

7.4 Using a Substitution Strategy to Solve a System of Linear Equations

Lesson Focus

Use the substitution of one variable to solve for a linear system

Substitution

Isolate **one variable** in **either** equation

$$\begin{array}{l} 2x + y = 5 \\ y = -x + 3 \end{array}$$

Substitute that variable in the **other equation** with what you solved in (1)

$$\begin{array}{l} 2x + (-x + 3) = 5 \\ 2x - x + 3 = 5 \end{array}$$

Solve for the **remaining variable**

$$\begin{array}{l} x + 3 = 5 \\ x = 2 \end{array}$$

Substitute **that solution** to find value of **other variable**

$$\begin{array}{l} \text{Find } y \\ y = -x + 3 \\ y = -(2) + 3 = 1 \end{array}$$

$$\underline{\underline{(2, 1)}}$$

Substitution

Isolate **one variable** in **either** equation

Solve this linear system.

$$x + y = 8 \rightarrow x = 8 - y$$

$$3x - 2y = 14$$

Substitute that variable in the **other equation** with what you solved in (1)

$$3(8 - y) - 2y = 14$$

$$24 - 3y - 2y = 14$$

$$24 - 5y = 14$$

$$-5y = -10$$

$$y = 2$$

Solve for the **remaining variable**

Substitute **that solution** to find value of **other variable**

Substitution

Isolate **one variable** in **either** equation

Substitute that variable in the **other equation** with what you solved in (1)

Solve for the **remaining variable**

Substitute **that solution** to find value of **other variable**

Solve this linear system.

$$x + y = 8 \rightarrow x = 8 - y$$

$$3x - 2y = 14$$

$$3(8 - y) - 2y = 14$$

$$24 - 3y - 2y = 14$$

$$24 - 5y = 14$$

$$-5y = -10$$

$$y = 2$$

Find

$$x = 8 - y$$

$$x = 8 - 2$$

$$x = 6$$

$$(6, 2)$$

Example

Solve this linear system.

$$2x - 4y = 7$$

$$4x + y = 5$$

$$y = -4x + 5$$

$$2x - 4(-4x + 5) = 7$$

$$2x + 16x - 20 = 7$$

$$18x - 20 = 7$$

$$18x = 27$$

$$x = \frac{27}{18} = \frac{3}{2}$$

Find ~~if~~

$$y = -4x + 5$$

$$y = -4\left(\frac{3}{2}\right) + 5$$

$$y = -6 + 5$$

$$y = -1$$

$$\left(\frac{3}{2}, -1\right)$$

Example

Solve this linear system.

$$5x - 3y = 18 \rightarrow 5x - 18 = 3y$$

$$(4x - 6y = 18) \div 2$$

$$2x - 3y = 9$$

$$2x - (5x - 18) = 9$$

$$2x - 5x + 18 = 9$$

$$-3x + 18 = 9$$

$$-3x = -9$$

$$\boxed{x = 3}$$

Example

Solve this linear system by substitution.

$$\left(\frac{1}{2}x + \frac{2}{3}y = -1 \right) \cdot 6$$

$$3x + 4y = -6$$

$$\left(y = \frac{1}{4}x - \frac{5}{3} \right) \cdot 12$$

$$12y = 3x - 20$$

$$12y + 20 = 3x$$

$$12y + 20 + 4y = -6$$

$$16y = -26$$

$$y = -26/16 = -13/8$$

Find x

$$3x = 12y + 20$$

$$3x = 12\left(-\frac{13}{8}\right) + 20$$

$$(3x = -\frac{39}{2} + 20) \cdot 2$$

$$6x = -39 + 40$$

$$6x = 1$$

$$x = \frac{1}{6}$$

$$\left(\frac{1}{6}, -\frac{13}{8}\right)$$

Homework

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4, 5, 19, 27

Handout

7.4 Using a Substitution Strategy to Solve Word Problems

Ex. 1

Alexia invested \$1800, part at an annual interest rate of 3.5% and the rest at an annual interest rate of 4.5%. After one year, the total interest was \$73.

How much money did Alexia invest at each rate?

Let $x =$ amount invested at 3.5%

$y =$ amount invested at 4.5%

$$x + y = 1800 \rightarrow x = 1800 - y$$

$$(.035x + 0.045y = 73) 10000$$

$$35x + 45y = 73000$$

$$35(1800 - y) + 45y = 73000$$

$$63000 - 35y + 45y = 73000$$

$$10y = 10000$$

$$y = 1000$$

Find x

$$x + y = 1800$$

$$x + 1000 = 1800$$

$$x = 800$$

Alexia invested \$800 at 3.5%
and \$1000 at 4.5%

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#'s 10, 11, 16, 17, 24

10. A study recorded the reactions of 186 polar bears as they were approached by a tundra buggy. Some bears did not appear to respond, while others responded by sitting, standing, walking away, or running away. There were 94 more bears that did not respond than did respond. How many bears responded and how many bears did not respond?

11. Louise purchased a Métis flag whose length was 90 cm longer than its width. The perimeter of the flag was 540 cm. What are the dimensions of the flag?



16. Five thousand dollars was invested in two savings bonds for one year. One bond earned interest at an annual rate of 2.5%. The other bond earned 3.75% per year. The total interest earned was \$162.50. How much money was invested in each bond?

- 17.** Tess has a part-time job at an ice-cream store. On Saturday, she sold 76 single-scoop cones and 49 double-scoop cones for a total revenue of \$474.25. On Sunday, Tess sold 54 single-scoop cones and 37 double-scoop cones for a total revenue of \$346.25. What is the cost of each cone?

24. Researchers at the Nk'Mip Desert and Heritage Centre in Osoyoos, B.C., measured the masses of 45 female rattlesnakes and 100 male rattlesnakes as part of a study. The mean mass of all the snakes was 194 g. The mean mass of the males was 37.7 g greater than the mean mass of the females. What was the mean mass of the males and the mean mass of the females? Show your work.

