Gaussian Elimination with Equations

Principal Operation: Add a non-zero multiple of one equation to another
$\implies$ same solutions since we can 'undo' this operation.

Gaussian Elimination (G-E):

1. Eliminate u from equations 2 and 3 by adding to them multiples of equation 1

2. Eliminate v from the new equation 3 by adding to it a multiple of new equation 2

$$
\begin{array}{rccccc}
& & 2u + v + w & = & 5 \\
\text{Step 1:} \quad R_2 - 2R_1 & : \longrightarrow & -8v - 2w & = & -12 \\
R_3 + R_1 & : & 8v + 3w & = & 14
\end{array}
$$

$$
\begin{array}{rccccc}
& & 2u + v + w & = & 5 \\
\text{Step 2:} & \longrightarrow & -8v - 2w & = & -12 \\
R_3 + R_2 & : & \underbrace{\qquad w \qquad}_{} & = & 2
\end{array}
$$

equivalent system (same solutions)