

DO NOW.... Define Each:

Consistent - at least one solution

Inconsistent - no solution.

Dependent - same line.

Independent - different lines....

SECTION 11.1

SOLVING SYSTEMS (SUBSTITUTION & ELIMINATION)

Homework

p.716

#3-4, 7-8, 17, 18, 22, 46

Solving Systems through Substitution:

- 1) Choose 1 equation and solve for y .**
- 2) Substitute y into the second equation**
- 3) solve for x**
- 4) plug x into the original equation**
- 5) solve for y .**

Solving Systems through Substitution:

- 1) Choose 1 equation and solve for y.
- 2) Substitute y into the second equation
- 3) solve for x
- 4) plug x into the original equation
- 5) solve for y.

Solve.
$$\begin{cases} 2x - y = 13 \\ -4x - 9y = 7 \end{cases}$$

$$y = 2x - 13$$

$$-4x - 9(2x - 13) = 7$$

$$-4x - 18x + 117 = 7$$
$$-22x = -110$$

$$x = 5$$

$$y = 2x - 13$$
$$y = 2(5) - 13$$

$$y = -3$$

solution
 $(5, -3)$

Solving Systems through Substitution:

- 1) Choose 1 equation and solve for y.
- 2) Substitute y into the second equation
- 3) solve for x
- 4) plug x into the original equation
- 5) solve for y.

$$\begin{aligned} 2) \quad 2x - 3y &= -1 \\ y &= x - 1 \end{aligned}$$

$$\begin{aligned} 2x - 3(x - 1) &= -1 \\ 2x - 3x + 3 &= -1 \\ -1x + 3 &= -1 \\ -1x &= -4 \\ \boxed{x = 4} \end{aligned}$$

$$\begin{aligned} y &= x - 1 \\ y &= 4 - 1 \\ \boxed{y = 3} \end{aligned}$$

solution
 $(4, 3)$

Solving Systems through Substitution:

- 1) Choose 1 equation and solve for y.
- 2) Substitute y into the second equation
- 3) solve for x
- 4) plug x into the original equation
- 5) solve for y.

$$\begin{aligned} 1) \quad & x + 3y = 1 \\ & -3x - 3y = -15 \end{aligned}$$

$$x = -3y + 1$$

$$-3(-3y + 1) - 3y = 15$$

$$+9y - 3 - 3y = 15$$

$$6y - 3 = 15$$

$$6y = 12$$

$$y = 2$$

$$x + 3y = 1$$

$$x + 3(-2) = 1$$

$$x - 6 = 1$$

$$x = 7$$

solution
(7, -2)

Solving Systems through Elimination:

Goal: Manipulate one of the equations so that when you add the two equations, a variable will automatically cancel.

- 1) add two equations so a variable will cancel. , solve for variable.
- 2) solve for second variable.
- 3) plug this variable back into equation to get second variable.

$$\begin{array}{r} 2) \quad 4x + 8y = 20 \\ + \quad -4x + 2y = -30 \\ \hline \end{array}$$

$$10y = -10$$

$$y = -1$$

$$\text{solution} \\ (7, -1)$$

$$4(x) + 8(-1) = 20$$

$$4x - 8 = 20$$

$$4x = 28$$

$$x = 7$$

Solving Systems through Elimination:

Goal: Manipulate one of the equations so that when you add the two equations, a variable will automatically cancel.

- 1) add two equations so a variable will cancel.
- 2) solve for second variable.
- 3) plug this variable back into equation to get second variable.

$$\begin{array}{r} 3) \ x - y = 11 \\ + \ 2x + y = 19 \\ \hline \end{array}$$



$$10 - y = 11$$

$$-y = 1$$

$$y = -1$$

$$3x = 30$$

$$x = 10$$

Solution
10, -1

Solving Systems through Elimination:

Goal: Manipulate one of the equations so that when you add the two equations, a variable will automatically cancel.

- 1) add two equations so a variable will cancel.
- 2) solve for second variable.
- 3) plug this variable back into equation to get second variable.

$$\begin{array}{l} 5) \left(\begin{array}{l} -2x - 9y = -25 \\ -4x - 9y = -23 \end{array} \right) \xrightarrow{-} \begin{array}{l} 2x + 9y = 25 \\ -4x - 9y = -23 \end{array} \end{array}$$

$$\rightarrow -2(-1) - 9y = -25 \quad 2x = 2$$

$$2 - 9y = -25$$

$$-9y = -27$$

$$y = 3$$

$$x = -1$$

Solution

$$\left(\begin{array}{l} -1 \\ 3 \end{array} \right)$$

Solving Systems through Elimination:

Goal: Manipulate one of the equations so that when you add the two equations, a variable will automatically cancel.

- 1) add two equations so a variable will cancel.
- 2) solve for second variable.
- 3) plug this variable back into equation to get second variable.

10) $-4x + 9y = 9$
 $x - 3y = -6$

$\rightarrow +3(x - 3y = -6)$

$$\begin{array}{r} -4x + 9y = 9 \\ +3x - 9y = -18 \\ \hline -x = -9 \end{array}$$

$x = 9$

$\rightarrow 9 - 3y = -6$
 $-3y = -15$
 $y = 5$

Solution
 $(9, 5)$

Solve:

$$\begin{cases} \textcircled{1} & 2x - 3y - z = 0 \\ \textcircled{2} & -x + 2y + z = 5 \\ \textcircled{3} & 3x - 4y - z = 1 \end{cases}$$

Goal:
Take 2 equations at a time \rightarrow try to eliminate as many variables as possible.

$$\textcircled{1} + \textcircled{2} \rightarrow \begin{array}{r} 2x - 3y - z = 0 \\ -x + 2y + z = 5 \\ \hline \end{array}$$

$$\textcircled{4} \quad x - y = 5$$

$$\textcircled{2} + \textcircled{3} \rightarrow \begin{array}{r} -x + 2y + z = 5 \\ + 3x - 4y - z = 1 \\ \hline \end{array}$$

$$\textcircled{5} \quad 2x - 2y = 6$$

$$\textcircled{4} + \frac{1}{2}\textcircled{5}$$

$$\begin{array}{r} x - y = 5 \\ -x + y = -3 \\ \hline \end{array}$$

$$0 = 2$$

no solution!

- ① $-x - 5y - 5z = 2$
- ② $4x - 5y + 4z = 19$
- ③ $x + 5y - z = -20$

$$\begin{aligned} \textcircled{2} + \textcircled{3} &\Rightarrow 4x - 5y + 4z = 19 \\ &+ x + 5y - z = -20 \\ \hline &5x + 3z = -1 \end{aligned}$$

$$\begin{aligned} \textcircled{1} + \textcircled{3} &\rightarrow -x - 5y - 5z = 2 \\ &+ x + 5y - z = -20 \\ \hline &-6z = -18 \end{aligned}$$

$$\begin{aligned} \textcircled{3} &\rightarrow -2 + 5y - 3 = -6z = -18 \\ &5y - 5 = -20 \\ &5y = -15 \\ &y = -3 \end{aligned}$$

$$z = 3$$

solution
 $(-2, -3, 3)$

$$5x + 3z = -1$$

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

$$5x + 9 = -1$$

$$5x = -10$$

$$x = -2$$

$$2) \quad -4x - 5y - z = 18$$

$$-2x - 5y - 2z = 12$$

$$-2x + 5y + 2z = 4$$

$$-1 \textcircled{1} + \textcircled{2}$$

$$\hookrightarrow 4x + 5y + z = -18$$

$$-2x - 5y - 2z = 12$$

$$\textcircled{2} + \textcircled{3} \rightarrow \begin{array}{r} -2x - 5y - 2z = 12 \\ -2x + 5y + 2z = 4 \\ \hline \end{array}$$

$$-4x = 16$$

$$x = -4$$

$$-4(-4) - 5y - (-2) = 18$$

$$y = 0$$

$$2x - z = -6$$

$$2(4) - z = -6$$

$$-z = 2$$

$$z = -2$$