

# Echelon form

When solving equations, we reduce the matrix to echelon form. It is in echelon form when the first nonzero element, if any, in each row is to the right of the first nonzero element of the previous row

$$\begin{pmatrix} 0 & \boxed{P} & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & \boxed{P} & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & 0 & \boxed{P} & \cdot & \cdot \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

These first nonzero elements will be called “pivots.”

Example echelon form

$$\begin{pmatrix} \boxed{1} & 2 & -1 & 3 \\ 0 & 0 & \boxed{6} & -3 \\ 0 & 0 & 0 & 0 \end{pmatrix} \begin{array}{l} (1) \\ (2') \\ (3'') \end{array}$$

Example nonechelon form

$$\begin{pmatrix} \boxed{1} & 2 & -1 & 3 \\ 0 & 0 & \boxed{6} & -3 \\ 0 & \boxed{1} & 0 & 0 \end{pmatrix} \begin{array}{l} (1) \\ (2') \\ (3'') \end{array}$$

Another nonechelon form

$$\begin{pmatrix} \boxed{1} & 2 & -1 & 3 \\ 0 & 0 & 0 & 0 \\ 0 & \boxed{1} & 0 & 0 \end{pmatrix} \begin{array}{l} (1) \\ (2') \\ (3'') \end{array}$$

You *must* reduce your systems *completely* to echelon form. You may not delete any rows as the book says.