

Linear combination aka elimination method

$$2x + 3y = 5 \quad (1)$$

$$x + y = 1 \quad (2)$$

is equivalent to

$$\begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 1 \end{bmatrix}$$

.

We want to multiply the bottom equation by -2 when solving with the elimination method normally, so we might expect to multiply by the identity matrix but with the "bottom row selector" modified:

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

$$\begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

=

$$\begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} 5 \\ 1 \end{bmatrix}$$

And then, to add the bottom to the top we can use $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$.

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