We assume that we have parametric form of a smooth curve $C$ given by
\[ \mathbf{r}(t) = x(t)i + y(t)j + z(t)k \]
\[ = \langle x(t), y(t), z(t) \rangle \]
\[ a \leq t \leq b. \]
If the equation is given in a non-parametric form then we can put it in a suitable parametric form.

**Differentiation:**
\[ \mathbf{r}'(t) = \left\langle \frac{dx}{dt}, \frac{dy}{dt}, \frac{dz}{dt} \right\rangle \]

**Del Operator:**
\[ \nabla = \left\langle \frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z} \right\rangle \]

We use this operator to define three operations

**Gradient:** Gradient of a scalar function $f(x,y,z)$ is defined as
\[ \nabla f = \frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial f}{\partial z} \]

**Divergence:** Divergence of a vector field is a scalar function defined as
\[ \text{div}\mathbf{F} = \frac{\partial F_1}{\partial x} + \frac{\partial F_2}{\partial y} + \frac{\partial F_3}{\partial z} \]

**Curl:** The curl of a vector field is given by
\[ \text{curl}\mathbf{F} = \nabla \times \mathbf{F} = \begin{bmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ F_1 & F_2 & F_3 \end{bmatrix} \]

A vector field $\mathbf{F}$ is called **IRROTATIONAL** if $\text{curl}\mathbf{F} = 0$. 