AP Physics C – Center of Mass

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$$\text{Center of Mass } = \sum_{i}^{\infty} \frac{x_i m_i}{M_{total}} \tag{1}$$

$$x_{com} = \frac{m_1 x_1 + m_2 x_2 + \cdots + m_n x_n}{m_1 + m_2 + \cdots + m_n} \tag{2}$$

$$y_{com} = \frac{m_1 y_1 + m_2 y_2 + \cdots + m_n y_n}{m_1 + m_2 + \cdots + m_n} \tag{3}$$

Shape center of mass:

$$\frac{1}{M_{total}} \int x \, dm \tag{4}$$

Center of Mass for rigid objects with uniform densities:

$$\text{Volume Mass Density } = \rho = \frac{m}{V} = \frac{dm}{dV} \tag{5}$$

$$\text{Surface Mass Density } = \sigma = \frac{m}{A} = \frac{dm}{da} \tag{6}$$

$$\text{Linear Mass Density } = \lambda = \frac{m}{L} = \frac{dm}{dL} \tag{7}$$