

MA280 Formula Sheet

Cylindrical Coordinates

$$x^2 + y^2 = r^2$$

$$\tan \theta = y/x$$

$$x = r \cos \theta$$

$$y = r \sin \theta$$

$$z = z$$

Spherical Coordinates

$$x^2 + y^2 + z^2 = \rho^2$$

$$x = \rho \cos \theta \sin \phi$$

$$y = \rho \sin \theta \sin \phi$$

$$z = \rho \cos \phi$$

Curvature of $\vec{r}(t)$

$$\kappa = \frac{|\vec{r}'(t) \times \vec{r}''(t)|}{|\vec{r}'(t)|^3}$$

$$\kappa = \frac{|f''(x)|}{[1 + (f'(x))^2]^{3/2}} \text{ for } y = f(x)$$

Normal and Tangential Components of acceleration

$$a_T = v' = \frac{\vec{v} \cdot \vec{a}}{|\vec{v}|} = \frac{\vec{r}' \cdot \vec{r}''}{|\vec{r}'|}$$

$$a_N = \kappa v^2 = \frac{|\vec{r}' \times \vec{r}''|}{|\vec{r}'|}$$