Answer on Question #77968 – Math – Calculus

Question

If^A=ti-sintj, and^B=costi+sintj+k, find d/dt(^A•^B)

Solution

$$\vec{A} = t\,\vec{\imath} - \sin t\,\vec{\jmath};$$

$$\vec{B} = \cos t\,\vec{\imath} + \sin t\,\vec{\jmath} + \vec{k}.$$

Dot product

$$\vec{A}\cdot\vec{B} = A_xB_x + A_yB_y + A_zB_z = t\cos t - (\sin t)^2 + 0\cdot 1 = t\cos t - (\sin t)^2.$$

Therefore, we have

$$\frac{d}{dt}\left(\vec{A}\cdot\vec{B}\right) = \frac{d}{dt}(t\cos t - (\sin t)^2) = \frac{d}{dt}(t\cos t) - \frac{d}{dt}((\sin t)^2) = \frac{dt}{dt}\cos t + t\frac{d(\cos t)}{dt} - 2\sin t\frac{d(\sin t)}{dt}$$
$$= \cos t - t\sin t - 2\sin t\cos t = \cos t - t\sin t - \sin 2t.$$

Answer: $\cos t - t\sin t - \sin 2t$.