Newton II For Rotation

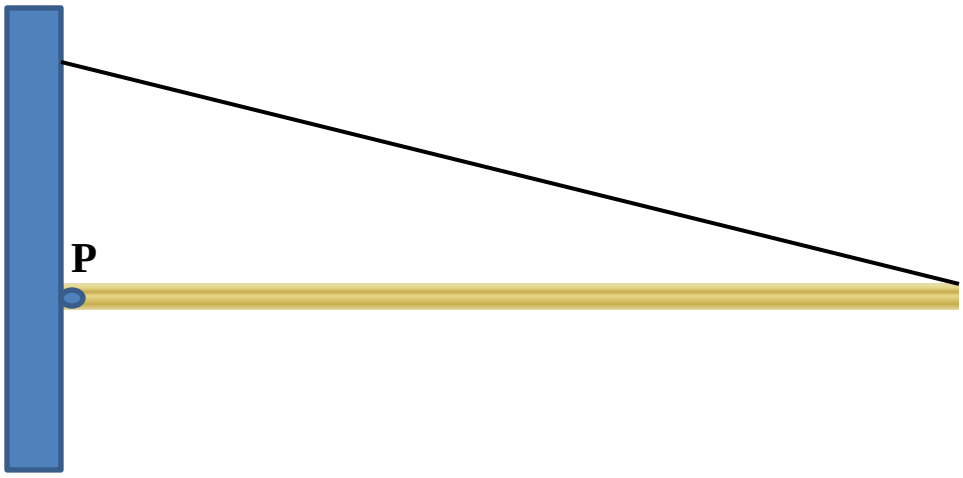
For a rigid body undergoing rotation about an axis with a constant moment of inertia, the sum of the external torques acting upon the body is equal to the object's moment of inertia times its angular acceleration.

$$\sum \vec{\tau}_{Ext} = I\ \vec{\alpha}$$

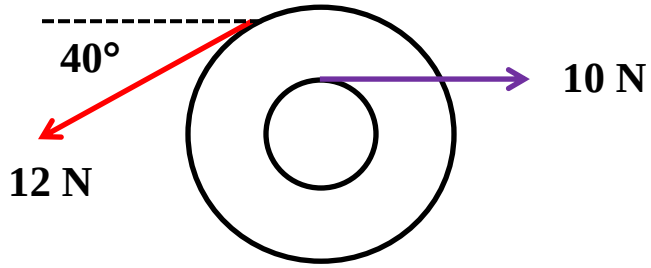
Our method of attack for rotation problems where we are asked to find the object's angular acceleration will be to:

a) Find (Calculate) the body's moment of inertia
b) Draw a Free Body Diagram
c) Use the Free Body Diagram to calculate the net-external torque
d) Solve Newton II for the angular accleration

Example: An 8 m long bar of mass 3 kg is attached to a wall at point P with a hinge and held in place by a cable as shown. The cable is then cut allowing the bar to rotate. What is the angular acceleration of the bar at the moment, the bar is released?



Example: A compound pulley is created by wielding a pulley with a radius of 2 m to a second pulley with a radius of 4 m. The compound pulley's total mass is 10 kg and it is attached to an axle through its center. Two ropes applying the forces shown to the compound pully.



A. What is the pulley's angular acceleration?

B. What is the force applied by the axle upon the pulley?