7.2 Suggested Practice Answers

#1) The number of entries in the rows of the first matrix must match the number of entries in the columns of the second.

#2) Symmetric: $A^T = A$

Skew symmetric: $A^T = -A$

Add both sides:

$$2A^T = A - A = 0$$

$$A^T = 0 \leftarrow \text{zero matrix}$$

Thus, a matrix that is both symmetric and skew-symmetric is the zero matrix.

#6) $U_1 + U_2 \rightarrow$ triangular

$U_1 U_2 \rightarrow$ triangular

$U_1 + L_1 \rightarrow$ not triangular

$U_1 L_1 \rightarrow$ not triangular

$U_1^2 \rightarrow$ triangular

$L_1 + L_2 \rightarrow$ triangular

#11)

$$AB = \begin{bmatrix} 10 & -14 & -6 \\ -5 & 7 & -12 \\ -5 & -1 & -4 \end{bmatrix}$$

AB^T = SAME AS ABOVE.
  B IS SYMMETRIC

$$BA = \begin{bmatrix} 10 & -5 & -15 \\ -14 & 7 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

B^TA = SAME AS ABOVE.
  B IS SYMMETRIC

#12)

$$AA^T = \begin{bmatrix} 29 & 8 & 6 \\ 8 & 41 & 12 \\ 6 & 12 & 9 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 23 & -4 & 6 \\ -4 & 17 & 12 \\ 2 & 4 & 19 \end{bmatrix}$$

$$BB^T = \begin{bmatrix} 10 & -6 & 0 \\ -6 & 10 & 0 \\ 0 & 0 & 4 \end{bmatrix}$$

B^2 = SAME AS ABOVE. B IS
  SYMMETRIC

#13)

$$CC^T = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 13 & -6 \\ 0 & -6 & 4 \end{bmatrix}$$

$$BC = \begin{bmatrix} -9 & -5 \\ 3 & -1 \\ 4 & 0 \end{bmatrix}$$

CB = not defined since c is
  3x2 and B is 3x3.

$$C^TB = \begin{bmatrix} -9 & 3 & 4 \\ -5 & -1 & 0 \end{bmatrix}$$

#14)

$$3A-2B = \begin{bmatrix} 10 & 0 & 9 \\ 0 & 1 & 18 \\ 3 & 6 & 10 \end{bmatrix}$$

$$(3A-2B)^T = \begin{bmatrix} 10 & 0 & 3 \\ 0 & 1 & 6 \\ 9 & 18 & 10 \end{bmatrix}$$

$$3A^T-2B^T = \begin{bmatrix} 10 & 0 & 3 \\ 0 & 1 & 6 \\ 9 & 18 & 10 \end{bmatrix}$$

?? :)

$$(3A-2B)^T a^T = \begin{bmatrix} 10 \\ -2 \\ -27 \end{bmatrix}$$

#15)

Aa = not defined since
A is 3x3 and a is 1x3.

$Aa^T = \begin{bmatrix} 8 \\ -4 \\ -3 \end{bmatrix}$

$(Ab)^T = \begin{bmatrix} 7 & -11 & 3 \end{bmatrix}$

$b^T A^T = \begin{bmatrix} 7 & -11 & 3 \end{bmatrix}$

#16)

$BC = \begin{bmatrix} -9 & -5 \\ 3 & -1 \\ 4 & 0 \end{bmatrix}$

BC^T = not defined since
B is 3x3 and C^T
is 2x3.

$Bb = \begin{bmatrix} 0 \\ -8 \\ 2 \end{bmatrix}$

$b^T B = \begin{bmatrix} 0 & -8 & 2 \end{bmatrix}$

#17)

$ABC = \begin{bmatrix} -30 & -18 \\ 45 & 9 \\ 5 & -7 \end{bmatrix}$

ABa = not defined since
a is 1x3.

$ABb = \begin{bmatrix} 22 \\ 4 \\ -12 \end{bmatrix}$

Ca^T = not defined since C
is 3x2 and a^T is
3x1.

#18)

$ab = \begin{bmatrix} 1 \end{bmatrix}$

$ba = \begin{bmatrix} 3 & -6 & 0 \\ 1 & -2 & 0 \\ -1 & 2 & 0 \end{bmatrix}$

$aA = \begin{bmatrix} 8 & -4 & -9 \end{bmatrix}$

$Bb = \begin{bmatrix} 0 \\ -8 \\ 2 \end{bmatrix}$

#19)

1.5a + 3b = not defined since a is 1×3 and b is 3×1.

$1.5a^T + 3b = \begin{bmatrix} 10.5 \\ 0 \\ -3 \end{bmatrix}$

$(A - B)b = \begin{bmatrix} 7 \\ -3 \\ 1 \end{bmatrix}$

hmm... ☺

$Ab - Bb = \begin{bmatrix} 7 \\ -3 \\ 1 \end{bmatrix}$

#20)

$b^T A b = \begin{bmatrix} 7 \end{bmatrix}$

$a B a^T = \begin{bmatrix} 17 \end{bmatrix}$

$a C C^T = \begin{bmatrix} -3 & -24 & 12 \end{bmatrix}$

$C^T b a = \begin{bmatrix} 5 & -10 & 0 \\ 5 & -10 & 0 \end{bmatrix}$