HW0 Robotics

1) By definition of orthogonal matrix, $A^{-1} = A^T$ for any orthogonal matrix A. The transpose can be found by switching the rows with columns.

$$A^{-1} = A^T = \begin{bmatrix} 1/3 & -2/3 & 2/3 \\ 2/3 & 2/3 & 1/3 \\ -2/3 & 1/3 & 2/3 \end{bmatrix}$$

2) Using dot product formula: $\vec{w} \cdot \vec{v} = |\vec{w}||\vec{v}| \cos\theta$

$$\cos\theta = \frac{\vec{w} \cdot \vec{v}}{|\vec{w}||\vec{v}|} = \frac{\langle 4, -3, 3 \rangle \cdot \langle 3, 3, -1 \rangle}{\sqrt{4^2+(-3)^2+3^2} \times \sqrt{3^2+3^2+(-1)^2}}$$

$$= \frac{(4)(3)+(-3)(3)+(3)(-1)}{\sqrt{16+9+9} \times \sqrt{9+9+1}} = \frac{0}{\sqrt{34} \times \sqrt{19}} = 0$$

$\cos\theta = 0$

$\theta = 90^\circ$

Equations used:

magnitude $= \sqrt{x^2+y^2+z^2}$

dot product $= w_1v_1 + w_2v_2 + w_3v_3$