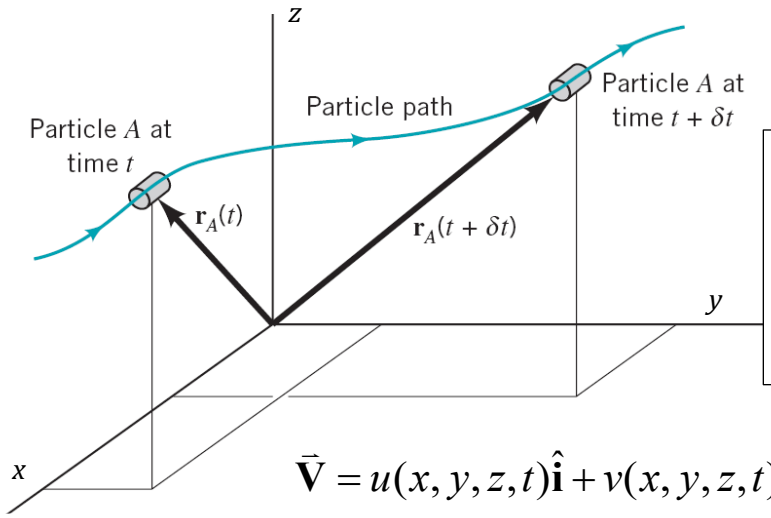
(KEY CONCEPT) [B-1-5]



Acceleration field (as a substantial derivative of a cartesian velocity field):

$$\frac{D\vec{V}}{Dt} = \frac{\partial \vec{V}}{\partial t} + (\vec{V}\cdot\nabla)\vec{V}$$
$$= \frac{\partial \vec{V}}{\partial t} + u\frac{\partial \vec{V}}{\partial x} + v\frac{\partial \vec{V}}{\partial y} + w\frac{\partial \vec{V}}{\partial z}$$

$$\vec{\mathbf{V}} = u(x,y,z,t)\hat{\mathbf{i}} + v(x,y,z,t)\hat{\mathbf{j}} + w(x,y,z,t)\hat{\mathbf{k}}$$

Flow field sketch (source: Munson, Young, & Okiishi "Fundamentals of Fluid Mechanics" 2017)