

Determine whether the following matrices are in row echelon form (write REF) or reduced row echelon form (write RREF) or neither (write N). If a matrix is in RREF, circle the pivot columns.

Pivot entries are circled in green, pivot cols. in red

1.

$$\begin{bmatrix} \textcircled{1} & 2 & 3 \\ 0 & \textcircled{1} & 0 \\ 0 & 0 & 0 \end{bmatrix} \text{ REF}$$

2.

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & \textcircled{1} & 0 & 2 \\ 0 & 0 & \textcircled{2} & 1 \end{bmatrix} \text{ N (zero row is not at the bottom)}$$

3.

$$\begin{bmatrix} \textcircled{1} & \textcircled{0} & \textcircled{0} \\ 0 & \textcircled{1} & \textcircled{0} \\ 0 & 0 & \textcircled{1} \end{bmatrix} \text{ RREF}$$

4.

$$\begin{bmatrix} \textcircled{1} & \textcircled{0} & 0 \\ 0 & \textcircled{1} & 1 \\ 0 & 0 & 0 \end{bmatrix} \text{ RREF}$$

5.

$$\begin{bmatrix} \textcircled{1} & 2 & 4 \\ 0 & 0 & 0 \\ 0 & 0 & \textcircled{2} \end{bmatrix} \text{ N (zero row is not at the bottom)}$$

6.

$$\begin{bmatrix} 0 & \textcircled{1} & 3 & 0 \\ 0 & 0 & \textcircled{1} & 0 \\ 0 & 0 & 0 & \textcircled{1} \end{bmatrix} \text{ REF}$$

7.

$$\begin{bmatrix} \textcircled{2} & 1 & 3 & 0 \\ 0 & \textcircled{3} & 9 & 2 \\ 0 & 0 & \textcircled{2} & -1 \end{bmatrix} \text{ REF}$$

8.

$$\begin{bmatrix} \textcircled{1} & \textcircled{0} & \textcircled{0} & 0 \\ 0 & \textcircled{1} & \textcircled{0} & 2 \\ 0 & 0 & \textcircled{1} & -1 \end{bmatrix} \text{ RREF}$$