$$\cos^2\theta = \frac{1+\cos 2\theta}{2} \qquad \sin^2\theta = \frac{1-\cos 2\theta}{2} \qquad \sin 2\theta = 2\sin\theta\cos\theta$$

$$\Delta = \begin{vmatrix} f_{xx} & f_{xy} \\ f_{xy} & f_{yy} \end{vmatrix}$$

$\Delta > 0$ and $f_{xx} > 0 \to$ Local Minimum

$\Delta > 0$ and $f_{xx} < 0 \to$ Local Maximum

$\Delta < 0 \to$ Saddle Point

$\Delta = 0 \to$ No Info

$$m = \iint_R \delta(x,y)dA \qquad \overline{x} = \frac{1}{m}\iint_R x\delta(x,y)dA \qquad \overline{y} = \frac{1}{m}\iint_R y\delta(x,y)dA$$

$$I_x = \iint_R y^2\delta(x,y)dA \qquad I_y = \iint_R x^2\delta(x,y)dA \qquad I_0 = \iint_R (x^2+y^2)\delta(x,y)dA$$

$$m = \iiint_Q \delta(x,y,z)dV \qquad \overline{x} = \frac{1}{m}\iiint_Q x\delta(x,y,z)dV$$

$$\overline{y} = \frac{1}{m}\iiint_Q y\delta(x,y,z)dV \qquad \overline{z} = \frac{1}{m}\iiint_Q z\delta(x,y,z)dV$$

$$I_x = \iiint_Q (y^2+z^2)\delta(x,y,z)dV \qquad I_y = \iiint_Q (x^2+z^2)\delta(x,y,z)dV$$

$$I_z = \iiint_Q (x^2+y^2)\delta(x,y,z)dV$$

Polar $\quad x = r\cos\theta \quad y = r\sin\theta \quad dA = r\,dr\,d\theta$

Cylindrical $\quad x = r\cos\theta \quad y = r\sin\theta \quad z = z \quad dV = r\,dz\,dr\,d\theta$

Spherical

$$x = \rho\sin\phi\cos\theta \qquad y = \rho\sin\phi\sin\theta \qquad z = \rho\cos\phi \qquad dV = \rho^2\sin\phi\,d\rho\,d\phi\,d\theta$$

$$dS = \sqrt{1 + (z_x)^2 + (z_y)^2}\, dA$$

$$dS = \|\mathbf{r}_u \times \mathbf{r}_v\|\, du\, dv$$

$$\frac{\partial(x,y)}{\partial(u,v)} = \begin{vmatrix} x_u & x_v \\ y_u & y_v \end{vmatrix} \qquad \frac{\partial(u,v)}{\partial(x,y)} = \begin{vmatrix} u_x & u_y \\ v_x & v_y \end{vmatrix}$$

Divergence $\nabla \cdot \mathbf{F} = \frac{\partial P}{\partial x} + \frac{\partial Q}{\partial y} + \frac{\partial R}{\partial z}$

Curl $\nabla \times \mathbf{F} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ P & Q & R \end{vmatrix}$

$$ds = \sqrt{(\tfrac{dx}{dt})^2 + (\tfrac{dy}{dt})^2 + (\tfrac{dz}{dt})^2}\, dt$$

Green's Theorem $\oint_C (P\,dx + Q\,dy) = \iint_R (\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y})\, dA$

Vector Form of Green's Theorem $\oint_C \mathbf{F} \cdot \mathbf{n}\, ds = \iint_R \nabla \cdot \mathbf{F}\, dA$

Divergence Theorem $\oiint_S \mathbf{F} \cdot \mathbf{n}\, dS = \iiint_Q \nabla \cdot \mathbf{F}\, dV$

Stokes' Theorem $\oint_C \mathbf{F} \cdot \mathbf{T}\, ds = \iint_S (\nabla \times \mathbf{F}) \cdot \mathbf{n}\, dS$