System of Equations

Determine the nature of the solution to each system of linear equations. If the system has a solution, find it algebraically using substitution.

1. $\begin{cases} 3x + 3y = -21 \\ x + y = -7 \end{cases}$

2. $\begin{cases} y = \frac{3}{2}x - 1 \\ 3y = x + 2 \end{cases}$

3. $\begin{cases} x = 12y - 4 \\ x = 9y + 7 \end{cases}$

System of Equations

Determine the nature of the solution to each system of linear equations. If the system has a solution, find it algebraically,

1. $\begin{cases} 3x + 3y = -21 \\ x + y = -7 \end{cases}$

These equations define the same line. Therefore, this system will have infinitely many solutions.

2. $\begin{cases} y = \frac{3}{2}x - 1 \\ 3y = x + 2 \end{cases}$

The slopes of these two equations are unique. That means they graph as distinct lines and will intersect at one point. Therefore, this system has one solution

$$3\left(y = \frac{3}{2}x - 1\right)$$
$$3y = \frac{9}{2}x - 3$$
$$x + 2 = \frac{9}{2}x - 3$$
$$2 = \frac{7}{2}x - 3$$
$$5 = \frac{7}{2}x$$
$$\frac{10}{7} = x$$

$$y = \frac{3}{2}\left(\frac{10}{7}\right) - 1$$
$$y = \frac{15}{7} - 1$$
$$y = \frac{8}{7}$$

The solution is $\left(\frac{10}{7}, \frac{8}{7}\right)$.

3. $\begin{cases} x = 12y - 4 \\ x = 9y + 7 \end{cases}$

The slopes of these two equations are unique. That means they graph as distinct lines and will intersect at one point. Therefore, this system has one solution.

$$12y - 4 = 9y + 7$$
$$3y - 4 = 7$$
$$3y = 11$$
$$y = \frac{11}{3}$$

$$x = 9\left(\frac{11}{3}\right) + 7$$
$$x = 33 + 7$$
$$x = 40$$

The solution is $\left(40, \frac{11}{3}\right)$.