Chapter 5 Homework Problems
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Section 5.1

1. Compute the following operations, if possible.

$$A = \begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & -1 & 3 \\ 0 & 2 & 1 \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & -2 \\ 0 & 2 \\ 4 & -1 \end{bmatrix} \qquad D = \begin{bmatrix} 1 & -2 & 0 \\ -1 & 3 & 2 \end{bmatrix}$$

   (a) $B^T - 2C =$
   (b) $A + C =$
   (c) $7D + 2C^T =$
   (d) $D + C =$
   (e) $3D - 2B =$

2. Compute the following operations, if possible.

$$A = \begin{bmatrix} 2 & 0 \\ -2 & 3 \end{bmatrix} \qquad B = \begin{bmatrix} a & -3 & 1 \\ 0 & 1 & 4 \end{bmatrix}$$

$$C = \begin{bmatrix} 2 & -1 \\ 1 & 0 \\ b & -3 \end{bmatrix} \qquad D = \begin{bmatrix} 3a & -3 & 1 \\ 0 & 1 & 3 \end{bmatrix}$$

$$E = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

   (a) $5B + 2D =$
   (b) $A + C =$
   (c) $A - 2D =$
   (d) $3A + E =$
   (e) $2\begin{bmatrix} 1 & 3 & j \\ -2 & 0 & 2 \end{bmatrix} + \begin{bmatrix} 0 & 3 & -5 \\ 7 & k & 2 \end{bmatrix} - C^T =$

3. If possible, solve for the variables.

   (a) $3\begin{bmatrix} 2x & 4 \\ -1 & 4 \end{bmatrix} + 2\begin{bmatrix} 1 & u \\ -z & 1 \end{bmatrix} = \begin{bmatrix} 2y & 5 \\ 7 & y \end{bmatrix}$
   (b) $-2\begin{bmatrix} 1 & 2x \\ -3y & 4 \end{bmatrix} + 5\begin{bmatrix} 1 & y \\ 2x & 4 \end{bmatrix} = \begin{bmatrix} 3 & 22 \\ -3 & 12 \end{bmatrix}$
   (c) $\begin{bmatrix} 2 & 3x \\ 6x & 6 \end{bmatrix} + 2\begin{bmatrix} 3 & 6y \\ -2y & -1 \end{bmatrix}^T = \begin{bmatrix} 8 & -13 \\ 84 & 4 \end{bmatrix}$
   (d) $\begin{bmatrix} x & 2 \\ y & 7 \end{bmatrix} - 2\begin{bmatrix} 3y & z \\ 7 & 4 \end{bmatrix} = \begin{bmatrix} 4 & 2x \\ 0 & -1 \end{bmatrix}^T$

Section 5.2

4. Give the size of the answer matrix for the calculations that are possible.

A	B	C	D	E	F	G
3 x 4	4 x 3	4 x 3	5 x 4	4 x 2	2 x 1	5 x 4

   (a) $6AEF =$
   (b) $D(B + C) =$
   (c) $2A + 4B =$
   (d) $3CB^T =$
   (e) $(BG)^T E =$
   (f) $A(D + G)^T =$

5. True or False.

   (a) For any two 2 x 2 matrices $(A + B)^2 = A^2 + 2AB + B^2$.
   (b) For every matrix A, $(A^T)^T = A$.
   (c) If A is a **4 x 1** matrix and B is a **1 x 4** matrix, then AB is a **1 x 1** matrix.

6. Compute the following operations, if possible.

$$A = \begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & -1 & 3 \\ 0 & 2 & 1 \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & -2 \\ 0 & 2 \\ 4 & -1 \end{bmatrix} \qquad D = \begin{bmatrix} 1 & -2 & 0 \\ -1 & 3 & 2 \\ 0 & 1 & 2 \end{bmatrix}$$

$$E = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \qquad G = \begin{bmatrix} 2 & -1 \\ 1 & 0 \\ 2 & -3 \end{bmatrix}$$

   (a) $AC =$
   (b) $BC =$
   (c) $AD =$
   (d) $BD =$
   (e) $BGA =$
   (f) $CE =$
   (g) $EB =$

7. Compute.
$$2\begin{bmatrix} 1 & 3 & -2 \\ 5 & 8 & -4 \\ -6 & 10 & 5 \end{bmatrix}\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} =$$

8. Find AB and BA when $A = \begin{bmatrix} x & 1 \\ y & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 2 \end{bmatrix}$

9. Find the indicated entries for $C = AB$ and $D = BA$ where
$$A = \begin{bmatrix} 1 & 3 & 4 \\ 0 & 2 & 8 \\ 10 & -5 & 0 \\ 1 & 3 & 9 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & 5 & 0 & 4 \\ 10 & 20 & 3 & 0 \\ 0 & 0 & 5 & 4 \end{bmatrix}.$$

   (a) $C_{1,3}$

   (b) $D_{3,1}$

10. Solve for x, y, and z.
$$\begin{bmatrix} 1 & 3 & 5 \\ 3 & \text{x} & \text{y} \end{bmatrix} \begin{bmatrix} 2 & 5 \\ 1 & 0 \\ -2 & 5 \end{bmatrix} = \begin{bmatrix} -5 & \text{y} + 2\text{z} \\ 1 & 35 \end{bmatrix}$$

11. A dietician plans a meal around two foods. The number of units of vitamin A and vitamin C in each ounce of these foods is represented by the matrix M.
$$M = \begin{array}{c} \\ \text{Vitamin A} \\ \text{Vitamin C} \end{array} \begin{array}{c} \begin{array}{cc} \text{Food I} & \text{Food II} \end{array} \\ \begin{bmatrix} 400 & 1200 \\ 110 & 570 \end{bmatrix} \end{array}$$
$$B = \begin{array}{c} \begin{array}{cc} \text{Food I} & \text{Food II} \end{array} \\ \begin{bmatrix} 7 & 1 \end{bmatrix} \end{array} \qquad L = \begin{array}{c} \begin{array}{cc} \text{Food I} & \text{Food II} \end{array} \\ \begin{bmatrix} 9 & 3 \end{bmatrix} \end{array}$$

   The matrices B and L represent the amount of each food (in ounces) consumed by the girl at breakfast and lunch, respectively. Compute and explain the meaning of the entries.

   (a) BM

   (b) ML^T

   (c) $(B + L)M$

   (d) $M(B + L)^T$

12. Write the system of linear equations as a matrix equation, AX=B.

   (a) $2x + 3y + 4z = 6$
   $y - 3z = 7$
   $x + y + z = 10$

   (b) $x + 8z = 4$
   $x - y + 2z = 15$
   $3x + 2y + z = 2$

Section 5.3

13. Find the inverses of these matrices. If it doesn't exist, then be sure to say not possible.

   (a) $\begin{bmatrix} 1 & 5 & 1 \\ 4 & 7 & 8 \\ 1 & 0 & 5 \end{bmatrix}$

   (b) $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 7 & 8 & 9 & 10 \\ 0 & 1 & 0 & 5 \\ 4 & 2 & 0 & -2 \end{bmatrix}$

14. Solve for the unknown matrix.
$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 0 & -5 \\ 3 & 10 & -5 \end{bmatrix} \qquad B = \begin{bmatrix} 7 & 2 & 9 \\ 0 & 9 & -4 \\ 1 & 1 & -6 \end{bmatrix}$$
$$C = \begin{bmatrix} 1 & 9 & 20 \\ -3 & 5 & 19 \\ -20 & -50 & 20 \end{bmatrix}$$

   (a) $AM - 3B = C$

   (b) $KA + KC = B$

   (c) $3J + CJ = 3A^T$

15. Use this system of equations to answer the next two questions.
   $3x + 2y + z = 10$
   $-3x + 3y + 4z = 5$
   $2x + 2y + z = -16$

   (a) What is the coefficient matrix?

   (b) Compute the inverse of the coefficient matrix. If it is not possible, then explain why.

16. Find the inverse for the coefficient matrix. If that is not possible, then explain why.
   $2x + 4y - 2z = 10$
   $-4x - 6y + z = 15$
   $3x + 5y - z = 7$