

Translational Idea	What it means
Position $\vec{s}$ Velocity $\vec{v}$ Acceleration $\vec{a}$	Where is the thing? How is it moving? How is its motion changing?
Kinematics: $\vec{s}(t) = \frac{1}{2}\vec{a}t^2 + \vec{v}_0t + \vec{s}_0$	How does accel relate to position and velocity?
Force $\vec{F}$ Mass $m$ Newton's second law $\vec{F} = m\vec{a}$	What pushes on the thing? How hard is the thing to move? How do forces make things move?
Kinetic energy $KE = \frac{1}{2}mv^2$ Work $W = \vec{F} \cdot \Delta\vec{s}$ Power $P = \vec{F} \cdot \vec{v}$	Energy associated with speed How do forces change objects' speed? At what rate do forces change objects' energy?
Momentum $\vec{p} = m\vec{v}$	The “persistence” of an object's motion

Translation	Rotation
Position $\vec{s}$ Velocity $\vec{v}$ Acceleration $\vec{a}$	Angle $\theta$ Angular velocity $\omega$ Angular acceleration $\alpha$
Kinematics: $\vec{s}(t) = \frac{1}{2}\vec{a}t^2 + \vec{v}_0t + \vec{s}_0$	$\theta(t) = \frac{1}{2}\alpha t^2 + \omega_0t + \theta_0$
Force $\vec{F}$ Mass $m$ Newton's second law $\vec{F} = m\vec{a}$	Torque $\tau$ Rotational inertia $I$ Newton's second law for rotation $\tau = I\alpha$
Kinetic energy $KE = \frac{1}{2}mv^2$ Work $W = \vec{F} \cdot \Delta\vec{s}$ Power $P = \vec{F} \cdot \vec{v}$	Kinetic energy $KE = \frac{1}{2}I\omega^2$ Work $W = \tau\Delta\theta$ Power $P = \tau\omega$
Momentum $\vec{p} = m\vec{v}$	Angular momentum $L = I\omega$