# Calc III Formulas for Ch12-13-14 Final Exam

$$\vec{T}(t)=\frac{\vec{r'}(t)}{\left|\vec{r'}(t)\right|} \qquad \vec{N}(t)=\frac{\vec{T'}(t)}{\left|\vec{T'}(t)\right|} \qquad \vec{B}(t)=\vec{T}(t)\times\vec{N}(t)$$

curvature:

$$\kappa(t)=\left|\frac{d\vec{T}}{ds}\right|=\frac{\left|\vec{T'}(t)\right|}{\left|\vec{r'}(t)\right|}=\frac{\left|\vec{r'}(t)\times\vec{r''}(t)\right|}{\left|\vec{r'}(t)\right|^3}$$

$$Hessian\ Determinant:\ D=f_{xx}f_{yy}-\left(f_{xy}\right)^2$$

$$Gradient:\ \nabla f=\left\langle f_x,\ f_y\right\rangle$$

$$Directional\ Derivative:\ D_u f=\nabla f\bullet\vec{u}$$

Tangent plane to surface $z=f(x,y)$ at point $(x_0,y_0,z_0)$

$$z-z_0=f_x\left(x-x_0\right)+f_y\left(y-y_0\right)$$

Common Parameterizations:

$$line:\ \vec{r}(t)=\vec{r_1}+t\,\vec{v} \qquad -\infty<t<\infty$$

$$line\ segment:\ \vec{r}(t)=(1-t)\vec{r_0}+t\,\vec{r_1} \qquad 0\le t\le 1$$

$$circle\,(clockwise):\ \vec{r}(t)=\left\langle a\cos t,\ a\sin t\right\rangle \qquad 0\le t\le 2\pi$$

$$ellipse\,(clockwise):\ \vec{r}(t)=\left\langle a\cos t,\ b\sin t\right\rangle \qquad 0\le t\le 2\pi$$