

Essential Question: Which algebraic methods can we use to solve a linear system?

Do Now: Consider the system: $-x + y = 3$
 $2x + y = 6$

a) Which algebraic method (elimination or substitution) would you use? Be ready to justify your response.

elimination
(multiply top by 2
to create an additive
inverse)

substitution
solve either for y since each
equation has a y with a
co-efficient of 1
yes

b) Will both methods produce the same solution?

$$\begin{array}{r} 1) \quad 2x + y = 6 \\ -2(x - 3y = -11) \end{array} \quad \begin{array}{r} 2x + y = 6 \\ -2x + 6y = +22 \end{array}$$

$$7y = 28$$

$$\boxed{y = 4}$$

$$2x + y = 6$$

$$2x + 4 = 6$$

$$2x = 2$$

$$\boxed{x = 1}$$

check solution (1, 4)

$$2x + y = 6$$

$$2(1) + 4 = 6$$

$$6 = 6 \checkmark$$

$$x - 3y = -11$$

$$1 - 3(4) = -11$$

$$1 - 12 = -11$$

$$-11 = -11 \checkmark$$

3) Think About This!

Consider the system below. Dana said that she can solve this system using elimination by multiplying the top equation by -2 and the bottom equation by 5.

Is she correct? Why?

Could Dana choose different multipliers and still eliminate a variable term? Explain.

$$\begin{array}{r} -2(5x - 2y = 20) \\ 5(2x + 3y = 27) \end{array} \quad \begin{array}{r} -10x + 4y = -20 \\ 10x + 15y = 135 \end{array}$$

$$\begin{array}{r} 3(5x - 2y = 20) \\ 2(2x + 3y = 27) \end{array} \rightarrow \begin{array}{r} 15x - 6y = 60 \\ 4x + 6y = 54 \end{array}$$

$$\begin{array}{r} 2) \quad 14y = 12 - 6x \rightarrow 6x + 14y = 12 \\ 2x + 6y = 4 \quad -3(2x + 6y = 4) \end{array}$$

$$6x + 14y = 12$$

$$-6x - 18y = -12$$

$$-4y = 0$$

$$\boxed{y = 0}$$

$$2x + 6y = 4$$

$$2x + 6(0) = 4$$

$$2x = 4$$

$$\boxed{x = 2}$$

check (2, 0)

$$14y = 12 - 6x$$

$$14(0) = 12 - 6(2)$$

$$0 = 0 \checkmark$$

$$2x + 6y = 4$$

$$2(2) + 6(0) = 4$$

$$4 = 4 \checkmark$$

Dana is correct because she created a pair of additive inverses.

she could also have multiplied the top equation by 3 and the bottom by 2 to create a zero pair for y .

* Create a linear system to solve each problem below. Choose an algebraic method (substitution or elimination) to solve your system.

4) Two small pitchers and one large pitcher can hold 8 cups of water. One large pitcher minus one small pitcher can hold 2 cups of water. How many cups of water can each pitcher hold?

Let x = capacity of small pitcher
Let y = capacity of large pitcher

small pitcher holds 2 cups of water.
large pitcher holds 4 cups of water

substitution

$$\begin{cases} 2x + y = 8 \\ y - x = 2 \end{cases} \rightarrow y = -2x + 8$$

$$\begin{aligned} y - x &= 2 \\ (-2x + 8) - x &= 2 \\ -3x + 8 &= 2 \\ -3x &= -6 \\ \boxed{x = 2} \end{aligned}$$

elimination

$$\begin{aligned} 2x + y &= 8 \\ -1(-x + y) &= 2 \end{aligned}$$

$$\begin{aligned} 2x + y &= 8 \\ x - y &= -2 \\ \hline 3x &= 6 \\ \boxed{x = 2} \end{aligned}$$

$$\begin{aligned} 2x + y &= 8 \\ 2(2) + y &= 8 \\ \boxed{y = 4} \end{aligned}$$

5) Pam has two part time jobs. At one job, she works as a cashier and makes \$8 per hour. At the second job, she works as a tutor and makes \$12 per hour. One week she worked 30 hours and made \$268. How many hours did she spend at each job?

system 2 variables means you need 2 equations to solve

Let x = number of hours tutoring \rightarrow 7 hours
Let y = number of hours working as a cashier \rightarrow 23 hours

$$\begin{aligned} -8(x + y = 30) &\rightarrow -8x - 8y = -240 \\ 12x + 8y &= 268 \\ \hline 4x &= 28 \\ \boxed{x = 7} \end{aligned}$$

check (7,23)

$$\begin{aligned} x + y &= 30 & 12x + 8y &= 268 \\ 7 + 23 &= 30 & 12(7) + 8(23) &= 268 \\ 30 &= 30 & 84 + 184 &= 268 \\ & & 268 &= 268 \end{aligned}$$

elimination

$$\begin{aligned} x + y &= 30 \\ 7 + y &= 30 \\ \boxed{y = 23} \end{aligned}$$

6) The sum of two angles is 90° . The difference between twice the larger angle and the smaller angle is 105° . Find the measures of the two angles.

Let x = larger angle
Let y = smaller angle

$$\begin{aligned} x + y &= 90 \\ 2x - y &= 105 \\ \hline 3x &= 195 \\ \boxed{x = 65} \end{aligned}$$

check (65,25)

$$\begin{aligned} x + y &= 90 \\ 65 + 25 &= 90 \\ 90 &= 90 \quad \checkmark \end{aligned}$$

$$\begin{aligned} x + y &= 90 \\ 65 + y &= 90 \\ \boxed{y = 25} \end{aligned}$$

$$\begin{aligned} 2x - y &= 105 \\ 2(65) - 25 &= 105 \\ 130 - 25 &= 105 \\ 105 &= 105 \quad \checkmark \end{aligned}$$