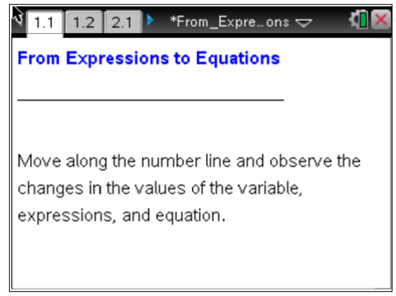


Math Objectives

- Students will recognize the difference between evaluating an **expression** and solving an **equation**.
- Students will recognize that an expression cannot be true or false for any value of the **variable** while an equation can be true or false depending on the values of the variable.
- Students will substitute replacements for the variables in an equation to find the solution.
- Students will recognize that an equation is composed of two expressions.
- Students will use appropriate tools strategically (CCSS Mathematical Practices)

Vocabulary

- expression
- equation
- variable

About the Lesson

- This lesson involves substituting values for variables, evaluating expressions, and solving equations. The emphasis is on helping students understand that an expression and an equation are two distinctly different **mathematical objects**.
- Students will slide a point attached to an arrow along a number line. They will be asked to observe the changes that take place in the expression or equation as the value of the variable changes.
- As a result, students will make conjectures about the connection between the values being substituted in the expression or equation and the outcomes.

TI-Nspire™ Navigator™ System

- Send out the *From_Eexpressions_To_Equations.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: TI-Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software

Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:
Student Activity

- From_Expressions_To_Equations_Student.pdf
- From_Expressions_To_Equations_Student.doc

TI-Nspire document

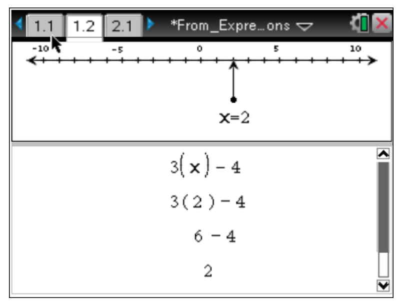
- From_Expressions_To_Equations.tns

Discussion Points and Possible Answers

Tech Tip: If students experience difficulty dragging a point, check to make sure that they have moved the cursor (arrow) until it becomes a hand ( ) getting ready to grab the point. Also, be sure that the word point appears. Then select ctrl to grab the point and close the hand ( ). When finished moving the point, select esc to release the point.

Tech Tip: If students experience difficulty dragging a point, check to make sure that they have placed their fingertip directly on the point. Students should avoid double tapping the screen in that location, as that action will bring up a menu of formatting options.

Move to page 1.2.



1. Describe something that changes as you move the point to the right or left on the number line.

   Sample Answer: The value of *x*; the value in the parentheses below the box; the product in the first line under the box; the final value of the expression.

Teacher Tip: You might choose to instruct students to name a specific number of things that change as they drag the point to the left or right. The other alternative is to have students name at least one thing that changes and then compare answers in a group or with the whole class.

2. If the value of the expression is 20, what is the value of *x*?

   Answer: $x = 8$

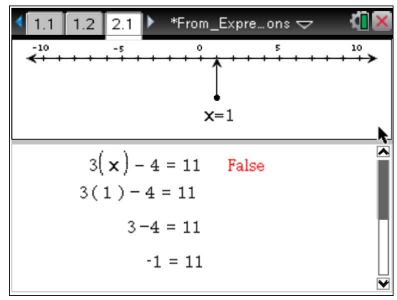
TI-Nspire Navigator Opportunity: *Quick Poll*
See Note 1 at the end of this lesson.

Teacher Tip: There is only one solution. For values of x greater than 8, the values of the expression are greater than 20. For values of x less than 8, the values of the expression are less than 20. For this expression, the value of the expression increases as the value of x increases.

3. If the value of the expression is -25, what is the value of x?

Answer: $x = -7$

Move to page 2.1.



4. What looks the same as the previous page? What looks different?

Answer: The number line is the same and the left side looks the same as the expression on page 1.2. There is a ≠ symbol on this page and the word "false." There is also a constant number on the right-hand side.

Teacher Tip: Emphasize that the = or ≠ symbol indicates the validity of the relationship between the two sides for each integral value of x. Also, the students might observe that the ≠ symbol separating the expressions changes to an equals sign when $x = 5$.

5. As you move the point, what changes? What stays the same?

Answer: As you move the point, the value of x changes, and the value of the expression on the left side of the equation changes. Also, the word "false" in the center changes to "True" when the expression on the left side of the equation has a value of 11. The value on the right side of the equation remains 11.

TI-Nspire Navigator Opportunity: *Quick Poll*
See Note 2 at the end of this lesson.

6. Find a value of x to make the equation true. Describe the process you used.

   Sample Answer: $x = 5$; A response might be: "I moved the point until the left side had a value of 11 and then I saw that the arrow was pointing to 5. In addition, when $x = 5$, there is an = between the two expressions."

   > **Teacher Tip:** The teacher might need to guide the students to see that when the value of the expression on the left side is 11 and the constant on the right side of the equation is the same, the equation is true. One should also stress that if a value makes an equation true, then that value is the solution to the equation. Students might describe their process in a number of ways; hence answers may vary but should somehow convey that they moved the point along the number line until they noticed that the value of the expression on the left was equal to 11.

7. Is that the only value of x that makes the equation true? Justify your answer.

   Sample Answer: Yes, when $x = 5$, the equation was true. When I moved x to the right of 5, the values of the expression were greater than 11. The expression value increased by 3 units each time I moved x to the right of 5. When I moved x to the left of 5, the values of the expression were less than 11. They decreased by 3 units each time I moved x to the left 1 unit.

8. The statement $3(x) + -4 = 11$ on page 2.1 is called an equation. The left side of the equation, $3(x) + -4$, is called an expression.

   a. What is the difference between an expression and an equation?

      Answer: An equation has two sides joined by an equal sign. An expression doesn't have an equal sign. Depending on the value substituted for the variable, an equation can be true or false. An expression does not have a truth value.

   b. Write an example of each.

      Answer: Equation: $2x + 2 = 5$; Expression: $2x + 2$

Teacher Tip: Possible answers can be as simple as the statement that an expression does not have an equal sign and an equation does. Or, they might state that an expression has only one side while an equation has two sides. Ideally, the students will discover that an expression has many possible replacement values and outputs, but with an equation you are looking for the value that can be substituted for the variable to make the statement true. It is recommended that the teacher have the students share some of their examples by writing them on the board for all to see. Ask students to compare the different examples and to describe the similarities and differences.

9. What does it mean to solve an equation?

   Answer: To solve an equation means to find the value for the variable that makes both sides of the equation have the same value.

10. Why can't an expression be solved?

    Answer: You can't solve an expression because there isn't an = sign, and you get many different values for the expression depending on the replacement for the variable.

Teacher Tip: An expression cannot be solved because while there are an infinite number of values that can be substituted for the variable, the results will never be true or false.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students are able to:

- understand the difference between an expression and the equation beyond the visual fact that one has an equal symbol and one does not
- understand that expressions cannot be true or false, no matter what replacement is used for the variables
- understand that when an equation of the type explored in this activity is solved you will find a value that will make the sentence a true statement

TI-Nspire Navigator

Note 1

Question 2, *Quick Poll*: Use Quick Poll to see what value of *x* each student found to make the expression equal to 20. If a student has trouble finding that value, use a 3-choice Quick Poll to ask students "When the *x*-value increases what happens to the value of the expression?" (increases, decreases, or stays the same) and "When the *x*-value decreases?" (increases, decreases, or stays the same).

Note 2

Question 4, *Quick Poll*: Use an open response Quick Poll to see what value of *x* each student found to make the equation true. There is only one value. Make sure that every student has found the value before moving on in the lesson.