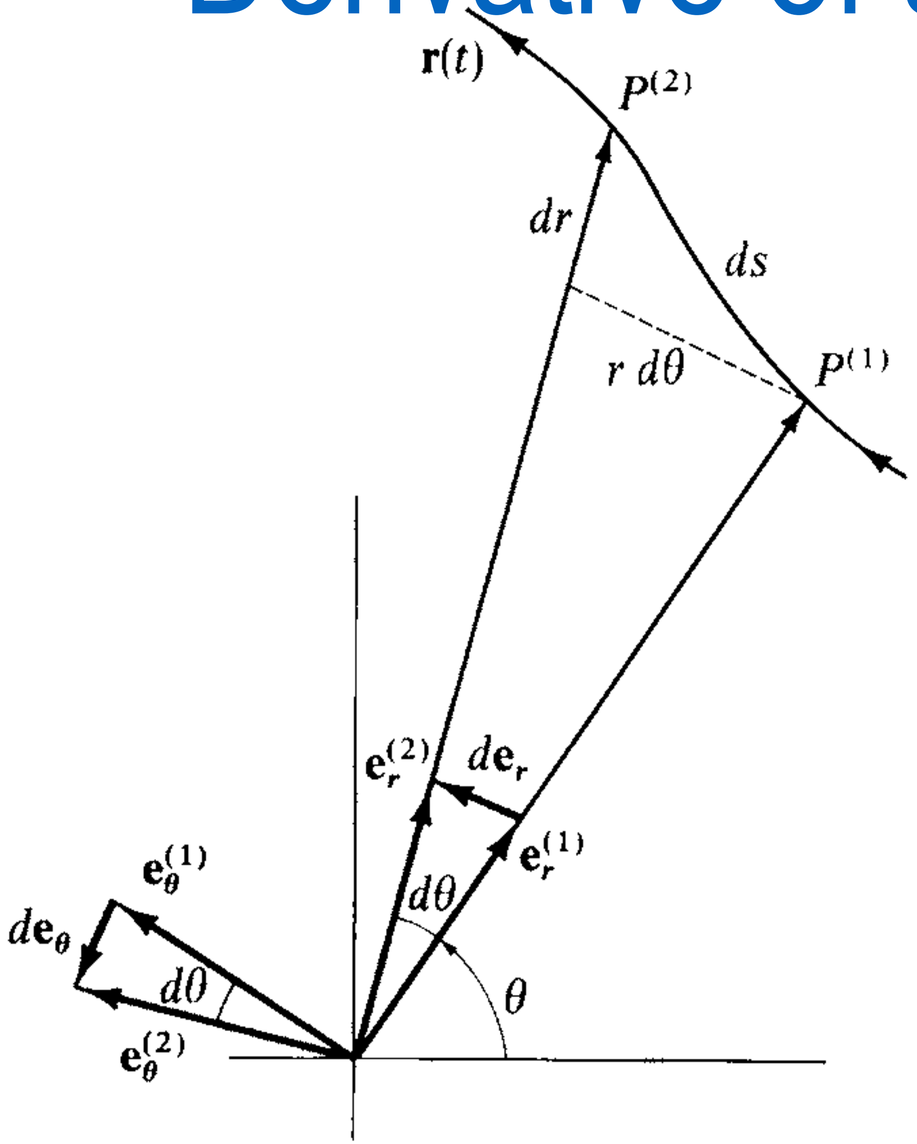
APPH E3200x
Lecture 2
Ch. 1: Derivatives, Vectors, and Geometry

Prof. Mike Mauel
mauel@columbia.edu

Derivative of a Vector (Sec. 1-14)

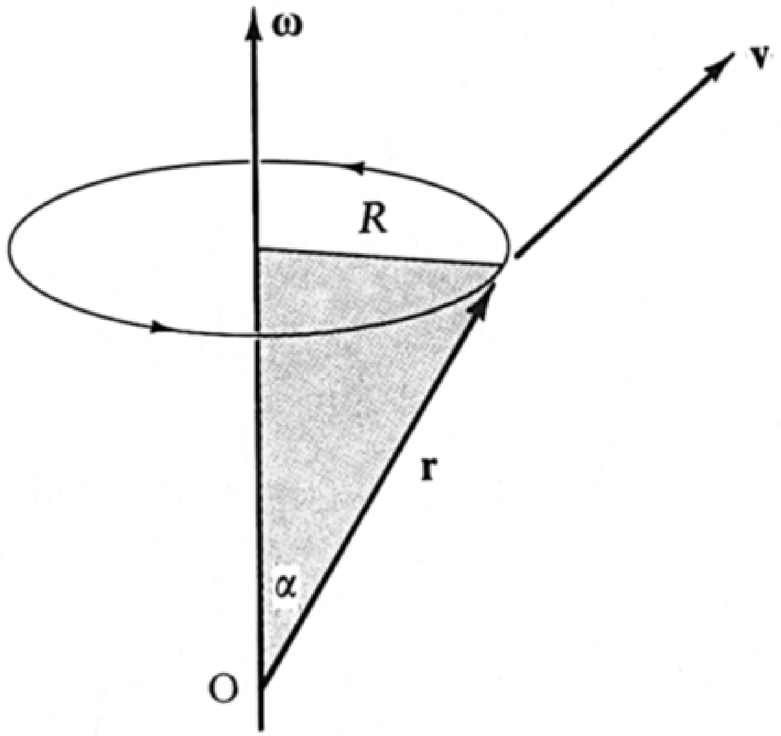


$$\mathbf{r} = x_1\mathbf{e}_1 + x_2\mathbf{e}_2 + x_3\mathbf{e}_3 = \sum_i x_i\mathbf{e}_i$$

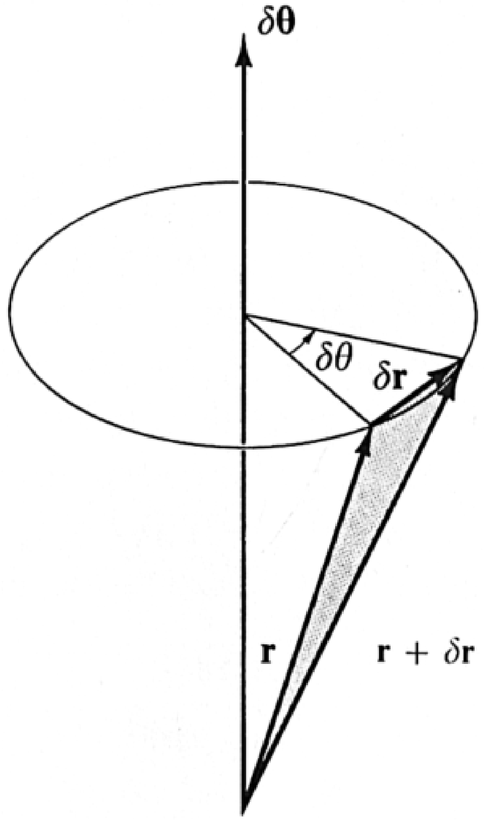
$$\mathbf{v} = \dot{\mathbf{r}} = \sum_i \dot{x}_i\mathbf{e}_i = \sum_i \frac{dx_i}{dt}\mathbf{e}_i$$

$$\mathbf{a} = \dot{\mathbf{v}} = \ddot{\mathbf{r}} = \sum_i \ddot{x}_i\mathbf{e}_i = \sum_i \frac{d^2x_i}{dt^2}\mathbf{e}_i$$

Angular Velocity (Sec. 1.15)



$$\mathbf{v} = \boldsymbol{\omega} \times \mathbf{r}$$



$$\delta\mathbf{r} = \delta\boldsymbol{\theta} \times \mathbf{r}$$