

Activity 1: Solving a System of Linear Equations

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CALCULATOR: Casio: fx-115ES

Teaching Notes and Solutions

Objective: Students will be able to solve a system of linear equations by using the Casio fx-115ES and interpret the solutions.

Getting Started:

When solving a system of linear equations, it is important to remember that when the equations are graphed on a coordinate plane, they will either intersect at a particular point, be parallel indicating that there is "no solution," or be identical lines indicating that there are "infinitely many solutions."

Students should achieve a solid understanding of how to solve these systems by graphing, substitution, and elimination. However, once the student has obtained mastery, incorporating technology to assist in obtaining the answer will allow the student the opportunity to interpret the solution and begin to solve more complex problems.

Answers to Scenario Problems:

1. Michael must cut 22 lawns in order to break-even. Theoretically, Michael will break-even once he has cut $21 \frac{1}{9}$ lawns. Since, it is unacceptable to cut only $\frac{1}{9}$ of a lawn, he must complete the lawn bringing the total to 22 lawns.
2. Todd and Betty must clean for $37 \frac{1}{7}$ hours in order to earn \$1,000.
3. A "dog day" is defined as taking care of one dog for one day. Since vacations typically run for more than one day, we will use the "dog days" to indicate \$12.50 earned per dog, per day. Therefore, Denny and Jeri will have to work 400 "dog days" in order to earn \$5,000.

Answers to Problems:

1. $Y = 10,000$; $Y = 50X$

This system is best solved by substitution. Michael will need to cut 200 lawns in order to earn \$10,000.

2. $N + Q = 15$; $0.05N + 0.25Q = 2.15$

Let $N =$ Nickels and $Q =$ Quarters

This system is best solved by elimination. There are 8 nickels and 7 quarters.

3. (4, 2)

4. (0.75, -0.25)

5. While the calculator displays the solution as a "Math Error", we can see from the equations that the second equation is double the first equation. We can interpret this system as having infinitely many solutions.

Extension:

Provide a detailed business plan for any of the three scenarios. In your business plan, you should include three different fee schedules and a rationale as to which fee schedule is best. Keep in mind that charging more does not always equate to earning more. There is always a balance between supply and demand and careful attention to detail is essential to any successful business.

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Student Worksheet Activity 1

You have been hired as a business consultant to work with three new business owners. The owners are opening their businesses in three months and are looking for some sound financial advice from you. Your job is to determine the break-even point for each of the businesses and provide each owner with alternatives for reaching their individual break-even points. Examine each of the scenarios and answer the questions that follow.

Scenario 1:

Michael is opening a landscaping business. He believes that the best way to begin his business is to start small and simply cut lawns. Because he is limiting his business to the small town of Oakville and the lawns are relatively the same size, he is able to charge the same price per lawn. Michael has bought a new lawn mower and supplies totaling \$950. This amount equals his "start-up" costs for his business. Michael will charge \$45 to cut each lawn.

How many lawns must Michael cut in order to break-even? _____

Scenario 2:

Todd and Betty have established a housecleaning business. They will charge \$28 per hour for their combined cleaning services. They purchased \$40 worth of cleaning supplies as a start-up cost, but have informed all homeowners that they are responsible for the purchase of any additional cleaning supplies. Todd and Betty believe that by making the owners responsible for the supplies, it will save them money.

How many hours must Todd and Betty clean in order to make a profit of \$1,000? _____

Scenario 3:

Denny and Jeri are creating a dog walking service. They believe this business will thrive because people who don't want to put their dogs in a kennel will hire them to care for their dogs when they go away on vacations. Denny and Jeri will charge \$12.50 per dog, per day and their services include visiting the animal twice per day along with daily walks and feedings.

How many days must they care for dogs in order to profit \$5,000? _____

Calculator Notes:

1. Turn the *fx-115ES* **ON**.
2. Press **MODE**.
3. Press **5** for **EQN** (Equation).
4. Press **1** for $anX+bnY=Cn$.
5. Input the values for a, b, and c for each equation into the matrix. (Note: All linear equations must be expressed in standard form in order to enter the values into the *fx-115ES*.)

Activity 1: Solving a System of Linear EquationsCALCULATOR: Casio: *fx-115ES***Student Worksheet Activity 1 (continued)**

6. Once you have entered all of the values, press = to obtain the value for X.
7. Press = again to obtain the value for "Y".
8. Press = again to return to the equation matrix.
9. Press **AC** to clean the values contained in the matrix.

Problems:

1. With the cost of oil increasing, Michael is forced to raise his cost per lawn. If Michael charges \$50 per lawn, how long will it take him to earn \$10,000? Write a system of equations, state whether it is best to solve by substitution or elimination and state your answer.

2. There are 15 coins in a jar. Some of the coins are quarters and some are nickels. Their total value is \$2.15. How many quarters and how many nickels are there in the jar? Write a system of equations, state whether it is best to solve by substitution or elimination and state your answer.

3. Solve the following system.

$$2X - Y = 6$$

$$3X + 5Y = 22$$

4. Solve the following system.

$$3X - 7Y = 4$$

$$6X + 14Y = 1$$

5. Solve the following system.

$$9X + 2Y = 37$$

$$18X + 4Y = 74$$