#4. \[ A = \begin{bmatrix} 3 & -5 & 2 \\ 1 & 3 & 5 \\ 4 & -4 & 1 \end{bmatrix} \]
\[
\det A = 3(3+20) - (-5)(1+20) + 3(-42)
\]
\[
= 69 - 95 - 48
\]
\[
= -74.
\]

The 1st component of the solution to \( A\mathbf{x} = \mathbf{b} \) is given by Cramer's Rule to be

\[
x_1 = \frac{\begin{vmatrix} b_1 & -5 & 3 \\ b_2 & 3 & 5 \\ b_3 & -4 & 1 \end{vmatrix}}{\det A}
\]

\[
= \frac{b_1(3+20) - b_2(-5+12) + b_3(-25-9)}{-74}
\]

\[
= \frac{23b_1 - 7b_2 - 34b_3}{-74}.
\]

So \( x_1 = 0 \) when \( 23b_1 - 7b_2 - 34b_3 = 0 \).

This constraint restricts \( \mathbf{b} \) to the plane in \( \mathbb{R}^3 \) that passes through the origin and has normal vector \( \begin{bmatrix} 23 \\ -7 \\ -34 \end{bmatrix} \).