Name: ____ Period: __________ Date: _______________

APPLICATIONS OF LINEAR SYSTEMS Assignment

Solve the following verbal problems involving linear systems:

1. The sum of two numbers is 13 and their difference is 3. Find the numbers.

2. A flour merchant has two types of flours, one selling for \$4 per pound and the other for \$7 per pound. The flours are to be mixed to provide 80lb of a mixture selling for \$12 per pound. How much of each type of flour should be used to form 100lb of the mixture?

3. A chemist has a 40% and a 20% basic solution. How much of each solution should be used to form 300 ml of a 30% acid solution?

4. The sum of 5 times a larger number and twice a smaller is 6. The difference of 4 times the larger and the smaller is 4. Find the numbers.

5. A roll of 24 bills contains only \$5 bills and \$10 bills. If the value of the roll is \$160, then how many of each bill are in the roll?

6. A total of \$5500 was invested in two accounts. Part was invested in a CD at 2% annual interest rate and part was invested in a money market fund at 3% annual interest rate. If the total simple interest for one year was \$250, then how much was invested in each account?

7. Mary traveled a total of 10 hours and a total of 1850 miles by car and by plane. Driving to the airport by car, she averaged 50 miles per hour. In the air, the plane averaged 300 miles per hour. How long did it take her to drive to the airport?

8. A manufacturer produces a standard model and deluxe model of a 20 inch TV set. The standard model requires 10 h of work to produce, and the deluxe model requires 16 h. The company has 350 h of work available per week. The capacity of the plant is a total of 20 sets per week. If all the available time and capacity are to be used, how many of each type of set should be produced?

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ANSWERS

Solve the following verbal problems involving linear systems:

1. The sum of two numbers is 13 and their difference is 3. Find the numbers.

- Identify variables

x: First unknown number　　　　　y: Second unknown number

- Set up equations

$$\boldsymbol{x+y=13 \qquad and \qquad x-y=3}$$

- Solve linear System

In this case we will use the elimination method, like follows:

$$\begin{cases} x+y=13 \\ x-y=3 \end{cases}$$

The result would be:

$$2x=16 \qquad \rightarrow \qquad x=\frac{16}{2}=8$$

Now, we calculate the value of variable "y" by substituting the result of "x" into one of the equations

$$y=13-x=13-8 \qquad \rightarrow \qquad y=5$$

The numbers are 8 and 5

2. A flour merchant has two types of flours, one selling for \$9 per pound and the other for \$15 per pound. The flours are to be mixed to provide 100 lb of a mixture selling for \$13.50 per pound. How much of each type of flour should be used to form 100 lb of the mixture?

- Identify variables

x: Flour of \$9　　　　　y: Flour of \$15

- Set up equations

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$$\boldsymbol{x+y=100 \qquad and \qquad 9x+15y=1350}$$

- Solve linear System

In this case we will use the elimination method, like follows:

$$\begin{cases} x+y=100 \\ 9x+15y=1350 \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to interchange the "x" coefficients of both equations, like follows:

$$\begin{cases} -9(x+y=100) \\ 1(9x+15y=1350) \end{cases}$$

Applying distributive property:

$$\begin{cases} -9x-9y=-900 \\ 9x+15y=1350 \end{cases}$$

The result would be:

$$6y=450 \qquad \rightarrow y=75$$

Now, we calculate the value of variable "x" by substituting the result of "y" into one of the equations

$$x=100-y=100-75=25$$

It must be needed 25 lb of $9 flour and 75 lb of $15 flour.

3. **A chemist has a 40% and a 20% basic solution. How much of each solution should be used to form 300 ml of a 30% acid solution?**

- Identify variables

x: 40% basic solution y: 20% basic solution

- Set up equations

$$\boldsymbol{x+y=300 \qquad and \qquad 0.40x+0.20y=0.30(300)}$$

- Solve linear System

We will use the elimination method, like follows:

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$$\begin{cases} x + y = 300 \\ 0.40x + 0.20y = 90 \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to interchange the "x" coefficients of both equations, like follows:

$$\begin{cases} 0.40(x + y = 300) \\ -1(0.40x + 0.20y = 90) \end{cases}$$

Applying distributive property:

$$\begin{cases} 0.40x + 0.40y = 120 \\ -0.40x - 0.20y = -90 \end{cases}$$

The result would be:

$$0.20y = 30 \quad \rightarrow y = 150$$

Now, we calculate the value of variable "x" by substituting the result of "y" into one of the equations

$$x = 300 - y = 300 - 150 = 150$$

It must be needed 150 ml of 40% basic solution and 150 ml of 20% basic solution.

4. **The sum of 5 times a larger number and twice a smaller is 6. The difference of 4 times the larger and the smaller is 4. Find the numbers.**

- Identify variables

x: Larger number y: Smaller number

- Set up equations

$$\mathbf{5x + 2y = 6} \qquad \boldsymbol{and} \qquad \mathbf{4x - y = 4}$$

- Solve linear System

We will use the elimination method, like follows:

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

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to interchange the "y" coefficients of both equations, like follows:

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$$\begin{cases} 1(5x+2y=6) \\ 2(4x-y=4) \end{cases}$$

Applying distributive property:

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

The result would be:

$$13x = 14 \qquad \rightarrow \quad x = \frac{14}{13}$$

Now, we calculate the value of variable "y" by substituting the result of "x" into one of the equations

$$y = 4x - 4 = 4\left(\frac{14}{13}\right) - 4 = \frac{4}{13}$$

The larger number is 14/13 and the smaller number is 4/13.

5. **A roll of 24 bills contains only \$5 bills and \$10 bills. If the value of the roll is \$160, then how many of each bill are in the roll?**

- Identify variables

x: Number of \$5 bills y: Number of \$10 bills

- Set up equations

$$\boldsymbol{x+y=24 \qquad and \qquad 5x+10y=160}$$

- Solve linear System

In this case we will use the elimination method, like follows:

$$\begin{cases} x+y=24 \\ 5x+10y=160 \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to interchange the "x" coefficients of both equations, like follows:

$$\begin{cases} 5(x+y=24) \\ -1(5x+10y=160) \end{cases}$$

Applying distributive property:

$$\begin{cases} 5x+5y=120 \\ -5x-10y=-160 \end{cases}$$

The result would be:

$$-5y = -40 \qquad \rightarrow y = 8$$

Now, we calculate the value of variable "x" by substituting the result of "y" into one of the equations

$$x = 24 - y = 24 - 8 = 16$$

There are 16 bills of \$5 and 8 bills of \$10

6. **A total of \$5500 was invested in two accounts. Part was invested in a CD at 2% annual interest rate and part was invested in a money market fund at 1% annual interest rate. If the total simple interest for one year was \$100, then how much was invested in each account?**

- Identify variables

x: Amount invested at 2% y: Amount invested at 1%

- Set up equations

$$\boldsymbol{x + y = 5500 \qquad and \qquad 0.02x + 0.01y = 100}$$

- Solve linear System

We will use the elimination method, like follows:

$$\begin{cases} x + y = 5500 \\ 0.02x + 0.01y = 100 \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to interchange the "x" coefficients of both equations, like follows:

$$\begin{cases} 0.02(x + y = 5500) \\ -1(0.02x + 0.01y = 100) \end{cases}$$

Applying distributive property:

$$\begin{cases} 0.02x + 0.02 = 110 \\ -0.02x - 0.01y = -100 \end{cases}$$

The result would be:

$$0.01y = 10 \qquad \rightarrow y = 1000$$

Now, we calculate the value of variable "x" by substituting the result of "y" into one of the equations

$$x = 5500 - y = 5500 - 1000 = 4500$$

It was invested \$4500 in the account at 2% and \$1000 in the account of 1%.

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7. **Mary traveled a total of 10 hours and a total of 1850 miles by car and by plane. Driving to the airport by car, she averaged 50 miles per hour. In the air, the plane averaged 300 miles per hour. How long did it take her to drive to the airport?**

- Identify variables

x: Time driving to the airport y: Time spent in the air

- Set up equations

$$\mathbf{50x + 300y = 1850} \qquad \boldsymbol{and} \qquad \mathbf{x + y = 10}$$

- Solve linear System

In this case we will use the elimination method, like follows:

$$\begin{cases} x + y = 10 \\ 50x + 300y = 1850 \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to interchange the "x" coefficients of both equations, like follows:

$$\begin{cases} 50(x + y = 10) \\ -1(50x + 300y = 1850) \end{cases}$$

Applying distributive property:

$$\begin{cases} 50x + 50y = 500 \\ -50x - 300y = -1850 \end{cases}$$

The result would be:

$$-250y = -1350 \qquad \rightarrow y = \frac{1350}{250} = \frac{27}{5} = 5.4\ h$$

Now, we calculate the value of variable "x" by substituting the result of "y" into one of the equations

$$x = 10 - y = 100 - \frac{27}{5} = \frac{23}{5}h = 4.6\ h$$

It took 4.6 h to drive to the airport and 5.4 h in the air.

8. **A manufacturer produces a standard model and deluxe model of a 20 inch TV set. The standard model requires 10 h of work to produce, and the deluxe model requires 16 h. The company has 350 h of work available per week. The capacity of the plant is a total of 20 sets per week. If all the available time and**

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capacity are to be used, how many of each type of set should be produced?

- Identify variables

x: Number of standard model y: Number of deluxe model

- Set up equations

$$\boldsymbol{x + y = 20 \qquad and \qquad 12x + 16y = 300}$$

- Solve linear System

In this case we will use the elimination method, like follows:

$$\begin{cases} x + y = 20 \\ 12x + 16y = 300 \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to interchange the "x" coefficients of both equations, like follows:

$$\begin{cases} 12(x + y = 20) \\ -1(12x + 16y = 300) \end{cases}$$

Applying distributive property:

$$\begin{cases} 12x + 12y = 240 \\ -12x - 16y = -300 \end{cases}$$

The result would be:

$$-4y = -60 \qquad \rightarrow y = 15$$

Now, we calculate the value of variable "x" by substituting the result of "y" into one of the equations

$$x = 20 - y = 20 - 15 = 5$$

It should be produced 5 standard models and 15 deluxe models with the available time and capacity.

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