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Grade received 100% To pass 80% or higher

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## Linear Algebra

Total points 5

1. Let two matrices be

1 / 1 point

$$A = \begin{bmatrix} 4 & 3 \\ 6 & 9 \end{bmatrix}, \quad B = \begin{bmatrix} -2 & 9 \\ -5 & 2 \end{bmatrix}$$

What is  $A - B$ ?

- ☐  $\begin{bmatrix} 2 & -6 \\ 1 & 7 \end{bmatrix}$
- ☐  $\begin{bmatrix} 6 & -12 \\ 11 & 11 \end{bmatrix}$
- ☒  $\begin{bmatrix} 6 & -6 \\ 11 & 7 \end{bmatrix}$
- ☐  $\begin{bmatrix} 4 & 12 \\ 1 & 11 \end{bmatrix}$

✔ Correct

To subtract B from A, carry out the subtraction element-wise.

2. Let  $x = \begin{bmatrix} 2 \\ 7 \\ 4 \\ 1 \end{bmatrix}$

1 / 1 point

What is  $\frac{1}{2} * x$ ?

- ☐  $\begin{bmatrix} 4 \\ 14 \\ 8 \\ 2 \end{bmatrix}$
- ☐  $\begin{bmatrix} 1 & \frac{7}{2} & 2 & \frac{1}{2} \end{bmatrix}$
- ☒  $\begin{bmatrix} 1 \\ 3.5 \\ 2 \\ 0.5 \end{bmatrix}$
- ☐  $\begin{bmatrix} 4 & 14 & 8 & 2 \end{bmatrix}$

✔ Correct

To multiply the vector x by  $\frac{1}{2}$ , take each element of x and multiply that element by  $\frac{1}{2}$ .

3. Let u be a 3-dimensional vector, where specifically

1 / 1 point

$$u = \begin{bmatrix} 5 \\ 1 \\ 9 \end{bmatrix}$$

What is  $u^T$ ?

- ☐  $\begin{bmatrix} 9 \\ 1 \\ 5 \end{bmatrix}$
- ☐  $\begin{bmatrix} 5 \\ 1 \\ 9 \end{bmatrix}$
- ☐  $\begin{bmatrix} 9 & 1 & 5 \end{bmatrix}$
- ☒  $\begin{bmatrix} 5 & 1 & 9 \end{bmatrix}$

✔ Correct

4. Let u and v be 3-dimensional vectors, where specifically

1 / 1 point

$$u = \begin{bmatrix} -3 \\ 4 \\ 3 \end{bmatrix}$$

and

$$v = \begin{bmatrix} 3 \\ 1 \\ 5 \end{bmatrix}$$

What is  $u^T v$ ?

(Hint:  $u^T$  is a

1x3 dimensional matrix, and v can also be seen as a 3x1

matrix. The answer you want can be obtained by taking

the matrix product of  $u^T$  and v.) Do not add brackets to your answer.

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✔ Correct

5. Let A and B be 3x3 (square) matrices. Which of the following

1 / 1 point

must necessarily hold true? Check all that apply.

☒ If  $B$  is the  $3 \times 3$  identity matrix, then  $A * B = B * A$

☒ **Correct**

Even though matrix multiplication is not commutative in general ( $A * B \neq B * A$  for general matrices  $A, B$ ), for the special case where  $B = I$ , we have  $A * I = A * I = A$ , and also  $B * A = I * A = A$ . So,  $A * B = B * A$ .

☒ If  $C = A * B$ , then  $C$  is a  $3 \times 3$  matrix.

☒ **Correct**

Since  $A$  and  $B$  are both  $3 \times 3$  matrices, their product is  $3 \times 3$ . More generally, if  $A$  were an  $m \times n$  matrix, and  $B$  a  $n \times o$  matrix, then  $C$  would be  $m \times o$ . (In our example,  $m = n = o = 3$ .)

☐  $A * B = B * A$

☐  $A * B * A = B * A * B$