Student Name

HW #1: WRITTEN

Box answers and show all work in the space provided. Submit at the start of class on the scheduled due date.

1) Given the rotation matrix $\mathbf{R}^{-1}$ below, find $\mathbf{R}^{T}$.

$$\mathbf{R}^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1/2 & -\sqrt{3}/2 \\ 0 & \sqrt{3}/2 & 1/2 \end{bmatrix}$$

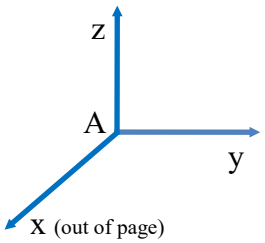
2) Given the rotation matrix $\mathbf{R}$ below, find $\mathbf{R}^{-1}$ (hint: you don't need to invert the matrix).

$$\mathbf{R} = \begin{bmatrix} 3/4 & -\sqrt{6}/4 & 1/4 \\ \sqrt{6}/4 & 1/2 & -\sqrt{6}/4 \\ 1/4 & \sqrt{6}/4 & 3/4 \end{bmatrix}$$

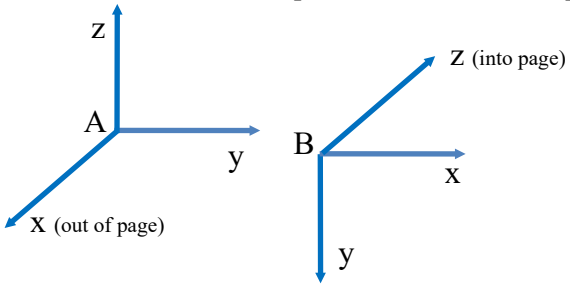
3) Given the rotation matrix $\mathbf{R}$ below, find $\det(\mathbf{R})$ (hint: you don't need to calculate the determinate).

$$\mathbf{R} = \begin{bmatrix} 3/4 & -\sqrt{6}/4 & 1/4 \\ \sqrt{6}/4 & 1/2 & -\sqrt{6}/4 \\ 1/4 & \sqrt{6}/4 & 3/4 \end{bmatrix}$$

4) Find the rotation matrix that rotates a point 45° about the y-axis.



5) Consider the two frames shown below. They are shown apart for clarity, but assume they have the same origin. Find the rotation matrix that maps the coordinates of a point specified in frame B to frame A.



6) Find the point $\mathbf{q}'$ after rotating the point $\mathbf{q} = \begin{bmatrix} 3 & 1 & 2 \end{bmatrix}^T$ using the rotation matrix $\mathbf{R}$ below.

$$\mathbf{R} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1/2 & -\sqrt{3}/2 \\ 0 & \sqrt{3}/2 & 1/2 \end{bmatrix}$$

7) Find the matrix $\hat{\boldsymbol{\omega}}$ from applying the hat-operator to the rotation axis $\boldsymbol{\omega} = \begin{bmatrix} 0 & 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}^T$.

8) Find the rotation matrix for rotation about the axis $\boldsymbol{\omega} = \begin{bmatrix} 0 & 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}^T$ for a rotation angle $\theta = \pi/3$ using the exponential coordinates for rotation and Rodrigues' formula.