

## 4.6. Matrix Equations and Systems of Linear Equations.

Goals:

- ① Use matrix equations to solve linear systems.
- ② Solve applications

① Simple linear equation:  $5x = 7$

$$\frac{1}{5} \cdot 5x = \frac{1}{5} \cdot 7$$
$$x = \frac{7}{5}$$

Simple Matrix Equation

$$AX = B$$

$$\begin{aligned} A^{-1}AX &= A^{-1}B \\ I X &= A^{-1}B \end{aligned}$$

$$X = A^{-1}B$$

Ex.

$$2x - y = -3$$

$$x + 2y = -4$$

$$\underbrace{\begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}}_A \underbrace{\begin{pmatrix} x \\ y \end{pmatrix}}_X = \underbrace{\begin{pmatrix} -3 \\ -4 \end{pmatrix}}_B$$

$$X = A^{-1} B$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \boxed{\frac{2}{5} \quad \frac{1}{5}} \\ \boxed{-\frac{1}{5} \quad \frac{2}{5}} \end{pmatrix} \begin{pmatrix} -3 \\ -4 \end{pmatrix}$$

$$= \begin{pmatrix} -\frac{6}{5} & -\frac{4}{5} \\ \frac{3}{5} & -\frac{8}{5} \end{pmatrix} = \begin{pmatrix} -2 \\ -1 \end{pmatrix}$$

$$A^{-1} = \frac{1}{5} \begin{pmatrix} 2 & 1 \\ -1 & 2 \end{pmatrix} = \begin{pmatrix} \frac{2}{5} & \frac{1}{5} \\ -\frac{1}{5} & \frac{2}{5} \end{pmatrix}$$

$$= \begin{pmatrix} \frac{2}{5} \cdot (-3) + \frac{1}{5} \cdot (-4) \\ -\frac{1}{5} \cdot (-3) + \frac{2}{5} \cdot (-4) \end{pmatrix}$$

E.g. 3-by-3.

$$x + y + 2z = 1$$

$$2x + y = 2$$

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

$$\begin{pmatrix} 1 & 1 & 2 \\ 2 & 1 & 0 \\ 1 & 2 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

$A$

$X$

$= B$

$$X = A^{-1} B = \begin{pmatrix} 0 \\ 2 \\ -\frac{1}{2} \end{pmatrix}$$

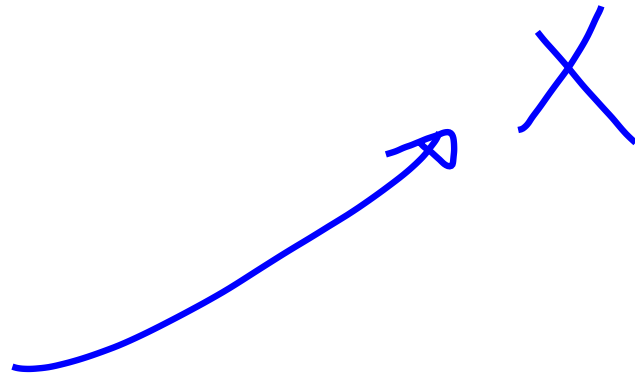
Process for TI - 84

① Input A

② Input B

③ Find  $A^{-1}$

④ Find  $A^{-1}B$



HW #2, 6, 7 (Done)