing in a particular way so that the student can obtain a pair of binomial factors for an otherwise difficult polynomial to factor.

Teacher Preparation and Notes

- Teachers should work all the way through the file more than once before using this activity with students with a variety of polynomials to factor. Avoid very basic quadratics where students would be better off recognizing a pattern or factoring out a GCD prior to the factoring process.
- Working with Algebra Tiles by hand or through interactive Web sites would be very helpful. Visualizing the dimensions of a rectangle that are binomial expressions will help the student to understand the concept more thoroughly.
- Students will utilize a spreadsheet and the GCD feature in the Calculator application, and store numeric values as variables for use in creating the binomial factors. An explanation of what the GCD is and why you are using it will help students through parts of this activity.
- This file can be used for any factorable quadratic by editing the initial values for a , b , and c on the first page of the file. If numbers become too large, some crowding will occur on various screens of the file.
- **To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter “12511” in the quick search box.**

Associated Materials

- *BoxMethod_Student.doc*
- *BoxMethod.tns*
- *BoxMethod_Soln.tns*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Learning Algebra Using a Variety of Tools (TI-Nspire CAS technology)* — 8513
- *Reviewing Factoring Quadratics (TI-84 Plus and TI-Navigator)* — 8790
- *Exploring Graphs and Factors (TI-84 Plus)* — 6328
- *Exploring Graphs of Quadratics in Factored Form (TI-Nspire CAS technology)* — 9148

Activity

Students will work through factoring the quadratic equation $12x^2 - 13x - 4$ using the Box Method.

Students are asked to place the quadratic term and the constant term into the 2×2 table on their worksheets. The terms will appear on page 1.3 and throughout the document.

The product $ax^2 \cdot c$ is found for this example: $12x^2 \cdot -4 = -48x^2$. Students will work with just the coefficient of this term for the next few steps. Remind them not to forget about the variable.

The spreadsheet is set up for students to enter a number in the first column that is (or could be) a factor of -48 .

Students can experiment with negative and positive factors until a pair is found that adds up to the middle term, cx ($-13x$ in this example).

Students will store d and e for future use. This is important for the file to work properly.

Observe where these values appear in the box. Students should update the chart on their worksheets at this time.

Now that the chart is filled, students must think about factoring out the greatest common factors in each row and column of the box.

Pages 1.7–1.8 are used to find the GCD of each pair of terms. On page 1.9, that number (without the x variable) will appear next to the row or beneath the column from which it came.

Once the “factors” appear outside of the box, lined up with each row and column, observe how each is indeed the GCD of the two numbers, and will also contribute to the factorization of the original polynomial.

Finally, students are asked to check the factorization by multiplying the pair of binomials. Be aware that there could be some necessary adjustments with negative signs if they were left out earlier.

Additional Practice

The student is encouraged to return to page 1.3 and try some problems for additional practice. If the student proceeds through the file in the same way as previously, the factorization of each polynomial will be discovered. Again, make special note when negative factors are required. Adjustments can be made at any point in the file if you wish to store a negative value for a variable.

Note 1: To change the values of *a*, *b*, and *c*, either double click on the values on page 1.3 or on a *Calculator* application, type **a:=** followed by the value, etc.

Note 2: After each different expression, students should reset the values of *d*, *e*, *f*, *g*, *h*, and *j* using the *Calculator* application on page 1.11.

1. $10x^2 + 17x + 3 = (5x + 1)(2x + 3)$
2. $9x^2 + 9x - 4 = (3x + 4)(3x - 1)$
3. $8x^2 + 22x + 5 = (4x + 1)(2x + 5)$
4. $6x^2 + 29x - 5 = (6x - 1)(x + 5)$