Homework Solution

Sec 3

#4. $A = \begin{bmatrix} 3 & -5 & 3 \\ 1 & 3 & 5 \\ 4 & -4 & 1 \end{bmatrix}$

$$\det A = 3(3+20) - (-5)(1-20) + 3(-4-12)$$
$$= 69 - 95 - 48$$
$$= -74.$$

The 1st component of the solution to $Ax = b = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$

is given by Cramer's Rule to be

$$x_1 = \frac{\det \begin{bmatrix} b_1 & -5 & 3 \\ b_2 & 3 & 5 \\ b_3 & -4 & 1 \end{bmatrix}}{\det A}$$

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

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

So $x_1 = 0$ when $23b_1 - 7b_2 - 34b_3 = 0$.

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