<u>**Summary of equations**</u>

Moment of a force: $\mathbf{M}_O = \mathbf{r} \times \mathbf{F}$

Scalar projection of **A** along **e**: $\mathbf{A} \cdot \mathbf{e}$

Equivalent systems: Two systems are equivalent if the resultant force for the systems is equal and if the resultant moment for the systems is equal

Equilibrium for a particle: $\sum \mathbf{F} = 0$

Equilibrium for a rigid body: $\begin{cases} \sum \mathbf{F} = 0 \\ \sum \mathbf{M}_O = 0 \end{cases}$

Centroid of a line: $x_c = \frac{1}{L}\int_L x dL, \quad y_c = \frac{1}{L}\int_L y dL, \quad z_c = \frac{1}{L}\int_L z dL$

Composite bodies: $x_c = \frac{\sum L_i \bar{x}_i}{\sum L_i}, \quad y_c = \frac{\sum L_i \bar{y}_i}{\sum L_i}, \quad z_c = \frac{\sum L_i \bar{z}_i}{\sum L_i}$

Centroid of an area: $x_c = \frac{1}{A}\int_A x dA, \quad y_c = \frac{1}{A}\int_A y dA, \quad z_c = \frac{1}{A}\int_A z dA$

Composite bodies: $x_c = \frac{\sum A_i \bar{x}_i}{\sum A_i}, \quad y_c = \frac{\sum A_i \bar{y}_i}{\sum A_i}, \quad z_c = \frac{\sum A_i \bar{z}_i}{\sum A_i}$

Centroid of a volume: $x_c = \frac{1}{V}\int_V x dV, \quad y_c = \frac{1}{V}\int_V y dV, \quad z_c = \frac{1}{V}\int_V z dV$

Composite bodies: $x_c = \frac{\sum V_i \bar{x}_i}{\sum V_i}, \quad y_c = \frac{\sum V_i \bar{y}_i}{\sum V_i}, \quad z_c = \frac{\sum V_i \bar{z}_i}{\sum V_i}$

Theorems of Pappus:

Surface of revolution: $A = 2\pi y_c L$

Volume of revolution: $V = 2\pi y_c A$

Static friction: $f \le \mu_s N$, Pending Motion: $f = \mu_s N$

Kinetic friction: $f = \mu_k N$

Belt friction: $T_2 = T_1 e^{\mu\theta}$

Area moment of inertia: $I = \int_A r^2 dA$, $I = \bar{I} + Ad^2$, $J_O = I_x + I_y$

Mass moment of Inertia: $I = \int_m r^2 dm$, $I = \bar{I} + md^2$