

Vector product.

$$\mathbf{V} := (v_1 \ v_2 \ v_3) \quad \mathbf{Q} := \begin{bmatrix} q_1 \\ q_2 \\ q_3 \end{bmatrix} \quad \mathbf{V} = (1 \ 1 \ 0) \quad \mathbf{Q} = \begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix} \quad \mathbf{V} \cdot \mathbf{Q} = 2$$

$$\mathbf{V} \cdot \mathbf{Q} = v_1 \cdot q_1 + v_2 \cdot q_2 + v_3 \cdot q_3 = 2$$

θ the angle between the vectors is: $\theta := \frac{\pi}{4}$

$$\mathbf{V_length} := \sqrt{(v_1)^2 + (v_2)^2 + (v_3)^2} \quad \mathbf{Q_length} := \sqrt{(q_1)^2 + (q_2)^2 + (q_3)^2}$$

$$\mathbf{V_length} = 1.414$$

$$\mathbf{Q_length} = 2$$

$$\mathbf{V_length} \cdot \mathbf{Q_length} \cdot \cos(\theta) = 2 = \mathbf{V} \cdot \mathbf{Q} = 2$$

Observe: if \mathbf{V} is perpendicular to \mathbf{Q} $\mathbf{V} \cdot \mathbf{Q} = 0$

$$\text{Test: } 4 \cdot \theta = \arccos\left(\frac{|\mathbf{V} \cdot \mathbf{Q}|}{|\mathbf{V}^T| \cdot |\mathbf{Q}|}\right) \cdot 4 = 3.142$$