

Solve

$$-x + 4y = 7$$

$$9x - 4y = 9$$

What you'd probably do...

add the equations

$$8x = 16$$

$$x = 2$$

$$\boxed{(2, 9/4)}$$

$$-2 + 4y = 7$$

$$4y = 9$$

$$y = 9/4$$

Using GE:

$$\begin{bmatrix} -1 & 4 & | & 7 \\ 9 & -4 & | & 9 \end{bmatrix}$$

$R_2 \rightarrow R_2 + 9R_1$

$$\begin{bmatrix} -1 & 4 & | & 7 \\ 0 & 32 & | & 72 \end{bmatrix}$$

in echelon form

$R_2 \rightarrow$

$\frac{1}{32}R_2 \rightarrow$

$$\begin{bmatrix} -1 & 4 & | & 7 \\ 0 & 1 & | & 9/4 \end{bmatrix}$$

if we did

$\times R_2 \rightarrow R_2 + R_1$,
we would get

$$\begin{bmatrix} -1 & 4 & | & 7 \\ 8 & 0 & | & 16 \end{bmatrix}$$

not in echelon form

$$R_1 \rightarrow (-1)R_1$$

$$\rightarrow \left[\begin{array}{cc|c} 1 & -4 & -7 \\ 0 & 1 & 9/4 \end{array} \right]$$

$$R_1 \rightarrow R_1 + 4R_2$$

$$\rightarrow \left[\begin{array}{cc|c} 1 & 0 & 2 \\ 0 & 1 & 9/4 \end{array} \right]$$

$$x = 2$$

$$y = 9/4$$