Sect 2.1
Answer key

1. $\begin{bmatrix} -4 & 0 & 2 \\ -8 & 10 & -4 \end{bmatrix}$, $\begin{bmatrix} 3 & -5 & 3 \\ -7 & 6 & -7 \end{bmatrix}$, not def, $\begin{bmatrix} 1 & 13 \\ -7 & -6 \end{bmatrix}$

2. $\begin{bmatrix} 16 & -10 & 1 \\ 6 & -13 & -4 \end{bmatrix}$, not def, $\begin{bmatrix} 9 & -13 & -5 \\ -13 & 6 & -5 \end{bmatrix}$, not def

3. $\begin{bmatrix} -1 & 1 \\ -5 & 5 \end{bmatrix}$, $\begin{bmatrix} 12 & -3 \\ 15 & -6 \end{bmatrix}$

4. $\begin{bmatrix} 4 & -1 & 3 \\ -8 & 2 & -6 \\ -4 & 1 & 3 \end{bmatrix}$, $\begin{bmatrix} 45 & -5 & 15 \\ -40 & 35 & -30 \\ -20 & 5 & 40 \end{bmatrix}$

5. a) $\begin{bmatrix} -7 \\ 7 \\ 12 \end{bmatrix}$, $\begin{bmatrix} 4 \\ -6 \\ -7 \end{bmatrix}$, $\begin{bmatrix} -7 & 4 \\ 7 & -6 \\ 12 & -7 \end{bmatrix}$

b) $AB = \begin{bmatrix} -1\cdot 3 + 2(-2) & -1(-2)+2\cdot 1 \\ 5\cdot 3 + 4(-2) & 5(-2)+4\cdot 1 \\ 2\cdot 3 + -3(-2) & 2(-2)-3\cdot 1 \end{bmatrix}$

$= \begin{bmatrix} -7 & 4 \\ 7 & -6 \\ 12 & -7 \end{bmatrix}$

6. a) $\begin{bmatrix} 0 \\ -3 \\ 13 \end{bmatrix}$, $\begin{bmatrix} 14 \\ -9 \\ 4 \end{bmatrix}$, $\begin{bmatrix} 0 & 14 \\ -3 & -9 \\ 13 & 4 \end{bmatrix}$

b) $\begin{bmatrix} 4\cdot 1 - 2\cdot 2 & 4\cdot 3 - 2(-1) \\ -3\cdot 1 + 0\cdot 2 & -3\cdot 3 + 0(-1) \\ 3\cdot 1 + 5\cdot 2 & 3\cdot 3 + 5(-1) \end{bmatrix}$

$= \begin{bmatrix} 0 & 14 \\ -3 & -9 \\ 13 & 4 \end{bmatrix}$

7. 3×7

8. B has 3 rows

9. $k = 5$

10. $AB = AC = \begin{bmatrix} 1 & -7 \\ -2 & 14 \end{bmatrix}$

11. $AD = \begin{bmatrix} 2 & 3 & 5 \\ 2 & 6 & 15 \\ 2 & 12 & 25 \end{bmatrix}$, $DA = \begin{bmatrix} 2 & 2 & 2 \\ 3 & 6 & 9 \\ 5 & 20 & 25 \end{bmatrix}$

- Right multiplication: each column of A is multiplied by the corresponding diagonal element of D
- Left multiplication: each row of A is multiplied by the corresponding diagonal element of D

one example of $B = \begin{bmatrix} 0 & 2 & 0 \\ 3 & -5 & 5 \\ -1 & 7 & 1 \end{bmatrix}$

12. Suitable column for B is any multiple of $(2,1)$

example: $B = \begin{bmatrix} 2 & 6 \\ 1 & 3 \end{bmatrix}$

15. a) F
b) F
c) T
d) T
e) F

16. a) F
b) T
c) F
d) F
e) T

17. $b_1 = \begin{bmatrix} 7 \\ 4 \end{bmatrix}$, $b_2 = \begin{bmatrix} -8 \\ -5 \end{bmatrix}$

18. The 1st 2 columns of AB are Ab_1 & Ab_2. They're equal b/c $b_1 = b_2$

19. the 3rd column of AB is the sum of the 1st 2 columns of AB

$$B = [b_1 \; b_2 \; b_3] \implies AB = [Ab_1 \; Ab_2 \; Ab_3]$$

if $b_3 = b_1 + b_2 \implies Ab_3 = A(b_1 + b_2) = Ab_1 + Ab_2$

20. 2nd Column of AB is all zeros b/c $Ab_2 = A \cdot 0 = 0$

27. $u^T v = v^T u = -2a + 3b - 4c$

$$uv^T = \begin{bmatrix} -2a & -2b & -2c \\ 3a & 3b & 3c \\ -4a & -4b & -4c \end{bmatrix} \qquad vu^T = \begin{bmatrix} -2a & 3a & -4a \\ -2b & 3b & -4b \\ -2c & 3c & -4c \end{bmatrix}$$

28. $u^T v$ is a real number, so it equals it's transpose

ie: $u^T v = (u^T v)^T = v^T (u^T)^T = v^T u$

uv^T is an nxn matrix ≠

$$(uv^T)^T = (v^T)^T u^T = vu^T$$