Applications of Systems of Equations

Procedure for Solving Application Problems.

1. Read the problem carefully.
2. Determine the unknowns and assign variable(s) to them.
3. Set up your equation(s).
4. Solve your system of equations by either the elimination method (adding) or substitution.
5. Answer the question asked in a full sentence using appropriate units.

In this video the emphasis is on understanding how to set up the system of equations that model the word problem. In order to accomplish this, many word problems need to be shown. To save time I will not spend time showing how to solve the systems of equations. The solutions will be shown. Pause the video if you would like to go through the steps carefully.

Objective 1: Problems Involving Finding Unknown Numbers

Example: One number is five less than three times another number. The sum of the numbers is 51. Find the two numbers.

Example: The sum of two unknown numbers is 122. The difference of the two numbers is 36. What are the two numbers?

Pause the video and try these problems on your own. Once you have finished, restart the video and review the answers.

Set up the system of equations that models the following word problems.

1. One number is seven more than nine times another number. The sum of the numbers is 187. Find the two numbers.

2. The sum of two unknown numbers is 218. The difference of the two numbers is 68. What are the two numbers?

Objective 2: Problems Involving Cost

Example: One morning a student orders 3 Lattes and 2 Mochas and pays a total of $16.05. The next week she orders 4 Lattes and 5 Mochas and pays a total of $29.45. What are the individual prices for a Latte and a Mocha?

Example: Gary is working two part-time jobs. He works as a teacher's aide and as a janitor. One week he earned $304.10 by working 5 hours as a teacher's aide and 20 hours as a janitor. The next week he earned $580.50 by working 25 hours as a teacher's aide and 20 hours as a janitor. What is Gary's hourly wage as a teacher's aide and as a janitor?

Example: Dominique is in charge of ticket sales for the Civic Theatre. Last night 325 people attended the show. The ticket booth collected $2180. The theatre charges $8 for an adult and $5 for a child. How many adults and how many children attended the show?

Pause the video and try these problems on your own. Once you have finished, restart the video and review the answers.

Set up the system of equations that models the following word problems.

1. George was in charge of ticket sales for last night's football game. 1850 people bought tickets for the game. The school charges $5 for students and $8 for adults. Total receipts were $12,640. How many students and how many adults bought tickets for the game?

2. One morning a student orders 4 lattes and 3 mochas and pays a total of $41.55. The next week she orders 6 lattes and 2 mochas and pays a total of $44.20. What are the individual prices for a latte and a mocha?

Objective 3: Distance, Rate and Time Problems

Example: It took Nancy 15 hours to fly from Grand Junction, Colorado to Caldwell, Ohio which is approximately 1620 miles. She was flying against the wind on the way to Caldwell. It took her 12 hours to fly back to Grand Junction with the wind. What is the speed of the wind? What is the airspeed of her plane?

Example: The Stafford family took their Cabin Cruiser out for a ride. They went down the Savannah river from Madison to Clarks Hill, a distance of 416 miles. The trip downstream took 16 hours. After enjoying the sites they returned, upstream. After going 16 hours on the return trip they noticed that they had only gone 256 miles. What is the speed of the boat in still water? What is the speed of the current?

Pause the video and try these problems on your own. Once you have finished, restart the video and review the answers.

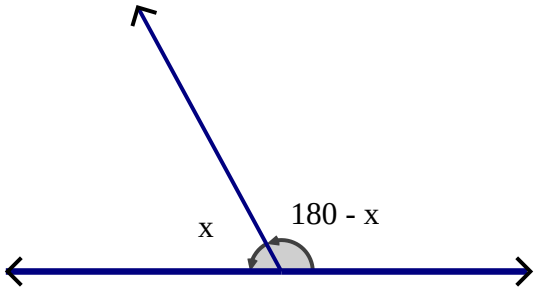
Set up the system of equations that models the following word problems.

1. A motor boat can travel 210 miles in 7 hours going upstream. The same boat can make the return trip downstream in only 5 hours. What is the speed of the motor boat in still water? What is the speed of the current?

2. A plane travels 3275 miles with the wind in 5 hours. The plane travels 4165 miles against the wind in 7 hours. What is the airspeed of the plane? What is the speed of the wind?

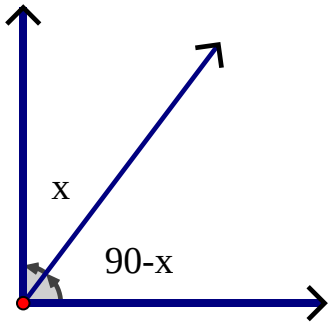
Objective 4: Problems Involving Geometry

Two angles are supplementary if their angle measures add to 180°.



The supplement of 10° is 170°.
The supplement of x is 180-x.

Two angles are complementary if their angle measures add to 90°.



The complement of 30° is 60°.
The complement of x is 90-x.

Example: Two angles are complementary. The measure of one angle is 2° more than seven times the other angle. Find the measure of each angle.

Example: The perimeter of a rectangle is 136 feet. The length is 46 feet longer than the width. Find the dimensions of the rectangle.

Pause the video and try these problems on your own. Once you have finished, restart the video and review the answers.

Set up the system of equations that models the following word problems.

1. Two angles are supplementary. The measure of one angle is of 6^{o} less than five times the other angle. Find the measure of each angle.

2. The perimeter of a rectangle is 520 feet. The length is 166 feet longer than the width. Find the dimensions of the rectangle.

Objective 5: Break Even Analysis

Businesses are often computing cost and revenue functions or equations to determine whether prices need to be adjusted and to predict sales. Recall that profit equals revenue minus cost. Companies are often interested in finding out when they are breaking even. To break even, profit would be zero. This means that revenue would equal cost. To find the break-even point, set the revenue function equal to the cost function and solve. This solution is the number of items that the company must make and sell in order to break even.

Profit = Revenue – Cost

Break Even

Profit = 0

0 = Revenue – Cost

Revenue = Cost

Example: Jack's Donuts has overhead costs of $4500 per month. It costs them $1.25 to make a dozen donuts. They sell a dozen donuts for $8.75. How many dozen donuts does Jack's Donuts need to make and sell in order to break even?

Example: Given the cost function $C(x) = 30x + 10000$ and the revenue function $R(x) = 46x$, find the number of units x that must be sold to break even.

Pause the video and try these problems on your own. Once you have finished, restart the video and review the answers.

Set up the system of equations that models the following word problem.

1. McDuck Computers has overhead costs of $21,000 per month. It costs them $535 for a computer. They sell a computer for $635. How many computers does McDuck Computers need to buy and sell in order to break even?

Solve the following problem.

2. Given the cost function $C(x) = 0.8x + 900$ and the revenue function $R(x) = 2x$, find the number of units x that must be sold to break even.

Objective 6: Problems Involving Coins

Example: Gertrude has a bunch of quarters and nickels. She has 65 coins altogether. The total value is $7.85. How many of each coin does Gertrude have?

Pause the video and try these problems on your own. Once you have finished, restart the video and review the answers.

Set up the system of equations that models the following word problem.

1. Oscar has a bunch of dimes and nickels. He has 133 coins altogether. The total value is $10.45. How many of each coin does Oscar have?