Balancing Equations

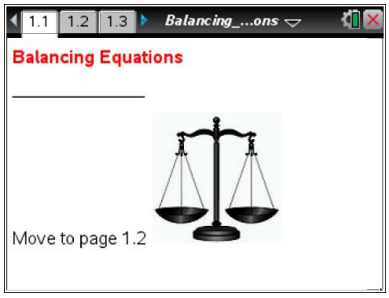
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Balancing_Equations.tns.*

In this activity, you will focus on solving linear equations with one variable. Initially, you will use a graph along with a scale balance to find a solution visually. Then you will use algebraic techniques and the idea of keeping equations balanced or equivalent to find a solution.



Move to page 1.3.

1. Before you begin balancing equations, describe the various items you see on Page 1.3.

2. Click on the slider to change the value of *x.*
   a. Describe what happens when you change the value of *x*. What happens with the points on the lines? What happens to the balance? What happens with the equations at the bottom of the screen?

   b. How are the changes you described in part a related?

   c. What values for *x* make the equation true?

   d. How many values of *x* make the equation true? How does the graph support your answer?

   e. For what values of *x* is the left-hand expression less than the right-hand expression? How does the graph support your answer?

Move to page 1.4.

3. Press enter to solve the equation $3x - 5 = x + 1$.

Tech Tip: To access the keyboard, tap the middle of the page.

- To find a solution to the equation algebraically, you want to change $3x - 5 = x + 1$ to a simpler, but equivalent form so that eventually your equation is $x = a$, where a is the solution.
- As you make the changes to the original equation, $3x - 5 = x + 1$, be sure the new form of the equation is equivalent to the original. Another way to think about this is to keep both sides of the equation "balanced" as you make your changes, so that the transformed equation is also a true statement for the same value of x.
- You will use the addition, subtraction, multiplication, and division Properties of Equality to transform your equation until it appears in its simplest form "$x = a$".

a. In the pop-up screen, you are asked to provide an operation (addition, subtraction, multiplication, or division) and a numeric value or a variable. Whatever you enter will be done to **both sides** of your equation to maintain the balance. If your final goal is to change $3x - 5 = x + 1$ into the simpler form $x = a$, you might want to try adding 5 to both sides of the equation. Predict what changes will happen to the equation if you add 5 to both sides.

b. After you have made your prediction, enter + 5 into the box, press enter. Was your prediction correct?

c. You are getting closer to your goal of creating a simpler equation of $x = a$. What do you want to try next? Discuss your decision with a partner to convince him/her that you are making an **efficient** choice. In other words, your choice will help you find a solution in as few steps as possible.

d. Once you and your partner have agreed on a decision, enter the operation into the box, press enter, and verify that your thinking is appropriate.

e. Continue with this process of deciding what to do next, convincing your partner of your thinking, and entering your decision until you finally arrive at an equation of $x = a$. Your final screen will tell you that you have found the correct solution.

f. Does the final solution you found algebraically match the solution you found graphically? Should it? Explain your thinking.

Move to page 2.1.

4. Now you will be asked to explore several other equations, first using a visual approach and then using an algebraic approach. Use the ***prob*** slider on the Page 2.2, and press ▲ or ▼ to create a new equation. Find a solution to the new equation both graphically (on Page 2.2) and algebraically (on Page 2.3). Write below how you found your solution algebraically for several different equations.

Equation: Solution Process:
Equation: Solution Process:
Equation: Solution Process:

5. Use the ***prob*** slider on Page 2.2, and press ▲ until you are at the last equation, $3x + 5 = 3x - 6.5$.
   a. What is different about the graph of this example from all of the other equations you have solved? What is different about the equation algebraically?

   b. Move the x slider to find a solution to this equation. What do you notice? Why is this happening?

   c. Write another equation for which you think the same thing would happen.

Extension:

6. Solve the following equation: $4x + 8 - x = 15 + 3x - 7$. What is your solution?

7. Do all linear equations have exactly one solution? Explain your thinking.