MATH 101
Lia Vas

Systems of Linear Equations. Applications

a) Solve the following systems of linear equations using your calculator.

1.
$$\begin{aligned} x + 2y - z &= -3 \\ 2x - y + z &= 5 \\ 3x + 2y - 2z &= -3 \end{aligned}$$

2.
$$\begin{aligned} 2x + 5y - z &= 3 \\ -3x - 2y + 7z &= 4 \\ -x + 3y + 6z &= 0 \end{aligned}$$

3.
$$\begin{aligned} 2x + 5y - z &= 3 \\ -x - 2y + z &= 4 \\ -4x - 10y + 2z &= -6 \end{aligned}$$

4.
$$\begin{aligned} x + 2y + 4z &= 7 \\ -x + y + 2z &= 5 \\ 2x + 3y + 6z &= 7 \end{aligned}$$

5.
$$\begin{aligned} x + 2y + 4z &= 7 \\ -x + y + 2z &= 5 \\ 2x + 3y + 6z &= 10 \end{aligned}$$

6.
$$\begin{aligned} 5x + 2y - 2z + 3u &= -3 \\ 2x + y - z - 2u &= -5 \\ -3x + 4y - 2z + 2u &= -6 \\ -4x - 2y + 3z + u &= 9 \end{aligned}$$

7.
$$\begin{aligned} x + 2y + z &= 8 \\ -2x + y - 12z &= -1 \\ 2x - y + 12z &= 2 \\ x + y + 3z &= 5 \end{aligned}$$

8.
$$\begin{aligned} x + 2y + z - u &= 8 \\ -2x + y - 12z + 2u &= -1 \\ x + y + 3z - u &= 5 \end{aligned}$$

b) 1. Chris has 32 coins in nickels, dimes and quarters totaling $3.25. If he has 3 more dimes than quarters, how many nickels does he have?

2. A certain diet should include 1530 mg of calcium, 575 mg of vitamin A and 321 mg of vitamin C. This requirement needs to be fulfilled by drinking milk, orange juice and tomato juice. Milk has 300 mg per cup of calcium, 100 mg per cup of vitamin A and 3 mg per cup of vitamin C. Orange juice has 300 mg per cup of calcium and 90 mg per cup of vitamin C. Tomato juice has 20 mg per cup of calcium, 250 mg per cup of vitamin A and 30 mg per cup of vitamin C. How many cups of each liquid should be taken?

3. Linda is making three punches for a party she is having. Punch 1 consists of 3 liters per gallon of orange juice and 2 liters per gallon of seltzer. Punch 2 consists of 1.5 liters per gallon of seltzer and 1 liter per gallon of cherry soda. Punch 3 consists of 1 liter per gallon of orange juice, 1 liter per gallon of seltzer and 2 liters per gallon of cherry soda. If Linda buys 16 liters of orange juice, 16 liters of seltzer and 8 liters of cherry soda, how many gallons of each punch can she make?

Solutions.

a) 1. One solution, (1, -1, 2).

2. No solutions.

3. Infinitely many solutions: $(-26+3z, 11-z, z)$, z is a free variable.

4. No solutions.

5. Infinitely many solutions $(-1, 4-2z, z)$, z is a free variable.

6. One solution, $(0, -1, 2, 1)$.

7. No solutions.

8. Infinitely many solutions: $(2-5z+u, 3+2z, z, u)$ z, u free variables.

b) 1. 17 nickels. 2. 2 cups of milk, 3 cups of orange juice and $1\frac{1}{2}$cups of tomato juice. 3. 4.5 gallons of punch 1, 3 gallons of punch 2 and 2.5 gallons of punch 3.