

How do we solve systems of equations by elimination?

Do Now: Solve

$$2x - 3y = 6$$

$$-2x + 1 = 4$$

$$-2y = 10$$

$$y = -5$$

Solve

$$x - 2y - 3z = 0$$

$$2y + z = -8$$

$$-x + y + 2z = 3$$

$$\rightarrow \begin{bmatrix} 1 & -2 & -3 \\ 0 & 2 & 1 \\ -1 & 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ -8 \\ 3 \end{bmatrix}$$

$$x \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + y \begin{bmatrix} -2 \\ 2 \\ 1 \end{bmatrix} + z \begin{bmatrix} -3 \\ 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 0 \\ -8 \\ 3 \end{bmatrix}$$

$$a \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + b \begin{bmatrix} -2 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} -3 \\ 1 \\ 2 \end{bmatrix}$$

$$\begin{aligned} a - 2b &= -3 \\ 2b &= 1 \rightarrow b = \frac{1}{2}, a = -2 \end{aligned}$$

$$\rightarrow \begin{bmatrix} 1 & -2 & -3 \\ 0 & 2 & 1 \\ -1 & 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ -8 \\ 3 \end{bmatrix}.$$

$$\begin{bmatrix} 1 & -2 & -3 \\ 0 & 2 & 1 \\ 0 & -1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ -8 \\ 3 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -2 & -3 \\ 0 & 2 & 1 \\ 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ -8 \\ -2 \end{bmatrix}$$

$$-z = -2 \rightarrow z = 2$$

$$2y + 2 = -8 \rightarrow y = -5$$

$$x + 0 - 6 = 0 \rightarrow x = 6$$