Name: _____

Date: _____

1. Solve the following system.

$$\begin{aligned} -4x - 7y &= 29 \\ -x + 2y &= -4 \end{aligned}$$

2. Solve the following system.

$$\begin{aligned} 20x + 10y &= 148 \\ 4x + 2y &= -16 \end{aligned}$$

3. Solve the following system.

$$\begin{aligned} -7x - 5y &= -55 \\ 14x + 10y &= 110 \end{aligned}$$

4. Solve the following system.

$$\begin{aligned} -8x - 3y - 5z &= 30 \\ 8x - 6y + 6z &= -76 \\ 2x - 2y + 6z &= -66 \end{aligned}$$

5. Solve the following system.

$$\begin{aligned} x + 2y + z &= 9 \\ 6x - 6y + 6z &= -72 \\ 2x - 7y + 2z &= -59 \end{aligned}$$

6. Solve the system of equations.

$$\begin{aligned} -2x^2 + 4x + y &= 168 \\ 2x - y &= 8 \end{aligned}$$

7. Solve the system of equations.

$$-3x^2 + 6x + y = 28$$
$$12x - y = -25$$

8. Solve the system of equations.

$$-10x^2 + 20x + y = 31$$
$$80x - y = 31$$

9. A thief is filling her backpack with two types of valuable substances. She can carry up to 30 kg, and her backpack can fit up to 10 liters.

   Each bag of X has a weight of 3 kg, volume of 0.4 L, and value of 10 thousand USD.

   Each bag of Y has a weight of 0.8 kg, volume of 0.6 L, and value of 5 thousand USD.

   There is no requirement to take full bags, so the thief can opt for a fraction of a bag.

   How many bags of each should the thief take to maximize her profit?

10. Determine the product of the matrix multiplication.

$$\begin{bmatrix} -1 & 4 \\ -8 & 0 \end{bmatrix} \cdot \begin{bmatrix} -2 & 5 & 2 \\ 2 & -3 & 6 \end{bmatrix}$$

11. Find the multiplicative inverse of matrix A.

$$A = \begin{bmatrix} 4 & 1 & 0 \\ 5 & 3 & 3 \\ 5 & 4 & 4 \end{bmatrix}$$

1. $$x = -2$$
$$y = -3$$

2. The system is inconsistent. The two equations represent two parallel lines, so no pair of x and y can satisfy both equations.

3. The system is undetermined. Both equations describe the same line, so there are infinite pairs of x and y that satisfy the system. Notice that "infinite" does not mean "all", *most* pairs of x and y are not solutions.

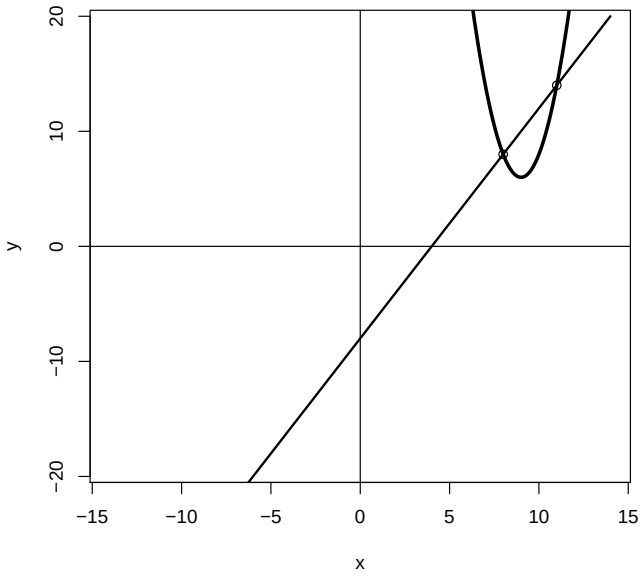
4. $$x = 1$$
$$y = 4$$
$$z = -10$$

5. The system is undetermined. There are infinite solutions. This might be because two planes are equivalent, or because all three planes meet in a line, or because all three planes are equivalent.

6. There are two solutions.

$$(8, 8) \text{ and } (11, 14)$$

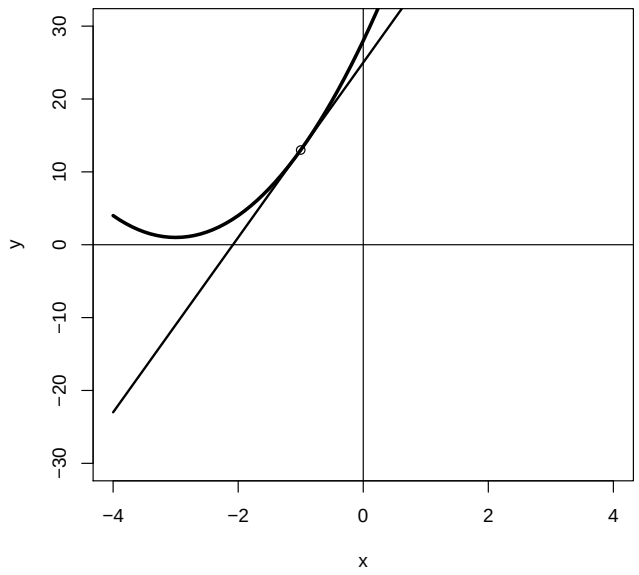
This system represents a parabola and a line.



7. There is one solution.

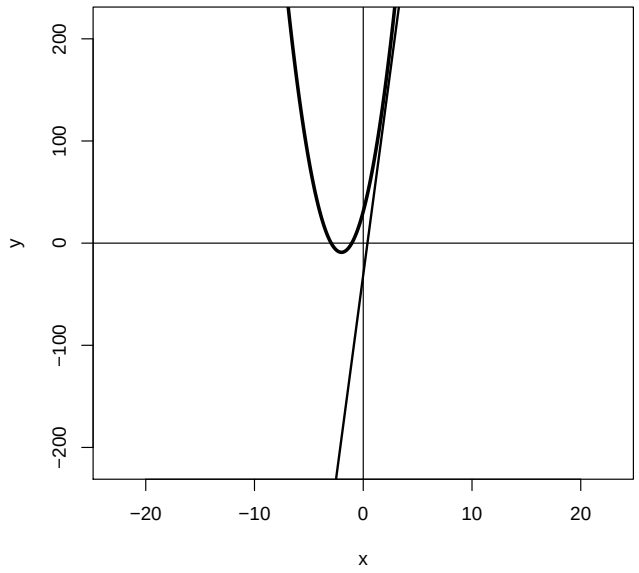
$$(-1, 13)$$

This system represents a parabola and a tangent line.



8. There is no solution.

   This system represents a parabola and a non-intersecting line.



9. The thief should take 6.76 bags of X and 12.16 bags of Y. We can use linear programming to see this.

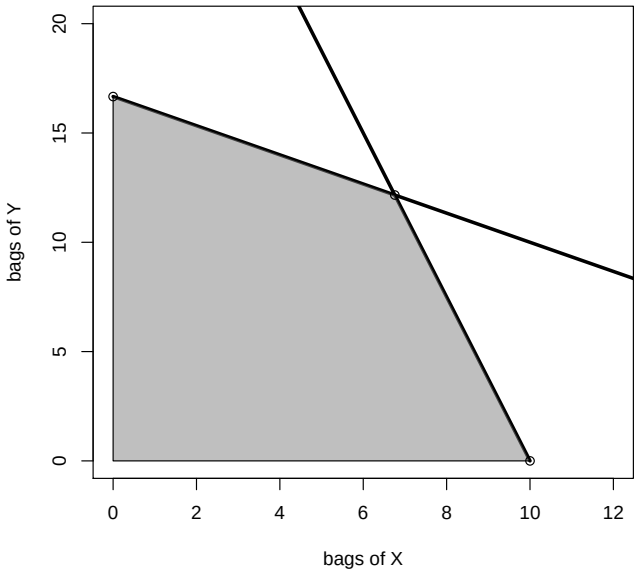
   We write a weight inequality.

   $$3x + 0.8y \leq 30$$

   We write a volume inequality.

   $$0.4x + 0.6y \leq 10$$

   We graph the two inequalities, shading the feasible region.



   There are three vertices of interest.

   $$(0, 16.67)$$

   $$(6.76, 12.16)$$

   $$(10, 0)$$

   We write a profit function (the objective function).

   $$P(x, y) = 10x + 5y$$

   We determine the profits.

   $$P(0, 16.67) = 83.33$$

   $$P(6.76, 12.16) = 128.38$$

   $$P(10, 0) = 100$$

   Thus, the thief should take 6.76 bags of X and 12.16 bags of Y.

10. The answer:

$$\begin{bmatrix} 10 & -17 & 22 \\ 16 & -40 & -16 \end{bmatrix}$$

The work:

1st row and 1st column... $(-1)(-2)+(4)(2)=10$

1st row and 2nd column... $(-1)(5)+(4)(-3)=-17$

1st row and 3rd column... $(-1)(2)+(4)(6)=22$

2nd row and 1st column... $(-8)(-2)+(0)(2)=16$

2nd row and 2nd column... $(-8)(5)+(0)(-3)=-40$

2nd row and 3rd column... $(-8)(2)+(0)(6)=-16$

11. The answer:

$$\begin{bmatrix} 0 & \frac{4}{5} & -\frac{3}{5} \\ 1 & -\frac{16}{5} & \frac{12}{5} \\ -1 & \frac{11}{5} & -\frac{7}{5} \end{bmatrix}$$