

Name _____
 Date _____
 Prof. Abel

MTH 098 Elementary Algebra
 Class #16

Solving Systems of Equations - Algebraically by Elimination

Quality - Accuracy - Transfer - 100%

Section 1. Solving Systems of Consistent Linear Equations - By Elimination.

1. Write the following equations in "Columns" Form: $ax + by = c$

a. $3x + 12 = 4y$ $3x - 4y = -12$

b. $5b + 7 - 2a = 0$ $-2a + 5b = -7$

c. $16 + 4a = 5b$ $4a - 5b = -16$

d. $15y = 2x + 20$ $-2x + 15y = 20$

e. $15 = 3y + 5x$
 $3y + 5x = 15$ $5x + 3y = 15$

Section 2. Goal for Simultaneous Linear Equations:

2. After arrangement in "columns" work to create Matching Opposite coefficients.

Solve the Following :

a. $x - 2y = 6$
 $3x + 2y = 2$

 $4x = 8$
 $x = 2$

$3(2) + 2y = 2$
 $6 + 2y = 2$
 $-6 \quad -6$

 $2y = -4$
 $y = -2$
 $2 - 2(-2) = 6$
 $2 + 4 = 6$
 $6 = 6$

b. $x + y = 6$
 $2x - y = 3$

c. $3x + y = 13$
 $x - y = 8$

d. $4x = -2y - 18$
 $-5y = 2x + 10$

Sometimes you have to decide which variable to eliminate, and to multiply through on both equations.

e.
$$\begin{cases} 4 \begin{cases} 2x + 3y = 6 \\ 5x - 4y = -8 \end{cases} \end{cases}$$

$$\begin{aligned} 8x + 12y &= 24 \\ 15x - 12y &= -24 \end{aligned}$$

$$23x = 0$$

$$\boxed{x=0}$$

Scalar

$$2(0) + 3y = 6$$

$$3y = 6$$

$$\boxed{y=2}$$

$$5(0) - 4(2) = -8$$

$$-8 = -8 \checkmark$$

Inconsistent and Dependent Equations:

f.
$$\begin{cases} -2 \begin{cases} 2x + y = 3 \\ 4x + 2y = 12 \end{cases} \end{cases}$$

$$-4x - 2y = -6$$

$$4x + 2y = 12$$

$$0 = 6 ?$$

Inconsistent

Parallel

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

$$2x - y = 4$$

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

$$0 = 0$$

Always !!!

Same Equations!

Dependent

Section 3. Word Problems in 2 Variables

1. The sum of two numbers is 104. The larger number is 1 less than twice the smaller number. Find the numbers.

X = larger
Y = smaller

$$X + Y = 104$$

$$X = (2Y - 1)$$

$$(2Y - 1) + Y = 104$$

$$2Y - 1 + Y = 104$$

$$3Y - 1 = 104$$

$$\begin{array}{r} 3Y - 1 = 104 \\ +1 \quad +1 \\ \hline 3Y = 105 \end{array}$$

$$Y = 35$$

$$X = 2(35) - 1$$

$$X = 70 - 1$$

$$\boxed{X = 69}$$

$$69 + 35 = 104$$

$$104 = 104 \checkmark$$

2. The difference between two complementary angles is 46° . Determine the measure of each angle.

X = Angle 1
Y = Angle 2

$$X + Y = 90$$

$$X - Y = 46$$

$$2X = 136$$

$$\boxed{X = 68}$$

$$\begin{array}{r} 68 + Y = 90 \\ -68 \quad -68 \\ \hline Y = 22 \end{array}$$

$$\boxed{Y = 22^\circ}$$

$$68 - 22 = 46$$

$$46 = 46$$

3. Steve, in his piper club airplane, flew an average of 121 mph with the wind and 87 mph against the wind. Determine the speed of his aircraft in still air and the speed of the wind.

X = rate in still air
Y = rate of wind

$$X + Y = 121$$

$$X - Y = 87$$

$$2X = 208$$

$$\boxed{X = 104}$$

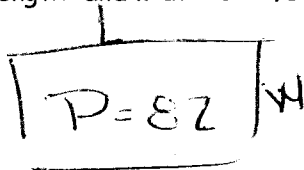
$$\begin{array}{r} 104 + Y = 121 \\ -104 \quad -104 \\ \hline Y = 17 \end{array}$$

$$\boxed{Y = 17}$$

$$104 - 17 = 87$$

$$87 = 87 \checkmark$$

- 3A. John has a large rectangular garden with a perimeter of 82 feet. The difference between the garden's length and width is 11 feet. Determine the length and width of the garden.



1. (Classic Perimeter Equation)

$$2L + 2W = 82$$

$$2[L - W = 11]$$

$$2L + 2W = 82$$

$$2L - 2W = 22$$

$$\begin{array}{r} 4L = 104 \\ \hline L = 26 \text{ feet} \end{array}$$

$$2(26) + 2W = 82$$

$$52 + 2W = 82$$

$$\begin{array}{r} 52 + 2W = 82 \\ -52 \quad -52 \\ \hline 2W = 30 \end{array}$$

$$2W = 30$$

$$\boxed{W = 15 \text{ feet}}$$

$$26 - 15 = 11$$

$$11 = 11 \checkmark$$

4. When the length of a rectangle is x and the width is y inches, the perimeter is 28 feet. If the length is doubled and the width is tripled, the perimeter becomes 66 feet. Find the length and width of the original rectangle.

$$\begin{array}{r} \boxed{x} \\ | P=28 | y \\ \hline 2x \\ | P=66 | 3y \end{array}$$

$$-2 \left[\begin{array}{l} 2x + 2y = 28 \\ 4x + 6y = 66 \end{array} \right]$$

$$\begin{array}{r} -4x - 4y = -56 \\ \underline{4x + 6y = 66} \\ 2y = 10 \\ y = 5 \text{ feet} \end{array}$$

$$\begin{array}{l} 2x + 2(5) = 28 \\ 2x + 10 = 28 \\ -10 \quad -10 \\ \hline 2x = 18 \\ \boxed{x = 9 \text{ feet}} \end{array}$$

$$\begin{array}{l} 4(9) + 6(5) = 66 \\ 36 + 30 = 66 \\ 66 = 66 \checkmark \end{array}$$

Section 3. Solving 2 Variable Word Problems by SUBSTITUTION.

5. Mr. DeCarolis left \$25,000 to be split between his daughter and his son. The son received \$5000 less than the daughter. How much was received by each child?

$$\begin{array}{l} x = \text{Son} \\ y = \text{Daughter} \end{array}$$

$$\begin{array}{l} x + y = 25000 \\ x = (y - 5000) \end{array}$$

$$\begin{array}{l} (y - 5000) + y = 25000 \\ y - 5000 + y = 25000 \\ 2y - 5000 = 25000 \\ \quad +5000 \quad +5000 \end{array}$$

$$\begin{array}{l} 2y = 30000 \\ \boxed{y = 15000} \\ x + 15000 = 25000 \\ -15000 \quad -15000 \\ \hline \boxed{x = 10000} \\ 10000 = 15000 - 5000 \\ 10000 = 10000 \checkmark \end{array}$$

6. The sum of two numbers is 104. The larger number is 1 less than twice the smaller number. Find the numbers.

HW Section

Section	Page(s)	Problem(s)
9.3	575 → 576	5, 7, 11, 13, 17, 19, 23, 31
9.5	593 → 594	3, 5, 9, 11, 13