Systems of 2 Equations / 2 Unknowns

$N = -13p + 760$
$N = 9p - 54$

Inconsistent Systems

$2x + 3y = -12$
$4x + 6y = -18$

Dependent Systems

$x - 3y = 8$
$-2x + 6y = -16$

Systems of 3 Equations / 3 Unknowns

$x + 2y - 3z = 9$
$2x - y + 2z = -8$
$-x + 3y - 4z = 15$

$x + 2y - 3z = 9$
$2x - y + 2z = -8$
$-x + 3y - 4z = 15$

Step 1: Reduce to 2 by 2

$\begin{align*}
\text{Eqn. 1} + \text{Eqn. 3} \\
-x + 2y - 3z = 9 \\
2x - y + 2z = -8 \\
-x + 3y - 4z = 15
\end{align*}$

Parallel Lines

Step 1: Reduce to 2 by 2

$\begin{align*}
-x + 2y - 3z = 9 \\
2x - y + 2z = -8 \\
-x + 3y - 4z = 15
\end{align*}$
Systems of 3 Equations / 3 Unknowns

\[\begin{align*}
  x + 2y - 3z &= 9 \\
 2x - y + 2z &= -8 \\
-x + 3y - 4z &= 15 \\
\end{align*}\]

Step 1: Reduce to 2 by 2

\[\begin{align*}
x + 2y - 3z &= 9 \\
2x - y + 2z &= -8 \\
-x + 3y - 4z &= 15 \\
\end{align*}\]

Step 2: Solve the 2 by 2

\[\begin{align*}
x + 2y - 3z &= 9 \\
-2x - 4y + 6z &= -18 \\
2x - y + 2z &= -8 \\
5y - 7z &= 24 \\
\end{align*}\]

Step 3: Back-substitute

\[\begin{align*}
x + 2y - 3z &= 9 \\
-5y + 8z &= -26 \\
5y - 7z &= 24 \\
2y - 3z &= 9 \\
-5y + 8(-2) &= -26 \\
z &= -2 \\
\end{align*}\]
Systems of 3 Equations / 3 Unknowns

\[ \begin{align*}
  x + 2y - 3z &= 9 \\
  2x - y + 2z &= -8 \\
  -x + 3y - 4z &= 15
\end{align*} \]

Step 1: Reduce to 2 by 2
Step 2: Solve the 2 by 2
Step 3: Back-substitute

\[ \begin{align*}
  x + 2y - 3z &= 9 \\
  -5y + 16 &= -26 \\
  z &= -2
\end{align*} \]
Applications
A ball is thrown directly upward from the top of a building. The position function \( s = \frac{1}{2}at^2 + v_0t + s_0 \)
gives the ball’s height \( s \), in feet, after \( t \) seconds.
Find the values of \( a \), \( v_0 \), and \( s_0 \) if \( s = 224 \) at \( t = 1 \),
\( s = 176 \) at \( t = 3 \), and \( s = 104 \) at \( t = 4 \).

\[
\begin{align*}
224 &= \frac{1}{2}a + v_0 + s_0 \\
176 &= \frac{1}{2}a + 3v_0 + s_0 \\
104 &= 8a + 4v_0 + s_0
\end{align*}
\]

Applications

\[
\begin{align*}
448 &= a + 2v_0 + 2s_0 \\
352 &= 9a + 6v_0 + 2s_0 \\
104 &= 8a + 4v_0 + s_0
\end{align*}
\]

Step 1: Reduce to 2 by 2

\[
\begin{align*}
352 + 8a + 4v_0 + s_0 &= 448 + 9a + 6v_0 + 2s_0 \\
9a + 18v_0 + 18s_0 &= 4032 \\
9a + 6v_0 + 2s_0 &= 352 \\
8a + 4v_0 + s_0 &= 104
\end{align*}
\]

Step 2: Solve the 2 by 2

\[
\begin{align*}
a + 2v_0 + 2s_0 &= 448 \\
9a + 6v_0 + 2s_0 &= 352 \\
8a + 4v_0 + s_0 &= 104
\end{align*}
\]

Step 1: Reduce to 2 by 2

\[
\begin{align*}
a + 2v_0 + 2s_0 &= 448 \\
9a + 6v_0 + 2s_0 &= 352 \\
8a + 4v_0 + s_0 &= 104
\end{align*}
\]

Step 2: Solve the 2 by 2

\[
\begin{align*}
a + 2v_0 + 2s_0 &= 448 \\
9a + 6v_0 + 2s_0 &= 352 \\
8a + 4v_0 + s_0 &= 104
\end{align*}
\]
Applications

\begin{align*}
    a + 2v_0 + 2s_0 &= 448 \\
    9a + 6v_0 + 2s_0 &= 352 \\
    8a + 4v_0 + s_0 &= 104 \\
    a + 2v_0 + 2s_0 &= 448 \\
    -12v_0 - 16s_0 &= -3680 \\
    s_0 &= 200
\end{align*}

Step 1: Reduce to 2 by 2
Step 2: Solve the 2 by 2
Step 3: Back-substitute

\begin{align*}
    a + 2v_0 + 2s_0 &= 448 \\
    9a + 6v_0 + 2s_0 &= 352 \\
    8a + 4v_0 + s_0 &= 104 \\
    a + 2v_0 + 2s_0 &= 448 \\
    -12v_0 - 16(200) &= -3680 \\
    s_0 &= 200
\end{align*}

Step 1: Reduce to 2 by 2
Step 2: Solve the 2 by 2
Step 3: Back-substitute

\begin{align*}
    a + 2v_0 + 2s_0 &= 448 \\
    9a + 6v_0 + 2s_0 &= 352 \\
    8a + 4v_0 + s_0 &= 104 \\
    a + 2v_0 + 2s_0 &= 448 \\
    -12v_0 - 3200 &= -3680 \\
    s_0 &= 200
\end{align*}

Step 1: Reduce to 2 by 2
Step 2: Solve the 2 by 2
Step 3: Back-substitute

\begin{align*}
    a + 2v_0 + 2s_0 &= 448 \\
    9a + 6v_0 + 2s_0 &= 352 \\
    8a + 4v_0 + s_0 &= 104 \\
    a + 2v_0 + 2s_0 &= 448 \\
    9a + 6v_0 + 2s_0 &= 352 \\
    8a + 4v_0 + s_0 &= 104 \\
    a + 2v_0 + 2s_0 &= 448 \\
    a + 2(40) + 2(200) &= 448 \\
    v_0 &= 40 \\
    s_0 &= 200
\end{align*}

Step 1: Reduce to 2 by 2
Step 2: Solve the 2 by 2
Step 3: Back-substitute
Applications

\[ a + 2v_0 + 2s_0 = 448 \]
\[ 9a + 6v_0 + 2s_0 = 352 \]
\[ 8a + 4v_0 + s_0 = 104 \]

\[ a + 80 + 400 = 448 \]
\[ v_0 = 40 \]
\[ s_0 = 200 \]

Step 1: Reduce to 2 by 2
Step 2: Solve the 2 by 2
Step 3: Back-substitute

Applications

\[ a = -32 \]
\[ v_0 = 40 \]
\[ s_0 = 200 \]

A ball is thrown directly upward from the top of a building. The position function

\[ s = \frac{1}{2}at^2 + v_0t + s_0 \]

gives the ball’s height \( s \), in feet, after \( t \) seconds.

\[ s = \frac{1}{2}(-32)t^2 + 40t + 200 \]
\[ s = -16t^2 + 40t + 200 \]