Print your name: _____

Worksheet on Vector Dot Products and Simple Matrix Mathematics

1. Given the vectors $a = \{2, 5, 3\}$ and $b = \{6, 9, 11\}$, what is the scalar result of the dot product $a \cdot b$? Show your work.

2. What are the norms (lengths) of vectors *a* and *b* from question 1?

3. What is the angle between vectors *a* and *b* from question 1?

4. What are the unit vectors $\hat{a}$ and $\hat{b}$ that coincide with vectors *a* and *b* from question 1?

5. What is the angle between vectors *a* (from question 1) and $\hat{a}$ (from question 4)? Show your work.

6. Where (in terms of rows and columns) is the value c_{23} located in a matrix *c*?

7. Represent vector *a* from question 1 as a 3x1 matrix where a_{11} is the *x* coordinate of a Cartesian coordinate system, a_{21} is the *y* coordinate, and a_{31} is the *z* coordinate.

8. Represent vector *b* from question 1 as a 1x3 matrix where b_{11} is the *x* coordinate of a Cartesian coordinate system, b_{12} is the *y* coordinate, and b_{13} is the *z* coordinate.

9. If we define matrix *c* as given below, (a) compute the product *d* of the equation $d = c \cdot a$, showing all your work, and (b) what sort of mathematical object/entity might *d* be considered to be?

$$c = \begin{bmatrix} 3 & -1 & 0 \\ 5 & 2 & 4 \\ -2 & 0 & 6 \end{bmatrix}$$

10. If we define matrix *e* as given below, (a) compute the product *p* of the equation $p = e \cdot c \cdot a$, showing all your work, and (b) what sort of mathematical object/entity might *p* be considered to be?

$$e = \begin{bmatrix} 4 & 0 & -3 \\ 8 & 3 & 2 \\ 7 & 1 & 5 \end{bmatrix}$$

11. Within the matrix brackets below, provide an example of a *symmetric* 3x3 matrix, and circle the diagonal of the matrix.

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$

12. Within the matrix brackets below, provide an example of an *antisymmetric* 3x3 matrix.

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$

13. Within the matrix brackets below, provide an example of an *asymmetric* 3x3 matrix.

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$

14. Within the matrix brackets below, give the transpose of matrix *e* from question 10.

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$

15. Within the matrix brackets below, show the identity matrix.

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$