Rotational Energy and Torques - 1

Three masses on equilateral triangle (1):

$$R = \frac{L}{2\cos(\pi/6)}\,, \quad \cos(\pi/6) =?\,; \quad R = \frac{L}{2}\,.$$

Disk with Hole (2). Solid disk:

$$I = \frac{1}{2}\,M\,R^2\,, \quad M = \pi\,R^2\,\rho\,.$$

Small disk:

$$I = \frac{1}{2}\,m\,r^2 + m\,r^2\,, \quad m = \pi\,r^2\,\rho\,, \quad r = R/3$$

Torque on a Merry Go Round (3):

$$I = I_{\rm disk} + I_{\rm kids}\,, \quad \tau = I\,\alpha\,, \quad \alpha = \frac{\omega}{t}\,, \quad F = \frac{\tau}{R}\,.$$

Rotational Energy and Torques - 2

Hoop Rolling up Hill (4):

$$K = m\,g\,h\,, \quad K = (1 + f_{\rm hoop})\,\frac{1}{2}\,m\,v^2\,.$$

Solid Sphere Rolling down the Ramp (5):

$$K = \frac{1+f}{2}\,M\,v^2 = M\,g\,h\,, \quad h = d\,?\,, \quad ?\,= \ .$$

Mass pullling a Pulley (6):

$$\triangle U = U - K \ \ \text{with} \ \ U = M_b\,g\,D \ \ \text{and} \ \ K = I_p\,\frac{\omega^2}{2} + M_b\,\frac{v^2}{2}\,.$$

Rolling around a Loop the Loop (7):

$$v_{\rm min}^2 = g\,R\,, \quad M\,g\,h_{\rm min} = (1+f)\,M\,\frac{v_{\rm min}^2}{2} + M\,g\,2R \ \Rightarrow \ h_{\rm min}\,.$$