

## Sec. 12.1 Systems of Linear Equations

**System of Equations** – a collection of two or more equations, each containing one or more variables

**Solution** – values for the variables that are answers of each equation of the system

### To Classify:

1. Consistent – a system of equations has at least one solution
2. Inconsistent – when a system of equations does not have a solution
3. Coincident – when a system of equations has identical solutions
4. **Independent** – the system of equations has exactly one solution (the point of intersection)
5. Dependent – the system of equations has many (infinite) solutions

Ex. A movie theater sells tickets for \$8.00 each, with seniors receiving a discount of \$2.00. One evening the theater took in \$3580 in revenue. If  $x$  represents the number of tickets sold at \$8.00 and  $y$  the number of tickets sold at the discounted price of \$6.00, write an equation that relates these variables if 525 tickets were sold that evening. Then solve for  $x$  and  $y$ .

$$x + y = 525 \rightarrow y = 525 - x$$

$$8x + 6y = 3580$$

$$8x + 6(525 - x) = 3580$$

$$8x + 3150 - 6x = 3580$$

$$2x + 3150 = 3580$$

$$2x = 430$$

$$x = 215$$

$$y = 525 - 215 \quad (215, 310)$$

$$y = 310$$

215 # 8 tickets

310 # 6 tickets

### Solving Systems –

1. Graphing Calculator – solve both equations for  $y$  and then find the point of intersection
2. Substitution – solve one equation for one of the variables and then substitute it into the second equation
3. Elimination – Multiply or divide one equation so that one of the variables has the same coefficient as that variable in the second equation. Then add or subtract the two equations to eliminate one variable.

Ex. Solve  $\begin{cases} 2x + y = 5 \\ 4x + 2y = 8 \end{cases}$  by using substitution.

$$\begin{aligned} y &= 5 - 2x & 4x + 2(5 - 2x) &= 8 \\ & & 4x + 10 - 4x &= 8 \\ & & 10 &\neq 8 \\ & & \text{NO SOLUTION} & \\ & & \text{(Parallel Lines)} & \end{aligned}$$

Ex. Solve  $\begin{cases} 2x + y = 4 \\ 3x + 2y = 10 \end{cases}$  by using elimination. Check your answers by graphing.

$$\begin{aligned} -4x - 2y &= -8 & 2(-2) + y &= 4 \\ \underline{3x + 2y} &= 10 & -4 + y &= 4 \\ -x &= \frac{2}{-1} & y &= 8 \\ x &= -2 & & \end{aligned}$$

$(-2, 8)$

Ex. Solve  $\begin{cases} 2x + 3y = 4 \\ 8x + 12y = 16 \end{cases}$  using either method. Check your answer by graphing.

$$\begin{aligned} -8x - 12y &= -16 \\ 6 &= 0 \\ & \text{INFINITELY MANY SOLUTIONS} \\ & \text{(Same Lines)} \end{aligned}$$

Ex. A store sells cashews for \$5.00 per pound and peanuts for \$1.50 per pound. The manager decides to mix 30 pounds of peanuts with some cashews and sell the mixture for \$3.00 per pound. How many pounds of cashews should be mixed with the peanuts so that the mixture will produce the same revenue as would selling the nuts separately?

$$\begin{aligned} C &= \text{pounds of cashews} & R &= 30(1.50) + 5C & R &= 3(C + 30) \\ R &= \text{revenue} & & & & \\ & & 45 + 5C &= 3C + 90 & & \\ & & 2C &= 45 & & \\ & & \boxed{C = 22.5 \text{ lbs}} & & & \end{aligned}$$