MATH 213 – QUIZ 3 – 14 FEBRUARY 2012

Answer the following question in the space provided. Show all work as partial credit may be given. Answers without justification, even if they are correct, will earn no credit. This quiz is worth 5 points.

Let $\mathbf{r}(t) = \langle t\ \sin(t), \cos(2t), 2\rangle$. *Find* $r'(t)$ *and* $r''(t)$.

$\vec{r}'(t) = \langle t\cos t + \sin t, -2\sin(2t), 0\rangle$

$\vec{r}''(t) = \langle -t\sin t + 2\cos t, -4\cos(2t), 0\rangle$

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Let $\mathbf{r}(t) = 2t^4\,\mathbf{i} + 6t^{3/2}\,\mathbf{j} + (10/t)\,\mathbf{k}$. *Find* $r'(t)$ *and compute the unit tangent vector at* $t = 1$.

$$\vec{r}'(t) = 8t^3\vec{i} + 9t^{1/2}\vec{j} - \left(\frac{10}{t^2}\right)\vec{k}$$

$$|\vec{r}'(t)| = \left(64t^6 + 81t + \frac{100}{t^4}\right)^{1/2}$$

$$\vec{T}(t) = \frac{\vec{r}'(t)}{|\vec{r}'(t)|} = \frac{8t^3\vec{i} + 9t^{1/2}\vec{j} - \frac{10}{t^2}\vec{k}}{\left(64t^6 + 81t + 100t^{-4}\right)^{1/2}} \;//$$

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Find $\frac{d}{dt}(\mathbf{u}(t)\cdot\mathbf{v}(t))$ *where* $\mathbf{u}(t)=2t^4\,\mathbf{i}+e^{3t}\,\mathbf{j}$ *and* $\mathbf{v}(t)=e^t\,\mathbf{i}+2e^t\,\mathbf{j}+\ln(t)\,\mathbf{k}$.

$$\frac{d}{dt}(\vec{u}(t)\cdot\vec{v}(t)) = \vec{u}(t)\cdot\frac{d\vec{v}}{dt}(t) + \frac{d\vec{u}}{dt}(t)\cdot\vec{v}(t)$$

$$= (2t^4\vec{i}+e^{3t}\vec{j})\cdot(e^t\vec{i}+2e^t\vec{j}+\frac{1}{t}\vec{k})$$

$$+(8t^3\vec{i}+3e^{3t}\vec{j})\cdot(e^t\vec{i}+2e^t\vec{j}+\ln t\,\vec{k})$$

$$= 2e^t t^4 + 2e^{4t} + 8e^t t^3 + 6e^{4t}$$

$$= 8t^3e^t + 2t^4e^t + 8e^{4t} \;//$$