Name: _____

Date: _____

1. Solve the following system.

$$-13x - 12y = -147$$
$$-2x - 15y = -141$$

2. Solve the following system.

$$2x - y = -22$$
$$-6x + 3y = 30$$

3. Solve the following system.

$$-12x - 6y = -108$$
$$-2x - y = -18$$

4. Solve the following system.

$$-19x - 9y - 2z = -136$$
$$5x + 13y - 10z = -112$$
$$9x - 2y - 7z = 10$$

5. Solve the following system.

$$-16x + 14y - 14z = 72$$
$$-3x + y + 12z = -6$$
$$19x - 15y + 2z = -66$$

6. Solve the system of equations.

$$5x^2 - 10x + y = -88$$
$$5x + y = -28$$

7. Solve the system of equations.

$$-x^2 + 2x + y = 38$$
$$6x - y = -29$$

8. Solve the system of equations.

$$2x^2 - 4x + y = -4$$
$$16x - y = -24$$

9. A thief is filling her backpack with two types of valuable substances. She can carry up to 40 kg, and her backpack can fit up to 10 liters.

   Each bag of X has a weight of 9 kg, volume of 0.8 L, and value of 80 thousand USD.

   Each bag of Y has a weight of 0.08 kg, volume of 0.03 L, and value of 0.8 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.

$$\begin{bmatrix} 2 & -1 & 0 \\ -4 & -6 & -3 \end{bmatrix} \cdot \begin{bmatrix} -3 & -1 \\ -7 & 4 \\ 2 & -7 \end{bmatrix}$$

11. Find the multiplicative inverse of matrix A.

$$A = \begin{bmatrix} 5 & 2 & 1 \\ 3 & 6 & 0 \\ 6 & 7 & 2 \end{bmatrix}$$

1.

$$x = 3$$
$$y = 9$$

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.

$$x = 8$$
$$y = -4$$
$$z = 10$$

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.

$$(-3, -13) \text{ and } (-4, -8)$$

This system represents a parabola and a line.

7. There is one solution.

$$(-3, 11)$$

This system represents a parabola and a tangent line.

8. There is no solution.

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

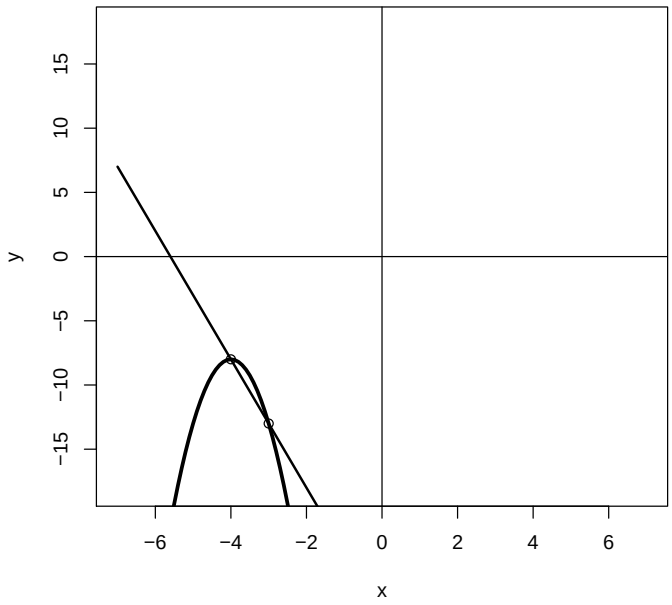


Figure 1: plot of chunk unnamed-chunk-2

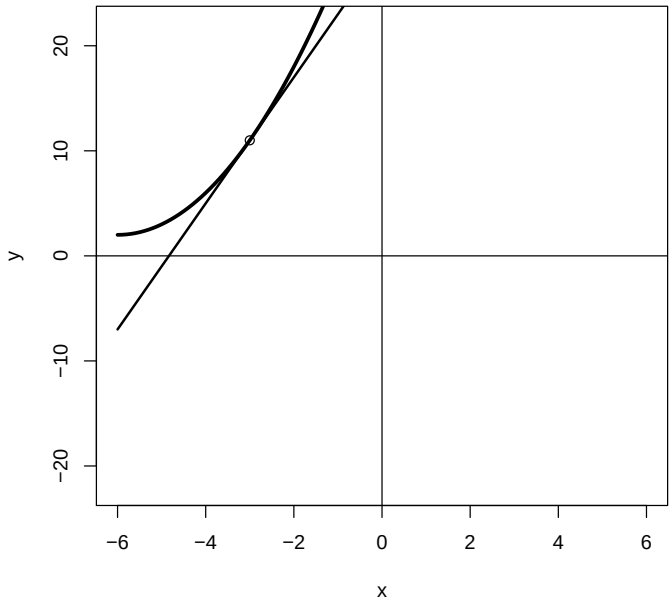


Figure 2: plot of chunk unnamed-chunk-2

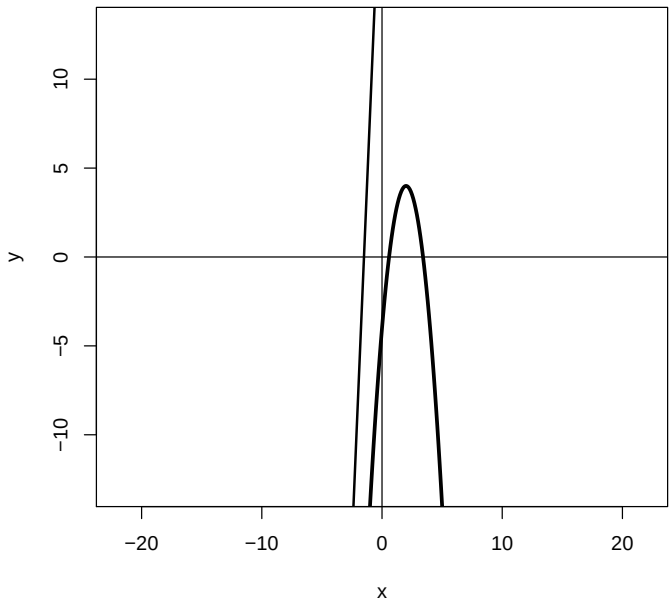


Figure 3: plot of chunk unnamed-chunk-2

9. The thief should take 1.94 bags of X and 281.55 bags of Y. We can use linear programming to see this.

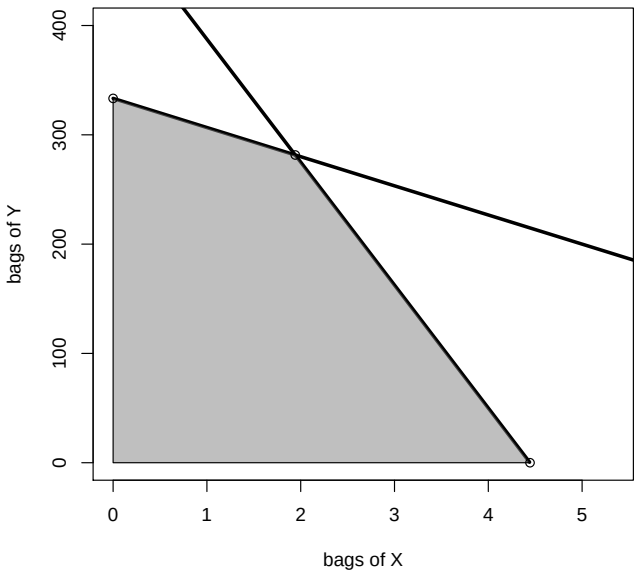
   We write a weight inequality.

   $$9x + 0.08y \leq 40$$

   We write a volume inequality.

   $$0.8x + 0.03y \leq 10$$

   We graph the two inequalities, shading the feasible region.



There are three vertices of interest.

$$(0, 333.33)$$

$$(1.94, 281.55)$$

$$(4.44, 0)$$

We write a profit function (the objective function).

$$P(x, y) = 80x + 0.8y$$

We determine the profits.

$$P(0, 333.33) = 266.67$$

$$P(1.94, 281.55) = 380.58$$

$$P(4.44, 0) = 355.56$$

Thus, the thief should take 1.94 bags of X and 281.55 bags of Y.

10. The answer:

$$\begin{bmatrix} 1 & -6 \\ 48 & 1 \end{bmatrix}$$

The work:

1st row and 1st column... $(2)(-3)+(-1)(-7)+(0)(2)=1$

1st row and 2nd column... $(2)(-1)+(-1)(4)+(0)(-7)=-6$

2nd row and 1st column... $(-4)(-3)+(-6)(-7)+(-3)(2)=48$

2nd row and 2nd column... $(-4)(-1)+(-6)(4)+(-3)(-7)=1$

11. The answer:

$$\begin{bmatrix} \frac{4}{11} & \frac{1}{11} & -\frac{2}{11} \\ -\frac{2}{11} & \frac{4}{33} & \frac{1}{11} \\ -\frac{5}{11} & -\frac{23}{33} & \frac{8}{11} \end{bmatrix}$$