University Physics with Modern Physics, 15/e
Young/Freedman
Chapter 3 Key Equations

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k} \quad \text{(Position vector)} \tag{3.1}$$

$$\vec{v}_{\text{av}} = \frac{\Delta\vec{r}}{\Delta t} = \frac{\vec{r}_2 - \vec{r}_1}{t_2 - t_1} \quad \text{(Average velocity vector)} \tag{3.2}$$

$$\vec{v} = \lim_{\Delta t \to 0} \frac{\Delta\vec{r}}{\Delta t} = \frac{d\vec{r}}{dt} \quad \text{(instantaneous velocity vector)} \tag{3.3}$$

$$v_x = \frac{dx}{dt} \quad v_y = \frac{dy}{dt} \quad v_z = \frac{dz}{dt} \quad \text{(component of, instantaneous velocity vector)} \tag{3.4}$$

$$\vec{a}_{\text{av}} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1} \quad \text{(Average acceleration vector)} \tag{3.8}$$

$$\vec{a} = \lim_{\Delta t \to 0} \frac{\Delta\vec{v}}{\Delta t} = \frac{d\vec{v}}{dt} \quad \text{(instantaneous acceleration vector)} \tag{3.9}$$

$$a_x = \frac{dv_x}{dt} \quad a_y = \frac{dv_y}{dt} \quad a_z = \frac{dv_z}{dt} \quad \text{(component of, instantaneous acceleration vector)} \tag{3.10}$$

$$x = (v_0 \cos\alpha_0)t \quad \text{(projectile)} \tag{3.19}$$

$$y = (v_0 \sin\alpha_0)t - \frac{1}{2}gt^2 \quad \text{(projectile)} \tag{3.20}$$

$$v_x = v_0 \cos\alpha_0 \quad \text{(projectile)} \tag{3.21}$$

$$v_y = v_0 \sin\alpha_0 - gt \quad \text{(projectile)} \tag{3.22}$$

$$a_{\text{rad}} = \frac{v^2}{R} \quad \text{(uniform circular motion)} \tag{3.27}$$

$$a_{\text{rad}} = \frac{4\pi^2 R}{T^2} \quad \text{(uniform circular motion)} \tag{3.29}$$

$$v_{P/A\text{-}x} = v_{P/B\text{-}x} + v_{B/A\text{-}x} \quad \text{(Relative velocity along a line)} \tag{3.32}$$

$$\vec{v}_{P/A} = \vec{v}_{P/B} + \vec{v}_{B/A} \quad \text{(Relative velocity in space)} \tag{3.35}$$