9.2 Solving System of Equations by Elimination

9. Solve problems that involve systems of linear equations in two variables, graphically and algebraically.

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9.2 Solving Systems of Linear Equations by Elimination

You can solve a system of linear equations using the **elimination method**. To do this, a variable in both equations must have the same or opposite coefficient. It is often necessary to multiply one or both equations by a constant.

For example, solve the following linear system:

$$6a + 5b = 24$$
$$4a + 3b = 12$$

In order to eliminate variable a, you need to multiply the first equation by -2. Multiply the second equation by 3. Now, when we add the terms together the variable a will be eliminated ($-12a + 12a = 0$).

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Example 1 Solve a System of Linear Equations by Elimination

Connor downloaded two orders of games and songs. The first order consisted of five games and four songs for $26. The second order consisted of three games and two songs for $15. All games cost the same amount, and all songs cost the same amount. Write a system of linear equations. Then, determine the cost of one song and the cost of one game.

Solution

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Your Turn

A group of people bought tickets for a University of Alberta basketball playoff game. Two student tickets and six adult tickets cost $102. Eight student tickets and three adult tickets cost $114. What was the price for a single adult ticket? What was the price for a single student ticket?

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Example 2

A crop farmer has contracted with the Pacific Carbon Trust (PCT) to convert some of her cropland into woodland. This will create a carbon sink that is used to offset the production of carbon resulting from her farm activities. The farmer has 500 ha of cropland. She earns approximately $220/ha from the crops. The PCT will pay her $60 for every hectare of cropland that she converts. She would like a minimum revenue of $90 800 that year. Using the elimination method, determine the number of hectares that she needs to convert to woodland. How many hectares of cropland would be left?

Solution

Let c represent the number of hectares of cropland.
Let w represent the number of hectares of woodland.

Organize the information in a table.

Type of Land	Revenue Generated Per Hectare($)	Number of Hectares	Revenue Generated ($)
Cropland	220	c	
Woodland	60	w	
Total			90 800

Write an equation to show the total number of hectares.

Write an equation to determine the revenue created.

Determine which variable to eliminate. One strategy is to examine each variable in both equations. Then, identify the coefficient, other than 1, that is closest to zero.

$c + w = 500$
$220c + 60w = 90\,800$

Multiply the first equation by -60 so that there are opposite terms.

Add the two equations to eliminate the *opposite terms*.

Solve for the remaining variable, w, by substitution.

Check:

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Your Turn

During lunch, the cafeteria sold a total of 160 muffins and individual yogurts. The price of each muffin is $1.50. Each container of yogurt is $2.00. The cafeteria collected $273.50. Set up and solve a linear system in order to determine the number of muffins and the number of yogurts sold.

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Example 3

The perimeter of a rectangular garden is 17.00 m. Triple the length is 2.46 m longer than five times the width. Sketch and label a diagram. Create a system of linear equations to determine the dimensions of the rectangle. Solve the system using elimination.

Solution

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Your Turn

A rectangular parking pad for a car has a perimeter of 12.2 m. The width is 0.7 m shorter than the length. Use a linear system to determine the dimensions of the pad.

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