HOMEWORK #2 (9.2 ~9.5)

Due on March 8

1) Suppose $\vec{r}(t)=t^2\vec{i}+(t^3-2t)\vec{j}+(t^2-5t)\vec{k}$ is the position vector of a moving particle. At what points does the particle pass through the xy-plane ? What are its speed, velocity, acceleration and tangent line (to the curve traced by $\vec{r}(t)$) at these points ? (Problem 9, page 457).

2) Suppose $\vec{r}(t)$ is the position vector of a moving particle. Find the curvature, the tangential and normal components of the acceleration at any t. $\vec{r}(t)=5\cos(t)\vec{i}+5\sin(t)\vec{j}$ (Problem 13, page 463).

3) If $u=f(x,y)$ and $x=r\cos\theta,\ y=r\sin\theta$, show that Laplace's equation $\partial^2u/\partial x^2+\partial^2u/\partial y^2=0$ becomes $\dfrac{\partial^2u}{\partial r^2}+\dfrac{1}{r}\dfrac{\partial u}{\partial r}+\dfrac{1}{r^2}\dfrac{\partial^2u}{\partial\theta^2}=0$ (Problem 53, page 470).

4) Find the directional derivative of the given function at the given point in the directed direction $f(x,y)=\tan^{-1}\dfrac{y}{x};(2,-2)$, $\vec{i}-3\vec{j}$ (Problem 13, page 475).