Our goals in our study of Rotations (which includes Chapter 7 – Rotational Motion and the associated lecture, lab, problem session, and problem set) are to be able to:

1. Compare and contrast rotational kinematics and dynamics quantities with their analogous translational (i.e. linear) counterparts: angular position θ and position x; angular velocity ω and velocity v; angular acceleration α and acceleration a; torque τ and force F; moment of inertia (i.e. rotational inertia) I and mass m; and Newton's Second Law for rotations $\vec{\tau}_{net} = I\vec{\alpha}$ and Newton's Second Law for translations $\vec{F}_{net} = m\vec{a}$.

2. Recognize $\vec{\theta}$, $\vec{\omega}$, $\vec{\alpha}$, and $\vec{\tau}$ are vector quantities, and use the clockwise is negative and counterclockwise is positive convention to add and subtract these vector quantities.

3. Relate θ, ω, α and time t algebraically and graphically.

4. Relate ω to tangential velocity v_t and α to tangential acceleration a_t.

5. Relate τ to F, the distance F is applied from the pivot (axis of rotation): r, and the angle (between the force and the radial line): ϕ. Alternatively, relate τ to r and the perpendicular component of the force: $F_\perp$, or to F and the moment (or lever) arm: $r_\perp$.

6. For point particles, relate I to m and r, or for extended bodies use a formula to relate I to the mass of the object and its size.

7. Use $\vec{\tau}_{net} = I\vec{\alpha}$ to solve rotational dynamics problems.

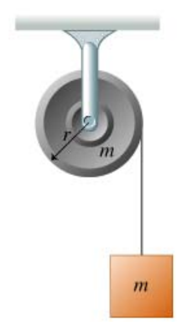
8. Use the no-slipping constraints to relate the linear motion of an object to the rotational motion of the same (or another connected) object, and to solve dynamics problems involving translations and rotations.

Reading Assignment
Ch. 7: Rotational Motion (skip pp. 210-212 and section 7.6)

Problem Set
Student Workbook Ch. 7: 1, 2, 5, 6, 17, 21, 23, 24

Ch. 7 Problems: 44, 45, 4, 6, 10, 11, 12, 13, 49, 32, 33, 34, 37, 41 (see Fig. P7.63 for a similar situation), 59

A1: A string is wrapped around a uniform solid cylinder of radius *r*, as shown in the figure. The cylinder can rotate freely about its axis. The loose end of the string is attached to a block. The block and cylinder each have mass *m*. As the block descends, the rope unwinds without slipping.



a) Show that the block accelerates downward at $\frac{2}{3}g$.

b) Discuss what happens to the acceleration of the block if the radius of the pulley doubles but the masses remain the same.