Linear Algebra

Question 1

Let two matrices be

$A = \begin{bmatrix} 1 & -1 \\ -2 & 1 \end{bmatrix}, B = \begin{bmatrix} 0 & 3 \\ 5 & 8 \end{bmatrix}$

What is $A + B$?

- [x] $\begin{bmatrix} 1 & -1 \\ 3 & 9 \end{bmatrix}$
- [ ] $\begin{bmatrix} 1 & -1 \\ 7 & 9 \end{bmatrix}$
- [ ] $\begin{bmatrix} 1 & 7 \\ 7 & 9 \end{bmatrix}$
- [ ] $\begin{bmatrix} 1 & -7 \\ -7 & -7 \end{bmatrix}$

> To add two matrices, add them element-wise.

Question 2

Let $x = \begin{bmatrix} 8 \\ 2 \\ 5 \\ 1 \end{bmatrix}$

What is $2 * x$?

- [ ] $\begin{bmatrix} 4 \\ 1 \\ \frac{5}{2} \\ \frac{1}{2} \end{bmatrix}$
- [x] $\begin{bmatrix} 16 \\ 4 \\ 10 \\ 2 \end{bmatrix}$
- [ ] $\begin{bmatrix} 4 & 1 & \frac{5}{2} & \frac{1}{2} \end{bmatrix}$
- [ ] $\begin{bmatrix} 16 & 4 & 10 & 2 \end{bmatrix}$

> To multiply the vector x by 2, take each element of x and multiply that element by 2.

Question 3

Let u be a 3-dimensional vector, where specifically

$u = \begin{bmatrix} 2 \\ 1 \\ 8 \end{bmatrix}$

What is u^T?

- [ ] $\begin{bmatrix} 8 & 1 & 2 \end{bmatrix}$
- [ ] $\begin{bmatrix} 2 \\ 1 \\ 8 \end{bmatrix}$
- [ ] $\begin{bmatrix} 8 \\ 1 \\ 2 \end{bmatrix}$
- [x] $\begin{bmatrix} 2 & 1 & 8 \end{bmatrix}$

Question 4

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

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

and

$u = \begin{bmatrix} 4 \\ 2 \\ 4 \end{bmatrix}$

What is $u^T v$?

(Hine: u^T is a

1×3 dimensional matrix, and v can also seen as a 3×1

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.

> -4

Question 5

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

must necessarily hold true? Check all that apply.

- [x] If B is the 3×3 identity matrix, then $A * B = B * A$

> 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 $A * B = A * I = A$, and also $B * A = I * A = A$. So $A * B = B * A$.

- [ ] $A * B = B * A$
- [x] If $C = B * A$, then C is a 3×3 matrix.

> Since A and B are both 3×3 matrices, their product is 3×3. 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, $m = n = o = 3$.)

- [ ] $A * B * A = B * A * B$