Chapter 5 Homework Solutions
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1. (a) $\begin{bmatrix} 1 & 0 \\ -1 & 2 \\ 3 & 1 \end{bmatrix} - \begin{bmatrix} 2 & -4 \\ 0 & 4 \\ 8 & -2 \end{bmatrix} = \begin{bmatrix} -1 & 4 \\ -1 & -2 \\ -5 & 3 \end{bmatrix}$

(b) Not possible, the dimension don't match.

(c) $\begin{bmatrix} 7 & -14 & 0 \\ -7 & 21 & 14 \end{bmatrix} + \begin{bmatrix} 2 & 0 & 8 \\ -4 & 4 & -2 \end{bmatrix} =$
$\begin{bmatrix} 9 & -14 & 8 \\ -11 & 25 & 12 \end{bmatrix}$

(d) Not possible, the dimensions don't match.

(e) $\begin{bmatrix} 3 & -6 & 0 \\ -3 & 9 & 6 \end{bmatrix} - \begin{bmatrix} 2 & -2 & 6 \\ 0 & 4 & 2 \end{bmatrix} = \begin{bmatrix} 1 & -4 & -6 \\ -3 & 5 & 4 \end{bmatrix}$

2. (a) $\begin{bmatrix} 5a & -15 & 5 \\ 0 & 5 & 20 \end{bmatrix} + \begin{bmatrix} 6a & -6 & 2 \\ 0 & 2 & 6 \end{bmatrix} = \begin{bmatrix} 11a & -21 & 7 \\ 0 & 7 & 26 \end{bmatrix}$

(b) Not possible, the dimensions don't match.

(c) Not possible, the dimensions don't match.

(d) $\begin{bmatrix} 6 & 0 \\ -6 & 9 \end{bmatrix} + \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 6+a & b \\ -6+c & 9+d \end{bmatrix}$

(e) $\begin{bmatrix} 2 & 6 & 2j \\ -4 & 0 & 4 \end{bmatrix} + \begin{bmatrix} 0 & 3 & -5 \\ 7 & k & 2 \end{bmatrix} - C^T =$
$\begin{bmatrix} 2 & 9 & 2j-5 \\ 3 & k & 6 \end{bmatrix} - \begin{bmatrix} 2 & 7 & 1 & b \\ -1 & 0 & -3 \end{bmatrix} =$
$\begin{bmatrix} 0 & 8 & 2j-5-b \\ 4 & k & 9 \end{bmatrix}$

3. (a) $\begin{bmatrix} 6x+2 & 12+2u \\ -3-2z & 14 \end{bmatrix} = \begin{bmatrix} 2y & 5 \\ 7 & y \end{bmatrix}$
Now solve these equations:
$6x+2 = 2y$
$12+2u = 5$
$-3-2z = 7$
$14 = y$
Answer:
$y = 14$, $z = -5$, $u = -3.5$, and $x = 26/6$

(b) $\begin{bmatrix} 3 & -4x+5y \\ 6y+10x & 12 \end{bmatrix} = \begin{bmatrix} 3 & 22 \\ -3 & 12 \end{bmatrix}$
Now solve these equations:
$-4x+5y = 22$
$6y+10x = -3$
Answer: $x = \frac{-147}{74}$ and $y = \frac{104}{37}$

(c) $\begin{bmatrix} 2 & 3x \\ 6x & 6 \end{bmatrix} + 2 \begin{bmatrix} 3 & -2y \\ 6y & -1 \end{bmatrix} = \begin{bmatrix} 8 & -13 \\ 84 & 4 \end{bmatrix}$
$\begin{bmatrix} 8 & 3x-4y \\ 6x+12y & 4 \end{bmatrix} = \begin{bmatrix} 8 & -13 \\ 84 & 4 \end{bmatrix}$
Now solve these equations:
$3x-4y = -13$
$6x+12y = 84$
Answer: $x = 3$ and $y = 5.5$

(d) $\begin{bmatrix} x-6y & 2-2z \\ y-14 & -1 \end{bmatrix} = \begin{bmatrix} 4 & 0 \\ 2x & -1 \end{bmatrix}$
Now solve these equations:
$x-6y = 4$
$2-2z = 0$
$y-14 = 2x$
Answer: $x = -8$, $y = -2$, and $z = 1$

4. (a) 3×1

(b) 5×3

(c) Not possible.

(d) 4×4

(e) Not possible.

(f) 3×5

5. (a) False. Try with the folowing.
$A = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$

(b) True

(c) False, it is a 4×4 matrix.

6. (a) Not possible

(b) $\begin{bmatrix} 13 & -7 \\ 4 & 3 \end{bmatrix}$

(c) Not possible

(d) $\begin{bmatrix} 2 & -2 & 4 \\ -2 & 7 & 6 \end{bmatrix}$

(e) $\begin{bmatrix} 17 & 20 \\ 7 & 6 \end{bmatrix}$

(f) $\begin{bmatrix} a-2c & b-2d \\ 2c & 2d \\ 4a-c & 4b-d \end{bmatrix}$

(g) $\begin{bmatrix} a & -a+2b & 3a+b \\ c & -c+2d & 3c+d \end{bmatrix}$

7. $\begin{bmatrix} 2 & 6 & -4 \\ 10 & 16 & -8 \\ -12 & 20 & 10 \end{bmatrix}$

8. $AB = \begin{bmatrix} x+5 & 2 \\ y+5 & 2 \end{bmatrix}$ and $BA = \begin{bmatrix} x & 1 \\ 5x+2y & 7 \end{bmatrix}$

9. Note: either multiple the entire matrix or only use the row and column needed for the answer.

(a) $C_{1,3} = 0+9+20 = 29$

(b) $D_{3,1} = 0+0+50+4 = 54$

10. $\begin{bmatrix} -5 & 30 \\ 6+x-2y & 15+5y \end{bmatrix} = \begin{bmatrix} -5 & y+2z \\ 1 & 35 \end{bmatrix}$
Now solve these equations:
$30 = y+2z$
$6+x-2y = 1$
$15+5y = 35$
Answer: $x = 3$, $y = 4$, and $z = 13$

11. (a) $BM = \begin{bmatrix} 2910 & 8970 \end{bmatrix}$

There is no meaning for these numbers since the lables of the rows/collumns do not match up.

(b) $ML^T = \begin{bmatrix} 7200 \\ 2700 \end{bmatrix}$

The 7200 is the amount of vitamin A and the 2700 is the amount of vitamin C that is consumed at lunch.

(c) $(B+L)M = \begin{bmatrix} 6840 & 21480 \end{bmatrix}$

There is no meaning for these numbers since the lables of the rows/collumns do not match up.

(d) $M(BL)^T = \begin{bmatrix} 11200 \\ 4040 \end{bmatrix}$

The 11200 is the amount of vitamin A and the 4040 is the amount of vitamin C that is consumed together at breakfast and lunch.

12. (a) $\begin{bmatrix} 2 & 3 & 4 \\ 0 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 7 \\ 10 \end{bmatrix}$

also acceptable is

$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 & 3 & 4 \\ 0 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 6 \\ 7 \\ 10 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 0 & 8 \\ 1 & -1 & 2 \\ 3 & 2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 15 \\ 2 \end{bmatrix}$

also acceptable is

$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 8 \\ 1 & -1 & 2 \\ 3 & 2 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 4 \\ 15 \\ 2 \end{bmatrix}$

13. (a) $\begin{bmatrix} -35/32 & 25/32 & -33/32 \\ 3/8 & -1/8 & 1/8 \\ 7/32 & -5/32 & 13/32 \end{bmatrix}$

(b) not possible.

14. (a) Solve the equation for M.

$$AM - 3B = C$$
$$AM = C + 3B$$
$$M = A^{-1}(C + 3B)$$

$$M = \begin{bmatrix} 11.5 & 25 & 26.1 \\ -2.55 & -10.4 & -3.11 \\ 5.2 & 3.6 & 9.04 \end{bmatrix}$$

(b) Solve the equation for K.

$$KA + KC = B$$
$$K(A + C) = B$$
$$K = B \cdot (A + C)^{-1}$$

$$K = \begin{bmatrix} \frac{427}{141} & \frac{-643}{141} & \frac{10}{47} \\ \frac{-2507}{1692} & \frac{4217}{1692} & \frac{-181}{564} \\ \frac{-169}{846} & \frac{-11}{846} & \frac{-23}{282} \end{bmatrix}$$

(c) Solve the equation for J.

$$3J + CJ = 3A^T$$
$$(3I + C)J = 3A^T$$
$$J = (3I + C)^{-1} \cdot 3A^T$$

$$J = \begin{bmatrix} \frac{-3741}{7937} & \frac{6639}{7937} & \frac{-26169}{7937} \\ \frac{795}{7937} & \frac{174}{7937} & \frac{14001}{7937} \\ \frac{1581}{7937} & \frac{975}{7937} & \frac{2505}{7937} \end{bmatrix}$$

15. (a) $\begin{bmatrix} 3 & 2 & 1 \\ -3 & 3 & 4 \\ 2 & 2 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 0 & -1 \\ -2.2 & -.2 & 3 \\ 2.4 & .4 & -3 \end{bmatrix}$

16. $A^{-1} = \begin{bmatrix} 0.5 & -3 & -4 \\ -0.5 & 2 & 3 \\ -1 & 1 & 2 \end{bmatrix}$