Math 1111 – Linear Equations and Rational Equations Applications

Objectives:

1. Solve real world linear application problems

a. Unknown numbers

b. Real-world

c. Problems involving formulas

* Interest
* Sales Tax or Discounts
* Mixture
* Uniform Motion
* Geometry

To set up or model a linear equation to fit a real-world application, we must first determine the known quantities and define the unknown quantity as a variable. Then, we begin to interpret the words as mathematical expressions using mathematical symbols.

When dealing with real-world applications, there are certain expressions that we can translate directly into math. Below is a list of some common verbal expressions and their equivalent mathematical expressions.

|  |  |
| --- | --- |
| Verbal | Translation to Math Operations |
| One number exceeds another by *a* | *x, x + a* |
| Twice a number | *2x* |
| One number is *a* more than another number | *x, x + a* |
| One number is *ales* than twice another number | *x, 2x – a* |
| The product of a number and *a*, decreased by *b* | *ax – b* |
| The product of three times a number and the number decreased by *b* is *c* | *3x(x – b) = c* |

Given a real-world problem, model a linear equation to fit it.

1. Identify known quantities

2. Assign a variable to represent the unknown quantity.

3. If there is more than one unknown quantity, find a way to write the second unknown in terms of the first.

4. Write an equation interpreting the words as mathematical operations.

5. Solve the equation. Be sure the solution can be explained in words, including the units of measure.

6. MAKE SURE THE SOLUTION MAKES SENSE!

**Objective 1a:** Solve an unknown number problem

One number exceeds another number by 17 and their sum is 31. Find the two numbers.

**Objective 1b:** Solve real-world application

There are two cell phone companies that offer different packages. Company A charges a monthly service fee of $34 plus $0.05/minute talk-time. Company B charges a monthly service fee of $40 plus $0.04/minute talk-time.

1. Write a linear equation that models the packages offered by both companies.

2. If the average number of minutes used each month is 1.160, which company offers the better plan?

3. If the average number of minutes used each month is 420, which company offers the better plan?

4. How many minutes of talk-time would yield equal monthly statements from both companies?

**Objective 1c:** Problems involving formulas

* Distance = Rate \* Time
* Perimeter of a Rectangle = 2L \* 2W
* Area or a Rectangle = L \* W
* (Sales Tax): Original Price + % (Original Price) = Final Price
* (Discount): Original Price - % (Original Price) = Final Price
* Interest = Principal \* Rate \* Time (in years)

1. It takes Andrew 30 minutes to drive to work in the morning. He drives home using the same route, but it takes 10 minutes longer and he averages 10 mph less than in the morning. How far does Andrew drive to work?

2. Two planes fly in opposite directions. One travels 450 mph and the other 550 mph. How long will it take before they are 4,000 miles apart?

3. It is a beautiful day so you take your speed boat out for a trip upstream for 24 miles. The total time for the trip took 6 hours. If current is running at 3 mph, what was the speed of the boat, assuming that the speed boat maintained a constant speed relative to the water.

4. The perimeter of a rectangular outdoor patio is 54 feet. The length is 3 feet greater than the width. What are the dimensions of the patio?

5. A rectangular painting measures 12” by 16” and is surrounded by a frame of uniform width around the four edges. The perimeter of the rectangle formed by the painting and the frame is 62”. Determine the width of the frame.

6. You purchase a pair of jeans for $35.00 and you have a coupon for 15% off. What is the price of the jeans?

7. You and your family went out to dinner and the cost of dinner with the tip was 189.60. If you left an 18% tip, what was the cost of the dinner?

8. Paul has $50,000 to invest but needs to make $6,000 a year from the interest to meet certain living expenses. One bond investment pays 15% annual interest and a CD pays 7%. How much money should he put in each investment to sustain a $6,000 annual return?

9. Sally wants to make a trail mix with peanuts and cashews. She decided to mix the peanuts that sell for $5 a pound with the cashews that sell for $10 a pound. How much does she need to use of each nut to make 100 pounds that will sell for $7 a pound?

10. A chemistry teacher needs to mix a 30% salt solution with 5 quarts of a 70% salt solution to make a 40% salt solution. Find the number of quarts that are needed for the 30% solution and the total number of quarts.

11. Sean takes 5 hours to paint a 2 rooms and Kim takes 8 hours to paint the same number of rooms. If they worked together, how long would it take them to paint both of the rooms?

OpenStax, Intermediate Algebra. OpenStax CNX. Jun 11, 2019 http://cnx.org/contents/02776133-d49d-49cb-bfaa-67c7f61b25a1@8.1.

OpenStax College Algebra, College Algebra. OpenStax CNX. Aug 2, 2019 http://cnx.org/contents/9b08c294-057f-4201-9f48-5d6ad992740d@11.1.