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Example 3:

Define your variables and write a system of equations for each situation. Then use algebra to solve the system.

1. Janelle has \$20 and is saving \$6 per week. April has \$150 and is spending \$4 per week. When will they both have the same amount of money, and how much will that be?

Define your variables:

Let $x =$ # weeks

Let $y =$ total money

Equation for Janelle:

Equation for April:

$$y = 6x + 20$$

$$y = -4x + 150$$

$$6x + 20 = -4x + 150$$

$$10x = 130$$

$$x = 13$$

$$y = 6(13) + 20$$

$$y = 98$$

$$(13, 98)$$

At week 13 they will both have \$98.

✓ Understanding Check:

1. Sam and Hector are gaining weight for football season. Sam weighs 205 pounds and is gaining two pounds per week. Hector weighs 195 pounds, but is gaining three pounds per week. In how many weeks will they both weigh the same amount, and what will the weight be?

Define your variables:

Let $x =$ # weeks

Let $y =$ weight

Equation for Sam: $y = 2x + 205$

Equation for Hector: $y = 3x + 195$

$$3x + 195 = 2x + 205$$

$$x = 10$$

$$y = 2(10) + 205$$

$$y = 225$$

In 10 weeks they will both weigh 225 lbs.

2. The population of Smallville is 22,000 people and is increasing by 500 people per year. The population of Busytown is 43,000 people, but the population is declining by 200 people per year. When will the towns have the same number of people?

Define your variables:

Let $x =$ # years

Let $y =$ population

Equation for Smallville: $y = 500x + 22000$

Equation for Busytown: $y = -200x + 43000$

$$-200x + 43000 = 500x + 22000$$

$$21000 = 700x$$

$$30 = x$$

$$y = 37000$$

(30, 37000)

In 30 yrs both towns will have 37000 people.

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Example 4: Finding a Break-Even Point

In the business world the "break-even point" is the point at which income equals expenses. Solving a system can find the "break-even point" for a business.

Suppose a club publishes a newsletter. Expenses are \$.50 for printing and mailing each copy, plus \$300 total for research and writing. The price of the newsletter is \$2.00 per copy. How many copies of the newsletter must the club sell to break even?

Define the variables: Let $x =$ # copies
 Let $y =$ Money \rightarrow income and expense

Write an equation for the expense of making the newsletter $y = .50x + 300$

Write an equation for the money earned by selling the newsletter $y = 2x$

Use the equations to find the "break-even" point. Explain your answer.

$$\begin{aligned} .50x + 300 &= 2x \\ 300 &= 1.5x \\ 200 &= x \end{aligned}$$

$$y = 2(200) = 400$$

They have to sell
200 copies to break even.

✓ Understanding Check:

Suppose another club publishes a newsletter. Expenses are \$.80 for printing and mailing each copy, plus \$120 total for research and writing. The newsletter costs \$1 per copy. How many copies of the newsletter must the club sell to break even?

Define the variables: Let $x =$ _____
Let $y =$ _____

Write an equation for the expense of making the newsletter _____

Write an equation for the money earned by selling the newsletter _____

Use the equations to find the "break-even" point. Explain your answer.