4-Minute Drill
Chapter 9-10

* If you're memorizing the formulas, you don't need to know the Starred items.

Distance a point on a body moves as the body rotates through an angle θ — Technically incorrect, but okay → Distance = θr → $\Delta x = \theta r$

Velocity of a point on a body as the body rotates with angular speed ω $v = \omega r$

Acceleration of a point on a body as the body's rotation rate increases $a = \alpha r$

Angular velocity in terms of θ $\omega = \frac{\Delta\theta}{\Delta t}$

Angular acceleration in terms of ω $\alpha = \frac{\Delta\omega}{\Delta t}$

One of the rotational kinematic equations ($\Delta\theta$ =) $\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

Another rotational kinematic equation (ω=) $\omega = \omega_0 + \alpha t$

One more rotational kinematic equation (ω^2=) $\omega^2 = \omega_0^2 + 2\alpha\Delta\theta$

Rotational kinetic energy formula $KE_{rot} = \frac{1}{2} I \omega^2$

Total kinetic energy of a rolling body $KE_{tot} = \frac{1}{2} m v^2 + \frac{1}{2} I \omega^2$

Rotational inertia of discrete particle of mass m at a distance r from the axis $I = mr^2$

* Rotational inertia of a cylinder with the axis through the center of the flat face $I = \frac{1}{2} mr^2$

* Rotational inertia of a solid sphere with the axis through the center $I = \frac{2}{5} mr^2$

Torque in terms of force applied at a given distance from the rotational axis $\tau = rF$

Torque (Newton's 2nd Law for rotation) $\tau = I\alpha$

Angular momentum $L = I\omega$

* Another expression for angular momentum $L = mr^2\left(\frac{v}{r}\right) = mvr = pr$

Conservation of angular momentum

$L_i = L_f$

$I_i \omega_i = I_f \omega_f$