DERIVATIVES OF VECTOR-VALUED FUNCTONS

(1-8) For each vector-valued function $\vec{r}(t)$ below, find $\dfrac{d\vec{r}}{dt}$.

1. $\vec{r}(t) = t\hat{i} + t^2\hat{j} + \dfrac{1}{t}\hat{k}$

2. $\vec{r}(t) = (t+1)\hat{i} + (t^2+1)\hat{j} + (t^3+1)\hat{k}$

3. $\vec{r}(t) = (e^t+1)\hat{i} + (e^{2t}+1)\hat{j} + (te^{t^2}+1)\hat{k}$

4. $\vec{r}(t) = \cos 2t\,\hat{i} + \sin 2t\,\hat{j} + t\,\hat{k}$

5. $\vec{r}(t) = \sqrt{t}\hat{i} + e^{3t}\hat{j} + \ln(t)\hat{k}$

6. $\vec{r}(t) = \cos(t)\hat{i} + \sin(t)\hat{j} + \tan(t)\hat{k}$

7. $\vec{r}(t) = \dfrac{t}{1+t^2}\hat{i} + \sec(t)\hat{j} + \dfrac{e^t - e^{-t}}{2}\hat{k}$

8. $\vec{r}(t) = \cos^2(t)\hat{i} + \sin^2(t)\hat{j} + \sec^2(t)\hat{k}$

9. If $\vec{r}(t)$ is a vector-valued function such that $\|\vec{r}(t)\|$ is constant, then use the derivative with respect to *t* of $\vec{r}\bullet\vec{r}$ to prove that $\vec{r}(t)$ is perpendicular to $\vec{r}'(t)$.

10. A ladder of length *L* is leaning against a wall, and the top of the ladder is sliding down towards the floor. If the point *P* is at the midpoint of the ladder and the origin is placed where the wall meets the floor, then find:
    a. The position of *P* in terms of a vector-valued function $\vec{r}(\theta)$, and
    b. The derivative $\vec{r}'(\theta)$.