

MATH 53 11 Feb 2008
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① Math: Given two vector-valued functions $\vec{v}(t)$ and $\vec{w}(t)$, state and prove the product rule for cross-product:

$$\frac{\partial}{\partial t} [\vec{v}(t) \times \vec{w}(t)] = ??$$

② Physics: If we apply a force \vec{F} to an object moving with momentum $\vec{p} = m \cdot \frac{\partial \vec{r}}{\partial t}$ at position \vec{r} , its momentum changes by

$$\frac{\partial \vec{p}}{\partial t} = \vec{F}.$$

The angular momentum of the object is defined by

$$\vec{l} = \vec{r} \times \vec{p}$$

and the torque is defined by

$$\vec{\tau} = \vec{r} \times \vec{F}.$$

Evaluate $\frac{\partial \vec{l}}{\partial t}$ in terms of $\vec{\tau}$.