Math 10 Lecture Videos

Section 4.4: Problem Solving Using Systems of Equations

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OBJECTIVES:

Solve problems using linear systems.

Objective 1: Solve problems using linear systems

A Strategy for Solving Word Problems
1. Use variables to represent unknown quantities.
2. Write a system of equations describing the problem's conditions (translate from English to Mathematical expressions).
3. Solve the system and answer the problem's question.
4. Check the proposed solution *in the original wording of the problem*.

Example 1: Burger and Fries

Two burgers and one order of fries contain 34 grams of fat. Two orders of fries and one burger contain 41 grams of fat. Find the number of grams of fat in each item.

1. Use variables to represent unknown quantities.

*Let B =* number of fat grams in one burger.
Let F = number of fat grams in one order of fries.

Example 1: Burger and Fries

Two burgers and one order of fries contain 34 grams of fat. Two orders of fries and one burger contain 41 grams of fat. Find the number of grams of fat in each item.

2. Write a system of equations describing the problem's conditions.

$$2B + 1F = 34 \qquad B + 2F = 41$$

The fat in 2 burgers

the fat in 1 fry

34 grams of fat.

The fat in 1 burger

the fat in 2 fries

41 grams of fat

Example 1: Burger and Fries

Two burgers and one order of fries contain 34 grams of fat. Two orders of fries and one burger contain 41 grams of fat. Find the number of grams of fat in each item.

3. Solve the system and answer the problem's question.

$$2B + 1F = 34$$
$$B + 2F = 41$$

We can use either *substitution* or the *addition property* to solve the system.

Solve the first equation for *F*.

$$F = 34 - 2B$$

Substitute into equation 2

$$B + 2(34 - 2B) = 41$$

Example 1: Burger and Fries

Two burgers and one order of fries contain 34 grams of fat. Two orders of fries and one burger contain 41 grams of fat. Find the number of grams of fat in each item.

3. Solve the system and answer the problem's question.

Solve for _B_:

$$B + 68 - 4B = 41$$

$$-3B + 68 = 41$$

$$-3B = -27$$

$$B = 9$$

If B = 9

$$F = 34 - 2B = 34 - 9(2)$$

$$F = 34 - 18$$

$$F = 16$$

There are 9 grams of fat in a burger and 16 grams of fat in an order of fries.

Example 1: Burger and Fries

Two burgers and one order of fries contain 34 grams of fat. Two orders of fries and one burger contain 41 grams of fat. Find the number of grams of fat in each item.

4. Check.

$$2B + 1F = 34$$
$$2(9) + 1(16) = 34$$
$$18 + 16 = 34$$
$$34 = 34 \quad \textbf{TRUE!}$$

$$B + 2F = 41$$
$$9 + 2(16) = 41$$
$$9 + 32 = 41$$
$$41 = 41 \quad \textbf{TRUE!}$$

Example 2: Socialization

Socializing is a favorite leisure activity. Each weekend day, the sum of the average times spent socializing for men and women is 138 minutes. The difference between the average times spent socializing for women and men is 8 minutes. How many minutes per day on weekends do men and women devote to socializing?

Let x = average time per day women spend socializing.
Let y = average time per day men spend socializing.

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$$x + y = 138$$
$$\underline{x - y = \quad 8}$$
$$2x \quad = 146$$
$$x \quad = \quad 73$$

Back-substitute 73 for x to find y.

$$x + y = 138$$
$$73 + y = 138$$
$$y = 65$$

Men average 65 minutes per day socializing and women average 73 minutes.

Example 3: Fences

A rectangular lot whose perimeter is 360 feet is fenced along three sides.

An expensive fencing along the lot's length costs $20 per foot. An inexpensive fencing along the two side widths costs only $8 per foot. The total cost of the fencing along the three sides comes to $3280. What are the lot's dimensions?

Let x = the length of the lot.
Let y = the width of the lot.

Use the formula for the perimeter of a rectangle to write the first equation.

$$P = 2l + 2w$$
$$360 = 2x + 2y$$
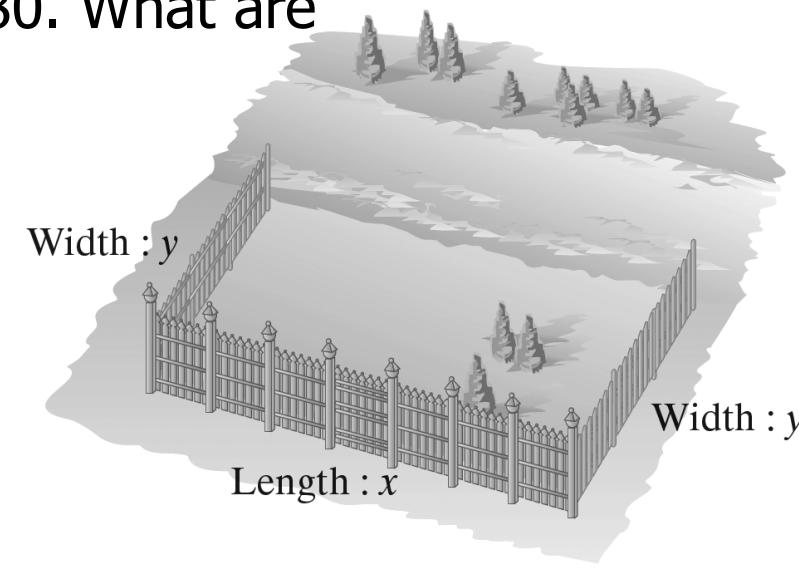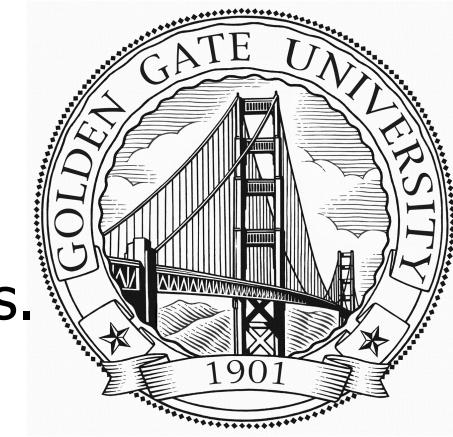
Width : y

Width : y

Length : x

Example 3: Fences

A rectangular lot whose perimeter is 360 feet is fenced along three sides.

An expensive fencing along the lot's length costs $20 per foot. An inexpensive fencing along the two side widths costs only $8 per foot. The total cost of the fencing along the three sides comes to $3280. What are the lot's dimensions?

Use the other information in the problem to write the second equation.

$$20x + 8 \cdot 2y = 3280$$

The two equations form the system.

$$\begin{cases} 2x + 2y = 360 \\ 20x + 16y = 3280 \end{cases}$$

Example 3: Fences

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$$\begin{cases} 2x + 2y = 360 \\ 20x + 16y = 3280 \end{cases}$$

Multiply the first equation by –8 and add the result to the second equation.

$$-16x - 16y = -2880$$
$$\underline{20x + 16y = 3280}$$
$$4x = 400$$
$$x = 100$$

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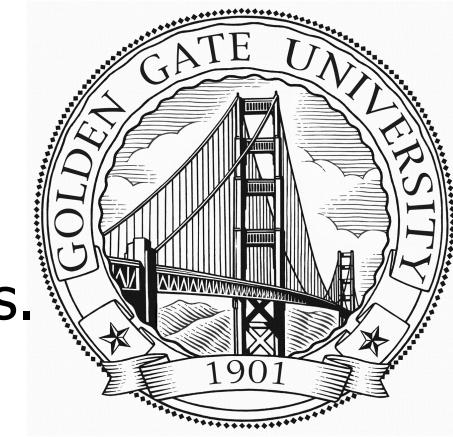
Back-substitute to find _y_.

$$2x + 2y = 360$$
$$2(100) + 2y = 360$$
$$200 + 2y = 360$$
$$2y = 160$$
$$y = 80$$

The length is 100 feet and the width is 80 feet.

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