7.1.7.

d.

$$\begin{cases} 3x_1 + 2x_2 - x_3 = 7 \\ 5x_1 + 3x_2 + 2x_3 = 4 \\ -x_1 + x_2 - 3x_3 = -1 \end{cases} \Rightarrow \begin{cases} 3x_1 + 2x_2 - x_3 = 7 \\ -\frac{1}{3}x_2 + \frac{11}{3}x_3 = -\frac{23}{3} \\ \frac{5}{3}x_2 - \frac{10}{3}x_3 = \frac{4}{3} \end{cases}$$

multipliers: $\frac{5}{3}, -\frac{1}{3}$ multiplier: -5

$$\begin{cases} 3x_1 + 2x_2 - x_3 = 7 \\ -\frac{1}{3}x_2 + \frac{11}{3}x_3 = -\frac{23}{3} \\ 15x_3 = -37 \end{cases} \Rightarrow \begin{cases} x_1 = \frac{64}{15} \approx 4.267 \\ x_2 = -\frac{62}{15} \approx -4.133 \\ x_3 = -\frac{37}{15} \approx -2.467 \end{cases}$$

7.2.9.

$$\begin{bmatrix} 2 & 3 & 0 & 8 \\ -1 & 2 & -1 & 0 \\ 3 & 0 & 2 & 9 \end{bmatrix} \qquad \begin{aligned} s &= (3,2,3) \\ \ell &= (1,2,3) \\ \text{ratios} &= \left\{\frac{2}{3}, \frac{1}{2}, \frac{3}{3}\right\} \Rightarrow \ell_1 = (3,2,1) \end{aligned}$$

$$\begin{bmatrix} 0 & 3 & -\frac{4}{3} & 2 \\ 0 & 2 & -\frac{1}{3} & 3 \\ 3 & 0 & 2 & 9 \end{bmatrix} \qquad \text{ratios} = \left\{\frac{3}{3}, \frac{2}{2}\right\} \Rightarrow \ell_2 = (3,1,2)$$

$$\begin{bmatrix} 0 & 3 & -\frac{4}{3} & 2 \\ 0 & 0 & \frac{5}{9} & \frac{5}{3} \\ 3 & 0 & 2 & 9 \end{bmatrix}$$

$$\begin{aligned} x_3 &= 3 \\ x_2 &= \left[2 + \frac{4}{3}(3)\right] \Big/ 3 = 2 \\ x_1 &= [9 - 2(3)]/3 = 1 \end{aligned}$$

7.3.5. The diagonals have the following relations:

subdiagonal	diagonal	superdiagonal
$i - 1 = j$	$i = j$	$i + 3 = j$
$i - 2 = j$		$i + 2 = j$
$i - 3 = j$		$i + 1 = j$

Since $i - 3 < i - 2 = j$, an upper triangular matrix with zero elements below or on the 3rd subdiagonal has $a_{ij} = 0$ when $j < i - 2$.

Since $i + 1 < i + 2 = j$, a lower triangular matrix with zero elements above or on the 2nd superdiagonal has $a_{ij} = 0$ when $j > i + 1$.

8.1.18. $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 1 & 3 & 1 \end{bmatrix} \begin{bmatrix} 2 & 2 & 1 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$