$$R_2 \to \tfrac{1}{4}R_2 \qquad \begin{array}{c|c} & \begin{array}{ccc} 1\text{st} & 2\text{nd} & 3\text{rd} \end{array} \\ \begin{array}{c} 1\text{st} \\ 2\text{nd} \\ 3\text{rd} \\ 4\text{th} \\ 5\text{th} \\ 6\text{th} \\ 7\text{th} \\ 8\text{th} \\ 9\text{th} \\ \vdots \end{array} & \begin{bmatrix} 1 & 2 & 3 & \cdots \\ 4 & 5 & 6 & \\ \cdot & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \\ \cdot & & & \\ \cdot & & & \\ \cdot & & & \\ \cdot & & & \\ \cdot & & & \\ \vdots & & & \end{bmatrix} \end{array}$$

is a matrix

RREF: $\xrightarrow{R_2 \to \frac{1}{4}R_2} \begin{bmatrix} 1 & 2 & 3 \\ 1 & \frac{5}{4} & \frac{6}{4} \end{bmatrix} \xrightarrow{R_2 \to R_2 - R_1} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -\frac{3}{4} & -\frac{6}{4} \end{bmatrix}$

① "Leading 1". The first non-zero entry of each row is 1. $\xrightarrow{R_2 \to -\frac{4}{3}R_2} \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \end{bmatrix}$

② "zero-off" Once "Leading 1" obtained, then look at the column where the "leading 1" is.

RREF requires that all other elements except the leading 1 in that column are zeros

③ "Stair-shape" All the leading ones form a stair-shape toward down to the right.

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$

A typical non-example looks like $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$

which satisfies ① ②, but not 3

$$\xrightarrow{R_2 \leftrightarrow R_3} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

④ $\underbrace{\text{zero-rows}}$ are placed at the bottom.

(A row with all zero entries)

$$\begin{bmatrix} 1 & 2 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \xrightarrow{R_2 \leftrightarrow R_3} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

Not RREF