

① a Undefined, A & D not same size

$$\text{(b)} \begin{bmatrix} 2 & -3 & 0 \\ 1 & 2 & -5 \\ 0 & -1 & -2 \end{bmatrix} \begin{bmatrix} 3 & -1 & 0 \\ -2 & 1 & 3 \\ 0 & -1 & -2 \end{bmatrix} = \begin{bmatrix} 6+6+0 & -2-3+0 & 0-9+0 \\ 3-4+0 & -1+2+5 & 0+6+10 \\ 0 & 0 & 0 \end{bmatrix}$$
$$= \begin{bmatrix} 12 & -5 & -9 \\ -1 & 6 & 16 \\ 0 & 0 & 0 \end{bmatrix}$$

③ Undefined C A
 3×3 2×3
don't match

④ B + AD

$$\begin{matrix} 2 \times 2 & 2 \times 3 & 3 \times 2 \\ & 2 \times 2 & \end{matrix}$$
$$AD = \begin{bmatrix} 2 & -3 & 0 \\ 1 & 2 & -5 \end{bmatrix} \begin{bmatrix} -2 & 3 \\ 1 & -1 \\ 2 & -2 \end{bmatrix} = \begin{bmatrix} -4-3+0 & 6+3+0 \\ -2+2-10 & 3-2+10 \end{bmatrix}$$
$$= \begin{bmatrix} -7 & 9 \\ -10 & 11 \end{bmatrix}$$

$$B + AD = \begin{bmatrix} 3 & -2 \\ 5 & 0 \end{bmatrix} + \begin{bmatrix} -7 & 9 \\ -10 & 11 \end{bmatrix} = \begin{bmatrix} -4 & 7 \\ -5 & 11 \end{bmatrix}$$

⑤ $-2BA + 6CD$
 2×2 2×3 3×3 3×2
 2×3 3×2
can't add

Undefined b/c

BA & CD not same size

$$\textcircled{2} \left[\begin{array}{cc|cc} 1 & 3 & 1 & 0 \\ 1 & 4 & 3 & 2 \end{array} \right] \xrightarrow{R_2 - R_1 \rightarrow R_2} \left[\begin{array}{cc|cc} 1 & 3 & 1 & 0 \\ 0 & 1 & 2 & 2 \end{array} \right]$$

$$\xrightarrow{R_1 - 3R_2 \rightarrow R_1} \left[\begin{array}{cc|cc} 1 & 0 & -5 & -6 \\ 0 & 1 & 2 & 2 \end{array} \right]$$

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} -5 & -6 \\ 2 & 2 \end{bmatrix}$$

$$\textcircled{3} \begin{bmatrix} 4 & 3 \\ -3 & -2 \end{bmatrix}^{-1} = \frac{1}{(4)(-2) - (-3)(3)} \begin{bmatrix} -2 & -3 \\ 3 & 4 \end{bmatrix}$$

$$= \frac{1}{-8 + 9} \begin{bmatrix} -2 & -3 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 3 & 4 \end{bmatrix}$$

$$\textcircled{4} \begin{bmatrix} 2 & 6 \\ 3 & 9 \end{bmatrix}^{-1} = \frac{1}{(2)(9) - (6)(3)} \begin{bmatrix} 9 & -6 \\ -3 & 2 \end{bmatrix} = \frac{1}{18 - 18} \begin{bmatrix} 9 & -6 \\ -3 & 2 \end{bmatrix}$$

can't divide by 0

No inverse

$$\textcircled{5} \left[\begin{array}{ccc|ccc} 2 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ -1 & -1 & 0 & 0 & 0 & 1 \end{array} \right] \xrightarrow{R_3 + R_2 \rightarrow R_3} \left[\begin{array}{ccc|ccc} 2 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 \end{array} \right]$$

row of zeros.

no inverse

⑥ a) FINITE_MATH

6 9 14 9 20 5 0 13 1 20 8

$$\begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} 6 & 14 & 20 & 0 & 1 & 8 \\ 9 & 9 & 5 & 13 & 20 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 6+18 & 14+18 & 20+10 & 0+26 & 1+40 & 8+0 \\ 6+27 & 14+27 & 20+15 & 0+39 & 1+60 & 8+0 \end{bmatrix}$$

$$= \begin{bmatrix} 24 & 32 & 30 & 26 & 41 & 8 \\ 33 & 41 & 35 & 39 & 61 & 8 \end{bmatrix}$$

24 33 32 41 30 35 26 39 41 61 8 8

⑦ b)

$$\text{Decoding Matrix} = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}^{-1} = \frac{1}{(1)(3)-(1)(2)} \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix}$$

$$\text{c) } \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 38 & 23 & 37 & 5 & 55 & 75 \\ 53 & 23 & 55 & 5 & 70 & 102 \end{bmatrix}$$

$$= \begin{bmatrix} 114-106 & 69-46 & 111-110 & 15-10 & 165-140 & 225-204 \\ -38+53 & -23+23 & -37+55 & -5+5 & -55+70 & -75+102 \end{bmatrix}$$

$$= \begin{bmatrix} 8 & 23 & 1 & 5 & 25 & 21 \\ 15 & 0 & 18 & 0 & 15 & 27 \end{bmatrix}$$

8 15 23 0 1 18 5 0 25 15 21 27

H O W _ A R E _ Y O U ?

$$\begin{aligned} \textcircled{7} \quad AX - X &= C \\ \Rightarrow (A - I)X &= C \\ \Rightarrow X &= (A - I)^{-1}C \end{aligned}$$

$$\begin{aligned} \textcircled{8} \quad AX - C &= D - BX \\ + BX + C &+ C + BX \\ \hline AX + BX &= D + C \\ \Rightarrow (A + B)X &= D + C \\ \Rightarrow X &= (A + B)^{-1}(D + C) \end{aligned}$$

$$\begin{aligned} \textcircled{9} \quad \begin{cases} 2x + y = k_1 \\ x + y = k_2 \end{cases} &\Leftrightarrow \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} k_1 \\ k_2 \end{bmatrix} \\ \Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} &= \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}^{-1} \begin{bmatrix} k_1 \\ k_2 \end{bmatrix} = \frac{1}{(2)(1) - (1)(1)} \begin{bmatrix} 1 & -1 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} k_1 \\ k_2 \end{bmatrix} \\ &= \frac{1}{1} \begin{bmatrix} 1 & -1 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} k_1 \\ k_2 \end{bmatrix} = \begin{bmatrix} k_1 - k_2 \\ -k_1 + 2k_2 \end{bmatrix} \end{aligned}$$

$$\textcircled{a} \quad x = (-1) - (-2) = 1$$

$$y = -(-1) + 2(-2) = -3$$

$$\textcircled{b} \quad x = 2 - 3 = -1$$

$$y = -(2) + 2(3) = 4$$

$$\textcircled{c} \quad x = 2 - 0 = 2$$

$$y = -(2) + 2(0) = -2$$

⑩ $x = \$$ of transportation
 $y = \$$ of manufacturing

$$\begin{array}{c} T \uparrow m \\ \begin{array}{c} T \\ m \end{array} \rightarrow \begin{bmatrix} 0.1 & 0.4 \\ 0.1 & 0.4 \end{bmatrix} = M \quad D = \begin{bmatrix} 5 \\ 20 \end{bmatrix}$$

$$I - M = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 0.1 & 0.4 \\ 0.1 & 0.4 \end{bmatrix} = \begin{bmatrix} 0.9 & -0.4 \\ -0.1 & 0.6 \end{bmatrix}$$

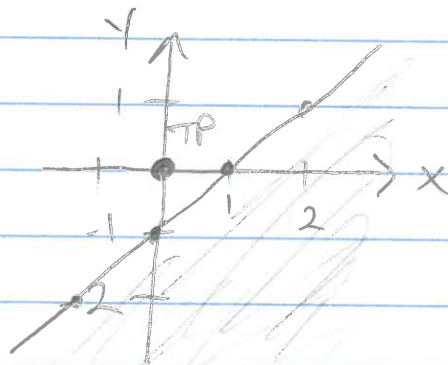
$$\begin{aligned} (I - M)^{-1} &= \frac{1}{(0.9)(0.6) - (-0.4)(-0.1)} \begin{bmatrix} 0.6 & 0.4 \\ 0.1 & 0.9 \end{bmatrix} \\ &= \frac{1}{0.5} \begin{bmatrix} 0.6 & 0.4 \\ 0.1 & 0.9 \end{bmatrix} = \begin{bmatrix} 1.2 & 0.8 \\ 0.2 & 1.8 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} X &= (I - M)^{-1} D = \begin{bmatrix} 1.2 & 0.8 \\ 0.2 & 1.8 \end{bmatrix} \begin{bmatrix} 5 \\ 20 \end{bmatrix} \\ &= \begin{bmatrix} 6 + 16 \\ 1 + 36 \end{bmatrix} = \begin{bmatrix} 24 \\ 37 \end{bmatrix} \end{aligned}$$

\$24 billion in transportation and \$37 billion in manufacturing must be produced.

⑪ $y \leq x - 1$
not strict: solid

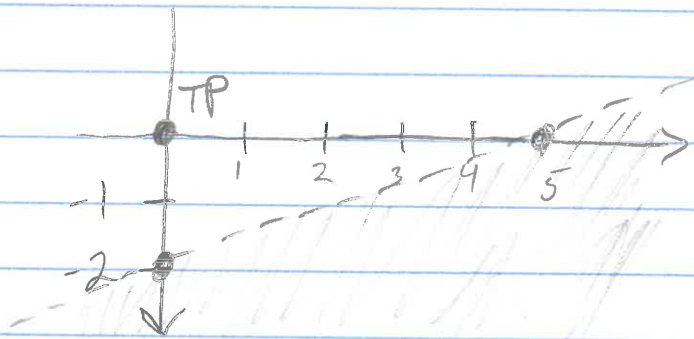
Graph $y = x - 1$
 $(0, -1), (1, 0)$



Test $(0, 0)$
 $0 \leq 0 - 1$
 $0 \leq -1$ false

⑫ $2x - 5y > 10$
strict: dotted

Graph $2x - 5y = 10$
 $(0, -2), (5, 0)$



Test $(0, 0)$
 $2(0) - 5(0) > 10$
 $0 > 10$
false

⑬ $x = \#$ of regular mattresses
 $y = \#$ of king mattresses

50 hours = 3000 minutes

$$5x + 6y \leq 3000$$