

$$[2][a] (\vec{u} \times (\vec{v} \times \vec{w})) - ((\vec{u} \times \vec{v}) \times \vec{w})$$

$$= (\vec{u} \cdot \vec{w})\vec{v} - (\vec{u} \cdot \vec{v})\vec{w} + (\vec{w} \times (\vec{u} \times \vec{v}))$$

$$= (\vec{u} \cdot \vec{w})\vec{v} - (\vec{u} \cdot \vec{v})\vec{w} + (\vec{w} \cdot \vec{v})\vec{u} - (\vec{w} \cdot \vec{u})\vec{v}$$

$$= (\vec{u} \cdot \vec{w})\vec{v} - (\vec{u} \cdot \vec{v})\vec{w} + (\vec{w} \cdot \vec{v})\vec{u} - (\vec{u} \cdot \vec{w})\vec{v}$$

$$= (\vec{v} \cdot \vec{w})\vec{u} - (\vec{v} \cdot \vec{u})\vec{w}$$

$$= \vec{v} \times (\vec{u} \times \vec{w}) \text{ (SUBTRACT 1 POINT IF MISSING)}$$

$$[b] \vec{u} \parallel \vec{w} \iff \vec{u} \times \vec{w} = \vec{0}$$

$$(\vec{u} \times (\vec{v} \times \vec{w})) - ((\vec{u} \times \vec{v}) \times \vec{w})$$

$$= \vec{v} \times (\vec{u} \times \vec{w})$$

$$= \vec{v} \times \vec{0}$$

$$\|\vec{v} \times \vec{0}\| = \|\vec{v}\| \|\vec{0}\| \sin \theta = 0$$

$$= \vec{0} \text{ (SUBTRACT 1 POINT IF MISSING)}$$

$$[3] \|\vec{u}\| = 1 \text{ SINCE } \vec{u} \text{ IS A UNIT VECTOR}$$

$$\vec{u} \cdot \vec{v} = 0 \text{ SINCE } \vec{u} \perp \vec{v}$$

$$\vec{u} \times (\vec{v} \times \vec{u}) = (\vec{u} \cdot \vec{u})\vec{v} - (\vec{u} \cdot \vec{v})\vec{u}$$

$$= \|\vec{u}\|^2 \vec{v} - 0\vec{u}$$

$$= 1^2 \vec{v}$$

$$= \vec{v} \text{ (SUBTRACT 1 POINT IF MISSING)}$$

$$[4] \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 2t & 3t^2 \\ 3t^2 & 2t & 1 \end{vmatrix} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 2t & 3t^2 \\ -6t^3 & -1 & -6t^3 \end{vmatrix} = \langle 2t - 6t^3, 9t^4 - 1, 2t - 6t^3 \rangle$$

$$= (3t^2 - 1) \langle -2t, 3t^2 + 1, -2t \rangle$$

$$\langle -2t, 3t^2 + 1, -2t \rangle \cdot \langle 1, 2t, 3t^2 \rangle = -2t + 6t^3 + 2t - 6t^3 = 0$$

$$\langle -2t, 3t^2 + 1, -2t \rangle \cdot \langle 3t^2, 2t, 1 \rangle = -6t^3 + 6t^3 + 2t - 2t = 0$$

$$\|\langle -2t, 3t^2 + 1, -2t \rangle\| = \sqrt{4t^2 + 9t^4 + 6t^2 + 1 + 4t^2} = \sqrt{9t^4 + 14t^2 + 1}$$

$$\left\langle \frac{-2t}{\sqrt{9t^4 + 14t^2 + 1}}, \frac{3t^2 + 1}{\sqrt{9t^4 + 14t^2 + 1}}, \frac{-2t}{\sqrt{9t^4 + 14t^2 + 1}} \right\rangle$$