

## 6°3 Solving Systems Using Elimination

\* Elimination Method - use the addition & subtraction properties in order to Eliminate (reduce to zero) a variable in the system

Example:

\* How can you eliminate (reduce to zero) with addition?

$$? + ? = 0$$

$$\text{opposite \#s} \Rightarrow \underline{3 + -3} = 0$$

$$\underline{-4 + 4} = 0$$

\* How can you eliminate (reduce to zero) with subtraction?

$$? - ? = 0$$

$$\text{same \#s} \Rightarrow \underline{2 - 2} = 0$$

$$\underline{8 - 8} = 0$$

$$\begin{array}{r} \textcircled{A} \quad 2x + 5y = 17 \\ + \quad 6x - 5y = -9 \\ \hline 8x \quad = 8 \end{array}$$

$$\begin{array}{c} 8 \\ \circlearrowleft \\ x = 1 \end{array}$$

\* Make sure the system is written in column form.

\* Add or subtract to eliminate



$$2x + 5y = 17$$

$$2(1) + 5y = 17$$

$$2 + 5y = 17$$

$$\begin{array}{r} -2 \\ -2 \end{array}$$

$$5y = 15$$

$$\frac{\quad}{5}$$

$$y = 3$$

\* Substitute to find

the other variable w

your ordered pair

\* Check your answer.  $(1, 3)$  One Solution, Intersecting Lines

$$\textcircled{B} \quad 2x - 3y = 11$$

$$-5x - 3y = 14$$

$$\begin{array}{r} -3x \\ -3 \end{array}$$

$$-3$$

$$x = 1$$

$$2x - 3y = 11$$

$$2(1) - 3y = 11$$

$$2 - 3y = 11$$

$$\begin{array}{r} -2 \\ -2 \end{array}$$

$$-3y = 9$$

$$\frac{\quad}{-3}$$

$$y = -3$$

$$\text{Solution} = (1, -3)$$

\* Check your answer!

One Solution, Intersecting Lines

\* Review Problem 2, "Solving a System by Subtracting Equation" on pg. 379

$$\begin{array}{r}
 * \text{ Got it \# 2) } \quad 2c + 3t = 130 \\
 \quad \quad \quad -2c + 5t = 190 \\
 \hline
 \quad \quad \quad -2t = -60 \\
 \quad \quad \quad \quad -2 \\
 \quad \quad \quad \quad t = 30
 \end{array}$$

$$\begin{array}{r}
 2c + 3t = 130 \\
 2c + 3(30) = 130 \\
 2c + 90 = 130 \\
 \quad -90 \quad -90 \\
 \hline
 \quad \quad 2c = 40 \\
 \quad \quad \quad 2 \\
 \quad \quad \quad c = 20
 \end{array}$$

A car takes  
20 minutes to  
wash & a  
truck takes  
30 minutes to  
wash.

\* Check your answer!

\* Elimination by Multiplication

$$\begin{array}{r}
 \textcircled{c} \quad x + 10y = 3 \\
 \quad \quad 4x + 5y = 5
 \end{array}$$

$$4(x + 10y = 3)$$

$$4x + 40y = 12$$

$$- \quad 4x + 5y = 5$$

$$35y = 7$$

$$\frac{35}{35} \\ y = \frac{1}{5}$$

SOME

OPTIONS

\* Multiply the first  
equation by 4 (or -4)  
or multiply the  
second equation by  
2 (or -2)

\* Make sure to multiply  
each term of the  
equation  $\Rightarrow$

$$x + 10y = 3$$

\* Solve for the other variable by substitution

$$x + 10\left(\frac{1}{5}\right) = 3$$

$$\begin{array}{r} x + 2 = 3 \\ -2 \quad -2 \end{array}$$

$$x = 1$$

$$\text{Solution} = \left(1, \frac{1}{5}\right)$$

\* Check your answer!

\* Review Problem 4, "Solving a System by Multiplying Both Equations" on pg. 380

\* Got it? 4a)

$$\begin{array}{l} (4x + 3y = -19) \cdot 2 \\ (3x - 2y = -10) \cdot 3 \end{array}$$

$$\begin{array}{r} \Rightarrow \quad 8x + 6y = -38 \\ \quad + 9x - 6y = -30 \\ \hline 17x \qquad \qquad -68 \end{array}$$

$$\begin{array}{r} 17 \\ \hline x = 4 \end{array}$$

$$4x + 3y = -19$$

$$4(4) + 3y = -19$$

$$-16 + 3y = -19$$

$$\begin{array}{r} +16 \qquad +16 \\ 3y = -3 \end{array}$$

$$\begin{array}{r} 3y = -3 \\ -3 \end{array}$$

$$y = 1$$

$$\left(4, 1\right)$$

\* Check your answer!

\* Review Problem 5, "Finding the Number of Solutions" on pg. 381

\* Got it #5)

$$\begin{array}{r} -2x + 5y = 7 \\ -2x + 5y = 12 \\ \hline 0 = -5 \end{array}$$

No solution,  
Parallel Lines

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6-3 pg. 382

#8-30 even (12 problems)

$$\begin{array}{r} 8) \quad -x + 5y = 13 \\ + \quad x - y = 15 \\ \hline \quad \quad 4y = 28 \\ \quad \quad \quad \frac{4}{4} \\ \quad \quad \quad y = 7 \end{array}$$

$$\begin{array}{r} x - 7 = 15 \\ + 7 \quad + 7 \\ \hline x = 22 \end{array}$$

(22, 7)

$$\begin{array}{r} 10) \quad 4x - 7y = 3 \\ - \quad x - 7y = -15 \\ \hline \quad \quad 3x = 18 \\ \quad \quad \quad \frac{3}{3} \\ \quad \quad \quad x = 6 \end{array}$$

$$\begin{array}{r} 6 - 7y = -15 \\ -6 \quad \quad -6 \\ \hline \quad -7y = -21 \\ \quad \quad \quad \frac{-7}{-7} \\ \quad \quad \quad y = 3 \end{array}$$

(6, 3)

$$\begin{array}{r} 12) \quad 6x + 5y = 39 \\ - \quad 3x + 5y = 27 \\ \hline \quad \quad 3x = 12 \\ \quad \quad \quad \frac{3x}{3} \\ \quad \quad \quad x = 4 \end{array}$$

$$\begin{array}{r} 6(4) + 5y = 39 \\ 24 + 5y = 39 \\ \hline \quad \quad 5y = 15 \\ \quad \quad \quad \frac{5y}{5} \\ \quad \quad \quad y = 3 \end{array}$$

$$\begin{array}{r} 6x + 5(3) = 39 \\ 6x + 15 = 39 \\ \hline \quad \quad 6x = 24 \\ \quad \quad \quad \frac{6x}{6} \\ \quad \quad \quad x = 4 \end{array}$$

(4, 3)

$x = \text{side leaf}$   
 $y = \text{middle}$

$$\begin{array}{r} \textcircled{14} \quad 2x + y = 7 \\ - \quad x + y = 5.5 \\ \hline 1x = 1.5 \\ x = 1.5 \end{array}$$

$$\begin{array}{r} x + y = 5.5 \\ 1.5 + y = 5.5 \\ -1.5 \quad -1.5 \\ \hline y = 4 \text{ feet} \end{array}$$

$$\begin{array}{r} \textcircled{16} \quad (3x + y = 5) \cdot 2 \\ \quad \quad 2x - 2y = -2 \\ \hline \Rightarrow \quad \begin{array}{r} 6x + 2y = 10 \\ + \quad 2x - 2y = -2 \\ \hline 8x = 8 \\ x = 1 \end{array} \end{array}$$

$$(1, 2)$$

$$\begin{array}{r} 3(1) + y = 5 \\ y = 2 \end{array}$$

$$\begin{array}{r} \textcircled{18} \quad (3x + 2y = 17) \cdot 2 \\ \quad \quad (2x + 5y = 26) \cdot 3 \\ \hline \Rightarrow \quad \begin{array}{r} 6x + 4y = 34 \\ - \quad 6x + 15y = 78 \\ \hline -11y = -44 \\ y = 4 \end{array} \end{array}$$

$$(3, 4)$$

$$\begin{array}{r} 3x + 2(4) = 17 \\ 3x + 8 = 17 \\ 3x = 9 \\ x = 3 \end{array}$$



$$20) \begin{cases} 5x - 9y = -43 \\ 3x + 8y = 68 \end{cases} \begin{matrix} \times 3 \\ \times 5 \end{matrix} \Rightarrow \begin{matrix} 15x - 27y = -129 \\ -15x + 40y = 340 \end{matrix}$$

$$\hline -67y = -469$$

$$y = 7$$

$$(4, 7)$$

$$3x + 8(7) = 68$$

$$3x + 56 = 68$$

$$3x = 12$$

$$x = 4$$

$$22) \begin{cases} 3x + 4y = 24 \\ 6x + 8y = 24 \end{cases} \times 2 \Rightarrow \begin{matrix} 6x + 8y = 48 \\ 6x + 8y = 24 \end{matrix}$$

No solution, parallel

$$24) \begin{cases} 2x - 5y = 17 \\ 6x - 15y = 51 \end{cases} \times 3 \Rightarrow \begin{matrix} 6x - 15y = 51 \\ 6x - 15y = 51 \end{matrix}$$

Same line, infinitely many

$$26) \begin{cases} 4x - 8y = 15 \\ -5x + 10y = -30 \end{cases} \begin{matrix} \cdot 5 \\ \cdot 4 \end{matrix} \Rightarrow \begin{matrix} 20x - 40y = 75 \\ -20x + 40y = -120 \end{matrix}$$


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$$0 = -45$$

No solution, parallel lines

$$28) \begin{cases} 3d + 4p = 11 \text{ oz.} \\ 2d + 3p = 9 \text{ oz.} \end{cases} \begin{matrix} \cdot 2 \\ \cdot 3 \end{matrix} \Rightarrow \begin{matrix} 6d + 8p = 22 \\ -6d + 9p = 27 \end{matrix}$$


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$$-p = -5$$

$$p = 5$$

$$3d + 4p = 11$$

$$3d + 4(5) = 11$$

$$3d + 20 = 11$$

$$-20 \quad -20$$

$$3d = -9$$

$$d = -3$$

dolls = -3  
plush toys = 5

can't have a  $\ominus$  toy

$$30) \begin{cases} \frac{1}{2}p + \frac{3}{4}h = 765 \\ \frac{1}{4}p + 1h = 745 \end{cases} \begin{matrix} \cdot 4 \\ \cdot 3 \end{matrix} \Rightarrow \begin{matrix} 2p + 3h = 3060 \\ -\frac{3}{4}p + 3h = 2235 \end{matrix}$$


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$$1\frac{1}{4}p = 825$$

pepperoni = 660 calories  $p = 660$   
ham & pineapple = 580 calories