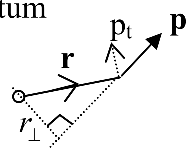
Chapter 12 – Summary

Definitions

$\vec{\tau} = \vec{r} \times \vec{F}$ $\tau = rF\sin\theta = r_{\perp}F = rF_t$	torque as a vector		
$\vec{l} = \vec{r} \times \vec{p} = m\vec{r} \times \vec{v}$ $l = mrv\sin\phi = mrv_{\perp} = mr_{\perp}v$	angular momentum 	$\vec{L} = \sum \vec{l}_i$	Total angular momentum

Theorems/Laws/Equations

<table>
<tr><td colspan="3">For smooth Rolling</td></tr>
<tr><td rowspan="5">$v_{com} = r\omega$
$a_{com} = r\alpha$
$K = \frac{1}{2}I_{com}\omega^2 + \frac{1}{2}mv_{com}^2$</td><td rowspan="5">$a_{com} = \frac{g\sin\theta}{1 + \left(I_{com}/MR^2\right)}$ down the incline
$\left(I_{com}/MR^2\right) = \begin{cases} 1 & \text{for ring} \\ 1/2 & \text{for cylinder} \\ 2/5 & \text{for solid sphere} \end{cases}$</td><td>$\sum \vec{\tau} = \frac{d\vec{l}}{dt}$ for a single particle</td></tr>
<tr><td>$\sum \vec{\tau}_{ext} = \frac{d\vec{L}}{dt}$ for a system of particles</td></tr>
<tr><td>$L_z = I\omega$ (rigid body, fixed axis)</td></tr>
<tr><td>Conservation of angular momentum</td></tr>
<tr><td>$\vec{L}_i = \vec{L}_f \quad \left\{\text{isolated system} \quad \sum \tau_{ext} = 0\right\}$</td></tr>
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