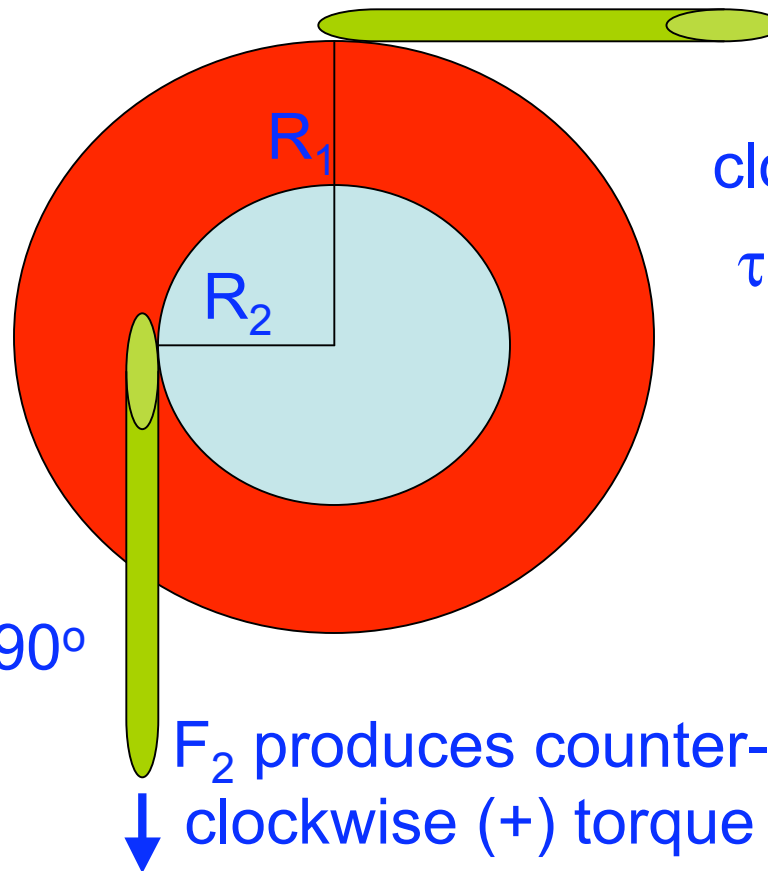


Rotational Acceleration of a Cylinder

- 1) A cylinder has an outer radius R_1 and an inner radius R_2 ($R_2 < R_1$)
- 2) A rope wrapped clockwise around the radius R_1 exerts a force F_1
- 3) A rope wrapped counterclockwise around the radius R_2 exerts F_2
- 4) What is the net torque on the cylinder?

Example numbers

$$F_1 = 5\text{ N}, F_2 = 6\text{ N}$$
$$R_1 = 1.0\text{ m}, R_2 = 0.5\text{ m}$$



F_1 produces
clockwise (-) torque

$$\tau_1 = -F_1 \cdot R_1 \cdot \sin 90^\circ$$

$$\tau_1 = -F_1 R_1$$

$$\tau_2 = +F_2 \cdot R_2 \cdot \sin 90^\circ$$

$$\tau_2 = +F_2 R_2$$

F_2 produces counter-
clockwise (+) torque

Net Torque

$$\tau = \tau_1 + \tau_2$$

$$\tau = F_2 R_2 - F_1 R_1$$

$$\tau = -5 \cdot 1.0 + 6 \cdot 0.5$$

$$\tau = -2\text{ N}\cdot\text{m}$$

$$\tau = I\alpha$$

Clockwise rotation