Lesson 3-1 – **Systems of Equations**

Have you ever noticed that when an item is popular and many people want to buy it, the price goes up, but items that no one wants are marked down to a lower price?

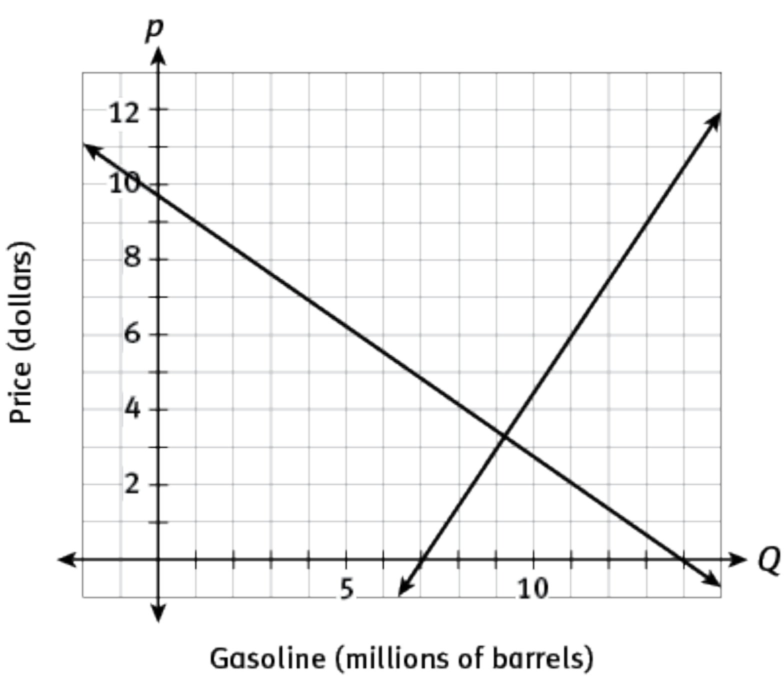
The change in an item's price and the quantity available to buy are the basis of the concept of *supply and demand* in economics. *Demand* refers to the quantity that people are willing to buy at a particular price. *Supply* refers to the quantity that the manufacturer is willing to produce at a particular price. The final price that the customer sees is a result of both supply and demand.

Suppose that during a six-month time period, the supply and demand for gasoline has been tracked and approximated by these functions, where Q represents millions of barrels of gasoline and P represents price per gallon in dollars.

- Demand function: $P = -0.7Q + 9.7$
- Supply function: $P = 1.5Q - 10.4$

A point, or set of points, is a **solution of a system of equations** in two variables when the coordinates of the points make both equations true.

To find the best balance between market price and quantity of gasoline supplied, find a solution of a system of two linear equations.

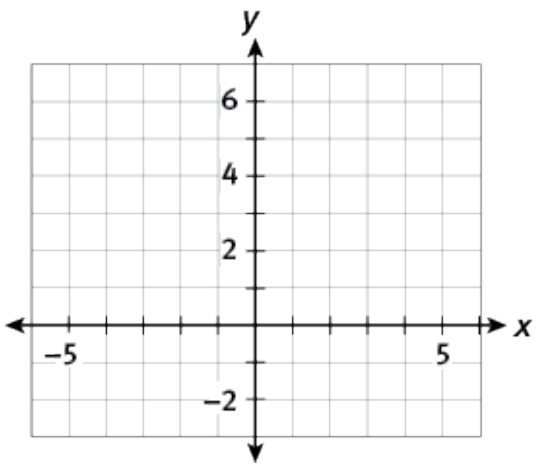


1. Find an approximation of the coordinates of the intersection of the supply and demand functions. Explain what the point represents.

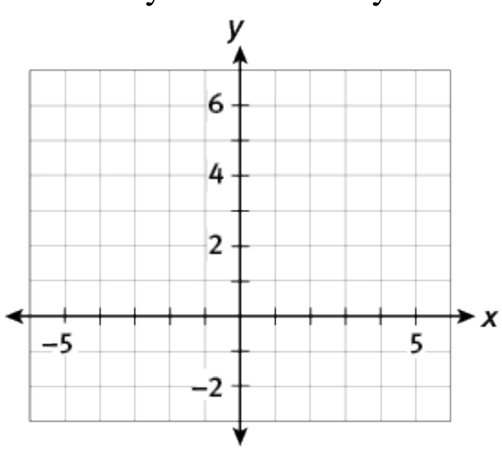
2.What problem(s) can arise when solving a system of equations by graphing?

3. For parts a–c, graph each system. Determine the number of solutions.

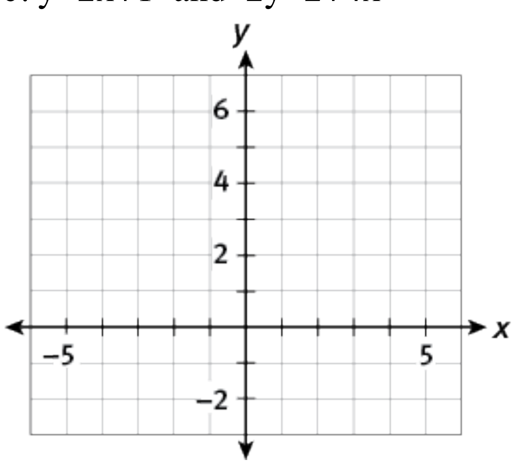
a. $y=x+1$ and $y=-x+4$



b. $y=5+2x$ and $y=2x$



c. $y=2x+1$ and $2y=2+4x$



Lesson 3-1 – **Systems of Equations**

Systems of linear equations are classified by the number of solutions:

- Systems with one or more solutions are **consistent**.
- Systems with no solutions are **inconsistent**.
- A system with exactly one solution is **independent**.
- A system with infinitely many solutions is **dependent**.

Graphing two linear equations illustrates the relationships of the lines. Classify the systems in parts a–c as consistent and independent, consistent and dependent, or inconsistent.

You try: Describe how you can tell whether a system of two equations is independent and consistent by looking at its graph.

You try: The graph of a system of two equations is a pair of parallel lines. Classify this system. Explain your reasoning.

Two methods for solving algebraically:

Substitution and Elimination

Example #1: Solve the system using substitution.

$$y + 2 =$$

$$2x - 3y = 3$$

You Try: Use substitution to solve:

$$2y + x = 4$$
$$3x - 4y = 7$$

Example #2: Use elimination method to solve the system.

$$3x + 2y = 4$$
$$4x - 2y = -18$$

Example #3: Use elimination method to solve the system

$$\begin{cases} 2x - 5y = 8 \\ x - 3y = -1 \end{cases}$$

You try:

Solve each system of equations algebraically.

1. $\begin{cases} x = 4y + 10 \\ 4x + 2y = 4 \end{cases}$

2. $\begin{cases} 6x - 5y = 9 \\ 2x - y = 1 \end{cases}$

Classify each system and determine the number of solutions.

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

4. $\begin{cases} x = 3y - 1 \\ 6x - 12y = -4 \end{cases}$

The senior classes at Leland and at Pioneer planned separate trips to New York City. The senior class at Leland rented and filled 1 van and 6 buses with 372 students. Pioneer rented and filled 4 vans and 12 buses with 780 students. Each van and each bus carried the same number of students. How many students can a van carry? How many students can a bus carry?

Leland is selling tickets to a spring musical. On the first day of ticket sales the school sold 3 senior citizen tickets and 9 child tickets for a total of $75. The school took in $67 on the second day by selling 8 senior citizen tickets and 5 child tickets. What is the price of each senior citizen ticket and child ticket?