

Math Physics: HWK #1

Convert the coordinates of the point from the current coordinate system into the remaining coordinate systems. Attach a copy of all your conversion work. Make sure all your angular measurements are in *radians*!

	Cartesian	Cylindrical	Spherical
1	$\langle 5, 0, 2 \rangle$		
2		$\langle 5, \frac{\pi}{9}, 8 \rangle$	
3			$\langle 20, \frac{\pi}{3}, \frac{\pi}{4} \rangle$
4	$\langle 1, 4, -1 \rangle$		
5		$\langle 2, \frac{11\pi}{6}, 3 \rangle$	
6			$\langle 6, \frac{\pi}{6}, \pi \rangle$
7	$\langle -2, b, 3 \rangle$		
8		$\langle 10, \pi, h \rangle$	
9			$\langle r, \alpha, \frac{\pi}{2} \rangle$
10	$\langle 0, 0, 0 \rangle$		

1) Find $A + B$, $A - B$, $3A$ and $-0.5B$ for the following matrices:

$$a) \quad A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & -1 \\ -1 & 8 \end{bmatrix}$$

$$b) \quad A = \begin{bmatrix} 5 & 4 & 4 \\ -3 & 1 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 2 & -7 \\ 0 & -5 & 1 \end{bmatrix}$$

$$c) \quad A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$$

2) What is the order for all the B matrices in question 1?

3) Find the transpose of the following matrices:

$$A = \begin{bmatrix} -1 \\ 3 \\ 2 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 1 & -4 \\ -3 & 5 & 0 \\ 7 & 5 & -2 \end{bmatrix} \quad C = \begin{bmatrix} 9 & 0 & 2 \\ 8 & -1 & -3 \end{bmatrix}$$

4) What is the trace of matrix B [written $Tr(B)$] in problem (3)?

5) What is the trace of an $n \times n$ unity matrix?

6) Prove that $Tr(A \pm B) = Tr(A) \pm Tr(B)$ if:

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & -4 \\ 3 & 1 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 1 & -1 & 7 \\ 2 & -1 & 8 \\ 3 & 1 & -1 \end{bmatrix}$$

- 7) Let $c = 3$ and $d = 2$. Use matrix A from problem (6) to verify the following properties of scalar multiplication:

$$(cd)A = c(dA) = d(cA)$$

$$(c + d)A = cA + dA$$

- 8) Find the Inner Product (matrix multiplication) for the following pairs of matrices:
(Show your work on this problem. You can use the CPU as a check.)

a) $A = \begin{bmatrix} 2 & -1 \\ 1 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}$

b) $A = \begin{bmatrix} 3 & -2 & -2 \\ 6 & 1 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 2 & -3 \\ 0 & -1 & 1 \end{bmatrix}$

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

d) $A = \begin{bmatrix} 0 & -1 & 0 \\ 4 & 0 & 2 \\ 8 & -1 & 7 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 1 & 2 \\ 2 & 1 & 1 \\ 1 & -3 & 2 \end{bmatrix}$

e) $A = \begin{bmatrix} 6 & -2 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 4 \\ 0 \\ -3 \end{bmatrix}$

f) $A = \begin{bmatrix} -1 & 3 & 6 \end{bmatrix}$ $B = \begin{bmatrix} 2 \end{bmatrix}$

- 9) Find the inverses of the following matrices:

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & -4 \\ 3 & 1 & 3 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & -1 & 7 \\ 2 & -1 & 8 \\ 3 & 1 & -1 \end{bmatrix}$$

- 10) Verify that $AB \neq BA$ using the matrices from problem (9).