

Mathematics for Computer Graphics

Tutorial 8

1. Using cross product, find the angle between the vectors $\mathbf{r}$ and $\mathbf{s}$

$$\mathbf{r} = \begin{bmatrix} 1 \\ 2 \\ 5 \end{bmatrix} \quad \mathbf{s} = \begin{bmatrix} -2 \\ -1 \\ -7 \end{bmatrix} ; \quad \mathbf{r} = \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} \quad \mathbf{s} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$$

$$\mathbf{r} = \begin{bmatrix} 3 \\ 0 \\ 8 \end{bmatrix} \quad \mathbf{s} = \begin{bmatrix} 2 \\ -4 \\ -3 \end{bmatrix} ; \quad \mathbf{r} = \begin{bmatrix} -1 \\ -4 \\ -9 \end{bmatrix} \quad \mathbf{s} = \begin{bmatrix} -1 \\ -2 \\ 0 \end{bmatrix}$$

2. Find $\mathbf{A} + \mathbf{B}$, $\mathbf{B} - \mathbf{A}$, $4\mathbf{A} + 2\mathbf{B}$ whenever possible in the following

$$\text{a.} \quad \mathbf{A} = \begin{bmatrix} 2 & -1 & 2 \\ -4 & 2 & 1 \\ 4 & -2 & 4 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 2 & -1 & 2 \\ -4 & 2 & 1 \\ 4 & -2 & 4 \end{bmatrix}$$

$$\text{b.} \quad \mathbf{A} = \begin{bmatrix} 2 & 2 \\ 4 & 4 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} -2 & 0 \\ 5 & -3 \end{bmatrix}$$

$$\text{c.} \quad \mathbf{A} = \begin{bmatrix} 1 & 2 \\ 0 & 3 \\ 3 & 1 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} -2 & 8 \\ 3 & 5 \\ 1 & 6 \end{bmatrix}$$

$$\text{d.} \quad \mathbf{A} = \begin{bmatrix} -3 & 1 & 3 \\ 2 & 0 & 1 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 3 & -2 & 0 \\ 1 & 5 & 4 \end{bmatrix}$$

3. Find $\mathbf{AB}$ and $\mathbf{BA}$ in the following

$$\text{a.} \quad \mathbf{A} = \begin{bmatrix} 2 & -1 & 2 \\ -4 & 2 & 1 \\ 4 & -2 & 4 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 2 & -1 & 2 \\ -4 & 2 & 1 \\ 4 & -2 & 4 \end{bmatrix}$$

$$\text{b.} \quad \mathbf{A} = \begin{bmatrix} 2 & 2 \\ 4 & 4 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} -2 & 0 \\ 5 & -3 \end{bmatrix}$$