Equation Sheet Final Exam
Math 2153 Spring 2022

Arc Length Function: $s(t) = \int_a^t |v(u)|du$

Curvature: $\kappa = \left|\dfrac{dT}{ds}\right| = \dfrac{1}{|v|}\left|\dfrac{dT}{dt}\right|$

Discriminant: $D(x,y) = f_{xx}(x,y)f_{yy}(x,y) - (f_{xy}(x,y))^2$

Changing between Cartesian/Spherical Coordinates:

$$\begin{gathered} \mathrm{x} = \rho\sin\phi\cos\theta \\ \mathrm{y} = \rho\sin\phi\sin\theta \\ \mathrm{z} = \rho\cos\phi \\ \mathrm{dV} = \rho^2\sin\phi\, d\rho\, d\phi\, d\theta \\ \rho^2 = x^2 + y^2 + z^2 \end{gathered}$$

Change of Variables: $\iint_R f(x,y)dA = \iint_S f(g(u,v),h(u,v))|J(u,v)|dA$

Circulation: $\int_C F \cdot T ds = \int_C F \cdot r'(t)dt$

Flux: $\int_C F \cdot n\, ds = \int_C F \cdot \langle y'(t), -x'(t)\rangle dt$

Green's Theorem - Circulation: $\oint_C F \cdot T ds = \oint_C f dx + g dy = \iint_R \frac{\partial g}{\partial x} - \frac{\partial f}{\partial y} dA$

Green's Theorem - Flux: $\oint_C F \cdot n ds = \oint_C f dy - g dx = \iint_R \frac{\partial f}{\partial x} + \frac{\partial g}{\partial y} dA$

Surface Integral - Flux: $\iint_S F \cdot n dS = \iint_R F \cdot (t_u \times t_v) dA$

Stokes' Theorem: $\oint_C F \cdot T ds = \oint_C F \cdot dr = \iint_S (\nabla \times F) \cdot n dS$

Divergence Theorem: $\iint_S F \cdot n dS = \iiint_D \nabla \cdot F dV$