Math Objectives

- Students will use substitution to evaluate an algebraic expression.
- Students will determine the role of the coefficient and the constant term in an expression.
- Students will identify patterns and make generalizations based on observations when values are substituted into an expression.
- Students will use appropriate tools strategically (CCSS Mathematical Practice).

Vocabulary

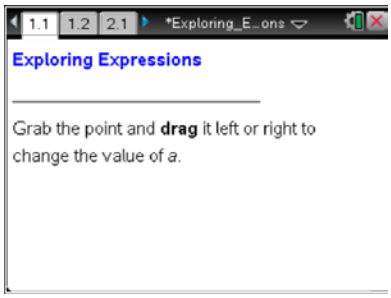
- coefficient
- constant term
- linear equation

About the Lesson

- This lesson involves substituting values for variables, and evaluating expressions. 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 and be asked to observe the changes that take place in the expression 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 and the outcomes.
- The lesson could lead to solving a **linear equation** in one variable or be extended to generating a table of solutions for a linear equation in two variables.

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™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handhelds is set to Medium.
- You can hide the function entry line by pressing ctrl G.

Lesson Materials:

Student Activity

Exploring_Expressions_Student.pdf

Exploring_Expressions_Student.doc

TI-Nspire document

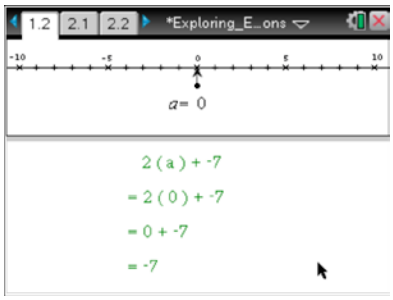
Exploring_Expressions.tns

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

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 press ctrl ☜ to grab the point and close the hand (✊). When finished moving the point, press esc to release the point.

Move to page 1.2.



1. As you grab the point and move the arrow beneath the number line, what numbers change? What numbers stay the same?

   Answer: The value of *a,* the value in the parentheses below the box, the product in the first line under the box, and the final value of the expression all change. The 2 and the –7 stay the same.

2. Move the point until $a = 4$. How does the value of the expression $2(a) + -7$ change as you move the point from $a = 4$ to $a = 5$?

   Answer: The value increases by 2.

3. What value of *a* would make the expression exactly equal to 0?

   Answer: The value of the expression is 0 when $a = 3.5$.

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

Read page 2.1. Then, move to page 2.2.

4. Move the two points so that a is positive ($a > 0$) and b is positive ($b > 0$):
   a. Is the value of the expression $5a + 4b$ positive or negative?
      Answer: Positive

   b. Is this true for all positive values of a and b? Why or why not?
      Answer: Yes, because you're finding the products and sum of positive numbers.

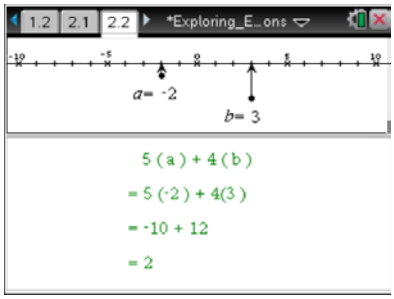
5. Move the two points so that a is negative ($a < 0$) and b is negative ($b < 0$):
   a. Is the value of the expression $5a + 4b$ positive or negative?
      Answer: Negative

   b. Is this true for all negative values of a and b? Why or why not?
      Answer: Yes, because the product of a positive and a negative is negative. And then you're finding the sum of negative numbers.

6. Is it possible for the value of $5a + 4b$ to be negative if a and b have opposite signs? Why or why not?
   Answer: Yes it is possible for $5a + 4b$ to be negative. For example, this is true when $a = -3$ and $b = 1$.

> **Teacher Tip:** Students can choose other examples to illustrate when this is true.

7. Move the points so that $a = -2$ and $b = 3$
   a. If the value of a is increased by 1, how does the value of $5a + 4b$ change?
      Answer: It increases by 5.



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

b. Would your answer to part 7a still be the same if you started at a different value of *a*? Why do you think so? Explain your answer.

Answer: Yes, it would still be true because any value of *a* is multiplied by 5, so an increase of 1 in the value of *a* will increase the value of the expression by 5.

8. Move the points so that $a = -2$ and $b = 3$:
   a. If the value of *b* is increased by 1, how does the value of $5a + 4b$ change?

   Answer: It increases by 4.

   b. Would your answer to part 8a still be the same if you started at a different value of *b*? Why do you think so? Explain your answer.

   Answer: Yes, it would still be true because any value of *b* is multiplied by 4, so an increase of 1 in the value of *b* will increase the value of the expression by 4.

9. If you had the expression $3a + 4b$ and increased the variable *a* by 1, how would the value of the expression change?

   Answer: It would increase by 3.

10. Is it possible to write an expression for which an increase in the value of *a* would cause the value of the expression to decrease? If so, give an example of such an expression. If not, explain why it is not possible.

    Answer: Yes, if the coefficient of *a* is negative, an increase in the value of *a* would cause the expression to decrease. $-2a + 3b$ is one example.

Wrap Up:

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

- Determine the role of the coefficient and constant in an expression.
- Evaluate expressions with one or more variables.

TI-Nspire Navigator

Note 1

Question 3, *Quick Poll*: Using Open Response, have students submit their answers to question 3.

Note 2

Question 7, *Quick Poll*: Using Open Response, have students submit their answers to questions 7a, 8a, and 9.