

# Exam 1 Practice Problems

## Part 3 - Matrices

1. Find the values of  $a$ ,  $b$ ,  $c$  and  $d$  in the matrix equation  $5 \begin{bmatrix} 2 & 4 \\ -1 & a \end{bmatrix} + \begin{bmatrix} -4 & b \\ c & 3 \end{bmatrix}^T = \begin{bmatrix} d & 0 \\ 1 & 6 \end{bmatrix}$

2. A chain owns three restaurants ( $I$ ,  $II$  and  $III$ ) in the area and each serves breakfast ( $B$ ), lunch ( $L$ ) and dinner ( $D$ ). The average number of meals sold on Mondays is shown in matrix  $A$ . The average price for a breakfast is \$3, the average price for a lunch is \$6 and the average price for a dinner is \$10. Find a matrix  $B$  such that when it is multiplied by matrix  $A$  it will give the matrix  $R$  with the average revenue for each restaurant on Mondays.

$$A = \begin{matrix} & \begin{matrix} I & II & III \end{matrix} \\ \begin{matrix} B \\ L \\ D \end{matrix} & \begin{bmatrix} 66 & 300 & 250 \\ 150 & 200 & 400 \\ 50 & 600 & 220 \end{bmatrix} \end{matrix}$$

3. What is the system of linear equations that corresponds to the matrix equation  $AX=B$  if

$$A = \begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix} \quad X = \begin{bmatrix} x \\ y \end{bmatrix} \quad B = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$$

4. We are given approximately how many grams of fat, carbohydrate and protein are in a “unit” of four different foods in matrix  $X$ . In matrix  $Y$  we are given how many calories are in a gram of fat, carbohydrate or protein. Is  $XY$  or  $YX$  meaningful and what does the meaningful product represent?

$$Y = \begin{matrix} & \begin{matrix} fat & carb & pro \end{matrix} \\ \begin{matrix} fat \\ carb \\ pro \end{matrix} & \begin{bmatrix} 8 \\ 4 \\ 5 \end{bmatrix} \end{matrix} \quad X = \begin{matrix} & \begin{matrix} meat \\ fruit \\ grain \\ dairy \end{matrix} \\ \begin{matrix} fat \\ carb \\ pro \end{matrix} & \begin{bmatrix} 5 & 0 & 7 \\ 0 & 10 & 1 \\ 0 & 15 & 2 \\ 10 & 12 & 8 \end{bmatrix} \end{matrix}$$

5. Given that  $A$  is a non-singular  $4 \times 4$  matrix,  $B$  is a singular  $4 \times 4$  matrix,  $I$  is a  $4 \times 4$  identity matrix,  $C$  is a  $4 \times 2$  matrix,  $D$  is a  $2 \times 4$  matrix, determine which of the operations below are allowed. If it is not allowed, explain why.

- (a)  $A+D$       (b)  $A+B$       (c)  $C+D^T$       (d)  $BI$       (e)  $B^{-1}$   
(f)  $A^{-1}$       (g)  $AC$       (h)  $D^2$       (i)  $B^2$       (j)  $CD$

6. Solve the matrix equation  $AX + X = D$  for  $X$ .