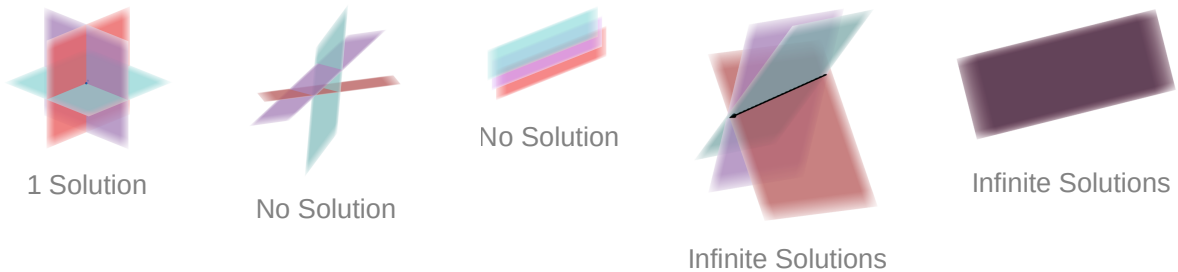# 8.1B Systems of Linear Equations in Three Variables

▼ Definition of a System of Linear Equations in Three Variables

A **system of linear equations in three variables** is the collection of three linear equations in three variables considered simultaneously. The solution to a system of equations in three variables is the set of all ordered triples for which all three equations are true.

▼ Visual Representation of Solutions in three variables

1 Solution

No Solution

No Solution

Infinite Solutions

Infinite Solutions

▼ Example of a reduced system of three linear equations with three variables

$$\begin{cases} 3x + 2y - 3z = 8 \\ y - 2z = 1 \\ 3z = 9 \end{cases}$$

▼ Rules for Obtaining Equivalent System of Equations

1. Interchange any two equations

2. Multiply or divide each side of an equation by a non-zero constant

3. Replace any equation by the sum or difference of that equation and a non-zero multiple of any other equation

▼ Solving a System of Three Equations in Three Variables

$$\begin{cases} x + y - z = -1 \\ 4x - 3y + 2z = 16 \\ 2x - 2y - 3z = 5 \end{cases}$$

▼ Solving an Inconsistent System of Three Equations

$$\begin{cases} 2x + y - z = -2 \\ x + 2y - z = -9 \\ x - 4y + z = 1 \end{cases}$$

▼ Solving a System of Three Equations with Infinite Solutions

$$\begin{cases} x - 2y - z = 8 \\ 2x - 3y + z = 23 \\ 4x - 5y + 5z = 53 \end{cases}$$