

$$\mathbf{N}(t) = \frac{\mathbf{T}'(t)}{\|\mathbf{T}'(t)\|}$$

$$\kappa = \frac{|x'y'' - x''y'|}{[(x')^2 + (y')^2]^{3/2}}$$

$$\kappa = \left\| \frac{d\mathbf{T}}{ds} \right\| = \frac{\|d\mathbf{T}/dt\|}{ds/dt} \quad \text{and} \quad ds/dt = \|\mathbf{v}\| \text{ is the speed}$$

$$\mathbf{a} = \frac{d^2s}{dt^2}\mathbf{T} + \kappa \left(\frac{ds}{dt} \right)^2 \mathbf{N}$$

$$\kappa = \frac{\|\mathbf{v} \times \mathbf{a}\|}{(ds/dt)^3}$$

$$f'_{\mathbf{u}}(\mathbf{x}) = \nabla f(\mathbf{x}) \cdot \mathbf{u}$$

$$z - z_0 = \frac{\partial g}{\partial x}(x_0, y_0)(x - x_0) + \frac{\partial g}{\partial y}(x_0, y_0)(y - y_0)$$

$$x = x_0 + \frac{\partial g}{\partial x}(x_0, y_0)t, \quad y = y_0 + \frac{\partial g}{\partial y}(x_0, y_0)t, \quad z = z_0 + (-1)t$$

$$\begin{cases} \nabla f(\mathbf{x}) = \lambda \nabla g(\mathbf{x}) \\ g(\mathbf{x}) = 0 \end{cases} \quad \text{or} \quad \begin{cases} \nabla g(\mathbf{x}) = \mathbf{0} \\ g(\mathbf{x}) = 0 \end{cases}$$