

5.2: Solving Systems Using Substitution

Name: Key  
Algebra 1

Date: \_\_\_\_\_  
Band: \_\_\_\_\_

**LT#3: Solve systems of equations using substitution.**

Solve each system by substitution. Check your solution.

1.  $\begin{cases} x = y \\ x + 2y = 3 \end{cases}$

$x + 2x = 3$

$3x = 3$

$x = 1$

$y = 1$

$(1, 1)$

2.  $\begin{cases} y = -x + 4 \\ y = 3x \end{cases}$

$-x + 4 = 3x$

$4 = 4x$

$1 = x$

$y = 3(1)$

$y = 3$

$(1, 3)$

3.  $\begin{cases} y = 2x - 10 \\ 2y = x - 8 \end{cases}$

$2(2x - 10) = x - 8$

$4x - 20 = x - 8$

$3x = 12$

$x = 4$

$y = 2(4) - 10$

$y = 8 - 10$

$y = -2$

$(4, -2)$

4.  $\begin{cases} 2y = x + 1 \\ -2x - y = 7 \end{cases}$

$2(-2x - 7) = x + 1$

$-4x - 14 = x + 1$

$-15 = 5x$

$-3 = x$

$-2(-3) - y = 7$

$-6 - y = 7$

$-y = 13$

$y = -13$

$(-3, -1)$

5.  $\begin{cases} x + 2y = 14 \\ y = 3x - 14 \end{cases}$

$x + 2(3x - 14) = 14$

$x + 6x - 28 = 14$

$7x = 42$

$x = 6$

$y = 3(6) - 14$

$y = 18 - 14$

$y = 4$

$(6, 4)$

6.  $\begin{cases} 2x - 3y = 13 \\ y = \frac{1}{2}x - \frac{7}{2} \end{cases}$

$2x - 3(\frac{1}{2}x - \frac{7}{2}) = 13$

$2x - \frac{3}{2}x + \frac{21}{2} = 13$

$4x - 3x + 21 = 26$

$x = 5$

$y = \frac{1}{2}(5) - \frac{7}{2}$

$y = \frac{5}{2} - \frac{7}{2}$

$y = -\frac{2}{2} = -1$

$(5, -1)$

7.  $\begin{cases} -3x - 2y = 5.5 \\ x + 3y = 7.5 \end{cases}$

$-3(-3y + 7.5) - 2y = 5.5$

$9y - 22.5 - 2y = 5.5$

$7y = 28$

$y = 4$

$x + 3(4) = 7.5$

$x + 12 = 7.5$

$x = -4.5$

$(-4.5, 4)$

8.  $\begin{cases} 6x - 4y = 54 \\ -9x + 2y = -69 \end{cases}$

$6x - 4y = 54$

$6x = 4y + 54$

$x = \frac{2}{3}y + 9$

$-9(\frac{2}{3}y + 9) + 2y = -69$

$-6y - 81 + 2y = -69$

$-4y - 81 = -69$

$-4y = 12$

$y = -3$

$6x - 4(-3) = 54$

$6x + 12 = 54$

$6x = 42$

$x = 7$

$(7, -3)$

9.  $\begin{cases} y = -\frac{x}{2} - 4 \\ -2x + y = -5 \end{cases}$

$-2x - (-\frac{x}{2} - 4) = -5$

$-2x + \frac{x}{2} + 4 = -5$

$-4x + x + 8 = -10$

$-3x + 8 = -10$

$-3x = -18$

$x = 6$

$y = -\frac{6}{2} - 4$

$y = -3 - 4$

$y = -7$

$(6, -7)$

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10. Jake purchased 8 T-shirts and 5 pairs of pants for \$220. The next day, he purchased 5 T-shirts and 1 pair of pants for \$112. How much does each T-shirt and each pair of pants cost?

$t$  = cost of t-shirts

$p$  = cost of pants

$$8t + 5p = 220$$

$$5t + 1p = 112 \Rightarrow p = 112 - 5t$$

$$p = 112 - 5(20)$$

$$8t + 5(112 - 5t) = 220$$

$$8t + 560 - 25t = 220$$

$$-17t = -340$$

$$t = 20$$

$$p = 112 - 100$$

$$p = 12$$

11. Matt bought 1 box of crayons and 5 reams of paper for \$54. He bought 5 boxes of crayons and 3 reams of paper for \$50. What is the cost of each box of crayons and each ream of paper?

$c$  = cost of crayon box

$p$  = cost of paper ream

$$1c + 5p = 54 \Rightarrow c = 54 - 5p$$

$$5c + 3p = 50$$

$$c = 54 - 5(10)$$

$$c = 54 - 50$$

$$c = 4$$

$$5(54 - 5p) + 3p = 50$$

$$270 - 25p + 3p = 50$$

$$-22p = -220$$

$$p = 10$$

12. Suppose you got 8 mangoes and 3 apples for \$18 and 3 mangoes and 5 apples for \$14.50. How much does each mango and each apple cost?

$m$  = cost of mango

$a$  = cost of apple

$$8m + 3a = 18 \Rightarrow a = 6 - \frac{8}{3}m$$

$$3m + 5a = 14.50$$

$$-31m = -46.5$$

$$m = 1.50$$

$$3m + 5\left(6 - \frac{8}{3}m\right) = 14.50$$

$$3(3m + 30 - \frac{40}{3}m) = 14.50$$

$$9m + 90 - 40m = 43.5$$

$$a = 6 - \frac{8}{3}(1.5)$$

$$a = 2$$

13. Tia purchased 4 tables and 2 chairs for \$200 and 2 tables and 7 chairs for \$400. What is the cost of each table and chair?

$t$  = cost of table

$c$  = cost of chair

$$4t + 2c = 200 \Rightarrow c = 100 - 2t$$

$$2t + 7c = 400$$

$$c = 100 - 2(25)$$

$$2t + 7(100 - 2t) = 400$$

$$2t + 700 - 14t = 400$$

$$-12t = -300$$

$$t = 25$$

$$c = 100 - 50$$

$$c = 50$$

Solve each system by substitution. Tell whether the system has *one solution*, *infinitely many solutions*, or *no solution*.

14.  $\begin{cases} 7x + 2y = -13 \\ -3x - 8y = -23 \end{cases}$   $y = -3.5x - 6.5$

$$\begin{aligned} -3x - 8(-3.5x - 6.5) &= -23 \\ -3x + 28x + 52 &= -23 \\ 25x + 52 &= -23 \\ \underline{-52 \quad -52} & \\ 25x &= -75 \\ \underline{25 \quad 25} & \\ x &= -3 \end{aligned}$$

7(1)  
7(-3) + 2y = -13

$$\begin{aligned} -21 + 2y &= -13 \\ +21 \quad +21 & \\ \hline 2y &= 8 \end{aligned}$$

$$\frac{2y}{2} = \frac{8}{2}$$

y = 4

**(-3, 4)**  
one solution

17.  $\begin{cases} x - 2y - 1 = 0 \\ y - 5x + 14 = 0 \end{cases}$   $x = 2y + 1$

$$y - 5(2y + 1) + 14 = 0$$

$$y - 10y - 5 + 14 = 0$$

$$-9y + 9 = 0$$

$$-9y = -9$$

$$y = 1$$

$$x - 2(1) - 1 = 0$$

$$x - 2 - 1 = 0$$

$$x - 3 = 0$$

$$x = 3$$

**(3, 1)**

one solution

15.  $\begin{cases} x - 9y = -10 \\ 6x + y = -5 \end{cases}$   $x = -10 + 9y$

$$6(-10 + 9y) + y = -5$$

$$-60 + 54y + y = -5$$

$$55y = 55$$

$$y = 1$$

$$x - 9(1) = -10$$

$$x - 9 = -10$$

$$x = -1$$

**(-1, 1)**

one solution

18.  $\begin{cases} y = -8x - 37 \\ x + 3y = 4 \end{cases}$

$$x + 3(-8x - 37) = 4$$

$$x - 24x - 111 = 4$$

$$-23x = 115$$

$$x = -5$$

$$y = -8(-5) - 37$$

$$y = 40 - 37$$

$$y = 3$$

**(-5, 3)**

one solution

16.  $\begin{cases} x = \frac{y}{4} + 1 \\ y = 4x - 5 \end{cases}$

$$y = 4\left(\frac{y}{4} + 1\right) - 5$$

$$y = y + 4 - 5$$

$$y = y - 1$$

$$0 = -1$$

**no solution**

19.  $\begin{cases} 3x + 6y = 18 \\ 3y = -\frac{3}{2}x + 9 \end{cases}$   $x = -2y + 6$

$$3y = -\frac{3}{2}(-2y + 6) + 9$$

$$3y = 3y - 9 + 9$$

$$3y = 3y$$

**infinitely many solutions**

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20.  $\begin{cases} 5x - 9y = 29 \\ 12x + y = 47 \end{cases} y = -12x + 47$       21.  $\begin{cases} 2x = 3y - 9 \\ -3x + y = 10 \end{cases} y = 3x + 10$       22.  $\begin{cases} 5y = 7x + 22 \\ x = -6y + 17 \end{cases}$

$$5x - 9(-12x + 47) = 29$$

$$5x + 108x - 423 = 29$$

$$113x = 452$$

$$x = 4$$

$$5(4) - 9y = 29$$

$$20 - 9y = 29$$

$$-9y = 9$$

$$y = -1$$

$$\boxed{(4, -1)} \text{ one solution}$$

$$2x = 3(3x + 10) - 9$$

$$2x = 9x + 30 - 9$$

$$-7x = 21$$

$$x = -3$$

$$-3(-3) + y = 10$$

$$+9 + y = 10$$

$$y = 1$$

$$\boxed{(-3, 1)} \text{ one solution}$$

$$5y = 7(-6y + 17) + 22$$

$$5y = -42y + 119 + 22$$

$$47y = 141$$

$$y = 3$$

$$x = -6(3) + 17$$

$$x = -18 + 17$$

$$x = -1$$

$$\boxed{(-1, 3)} \text{ one solution}$$

23.  $\begin{cases} x = 6y + 16 \\ 9x - 2y = -12 \end{cases}$

$$9(6y + 16) - 2y = -12$$

$$54y + 144 - 2y = -12$$

$$52y + 144 = -12$$

$$52y = -156$$

$$y = -3$$

$$x = 6(-3) + 16$$

$$x = -18 + 16$$

$$x = -2$$

$$\boxed{(-2, -3)}$$

one solution

24.  $\begin{cases} 4x - y - 4 = 0 & y = 4x - 4 \\ 3x + 2y - 14 = 0 \end{cases}$

$$3x + 2(4x - 4) - 14 = 0$$

$$3x + 8x - 8 - 14 = 0$$

$$11x - 22 = 0$$

$$11x = 22$$

$$x = 2$$

$$4(2) - y - 4 = 0$$

$$8 - y - 4 = 0$$

$$y = 4$$

$$\boxed{(2, 4)}$$

one solution

25.  $\begin{cases} x + 3y = -5 & x = -5 - 3y \\ -2x - y = 5 \end{cases}$

$$-2(-5 - 3y) - y = 5$$

$$10 + 6y - y = 5$$

$$10 + 5y = 5$$

$$5y = -5$$

$$y = -1$$

$$x + 3(-1) = -5$$

$$x - 3 = -5$$

$$x = -2$$

$$\boxed{(-2, -1)}$$

one solution