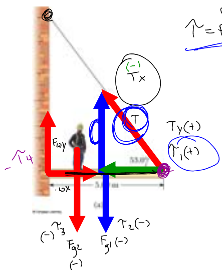
A uniform horizontal beam 5.00 m long and weighing 3.00 x 10² N is attached to a wall by a pin connection that allows the beam to rotate. Its far end is supported by a cable that makes an angle of 53.0° with the horizontal. If a person weighing 6.00 x 10² N stands 1.50 m from the wall, find the magnitude of the tension in the cable and the force exerted by the wall.



$\tau = F \cdot d$ $\Sigma F = 0$ $\Sigma \tau = 0$

$\Sigma \tau = 0$

$\tau_1 - \tau_2 - \tau_3 = 0$

$T_y(5) - F_{g1}(2.5) - F_{g2}(1.5) = 0$

$T_y = \frac{F_{g1}(2.5) + F_{g2}(1.5)}{5}$

$T_y = \frac{300(2.5) + 600(1.5)}{5}$

$T_y = 330\,N$

$\Sigma F_y = 0$

$T_y + F_{wy} - F_{g1} - F_{g2} = 0$

$F_{wy} = F_{g1} + F_{g2} - T_y$

$F_{wy} = 300 + 600 - 330$

$F_{wy} = 570\,N$

$\sin\theta = \frac{O}{H}$

$H = \frac{O}{\sin\theta}$

$H = \frac{330}{\sin 53}$

$H = 413\,N$

$\Sigma F_x = 0$

$-T_x + F_{wx} = 0$

$F_{wx} = T_x$

$F_{wx} = T\cos\theta$

$F_{wx} = 413\cos 53$

$F_{wx} = 249\,N$

$a^2 + b^2 = c^2$

$c = 622\,N$

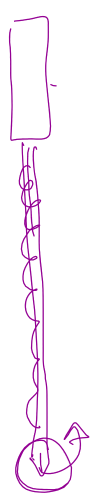
66.4° N of E

$\Sigma \tau = -\tau_4 + \tau_3 + \tau_1 = 0$

$= -F_{wy}(5) + F_{g2}(3.5) + F_{g1}(2.5)$

1 Using a screwdriver, you try to remove a screw from a piece of furniture, but can't get it to turn. To increase the chances of success you should us a screwdriver that

A is longer
B is shorter
C has a narrower handle
D has a wider handle

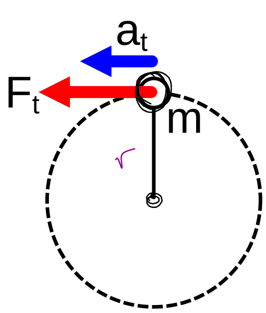


FR = τ

2 A constant net torque is applied to an object. Which one of the following will not be constant?

A angular acceleration
B angular velocity
C moment of inertia
D center of gravity

Torque and Angular Acceleration



$F_t = ma_t$

$F_t r = m a_t r$

$\tau = m a_t r$

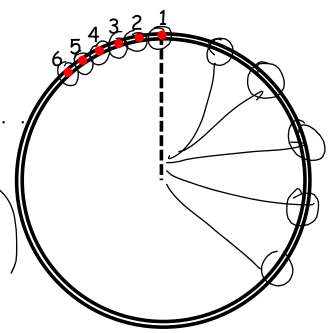
$a_t = \alpha r$

$\tau = m \alpha r r$

$\tau = mr^2 \alpha$

Force, Moment of Inertia, accel

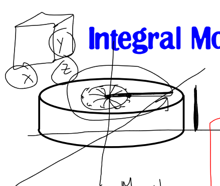
$I = \Sigma mr^2$



$I = m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 + \dots$

$I = r^2 (m_1 + m_2 + m_3 + \dots)$

$I = Mr^2$



Integral Moments of Inertia

$\int_0^M r^2 dm$ — small piece

$V\rho = \frac{M}{V} \cdot V$

$m = V\rho$ ← const

$dm = dV\rho$

$dV = r\,dr\,d\theta\,dz$

$dm = \rho r\,dr\,d\theta\,dz$

$$\int_0^h \int_0^{2\pi} \int_0^R r^2 \rho r\,dr\,d\theta\,dz$$

$$\int_0^h \int_0^{2\pi} \int_0^R r^3 \rho\,dr\,d\theta\,dz$$

$$\int_0^h \int_0^{2\pi} \frac{1}{4} r^4 \rho \Big|_0^R d\theta\,dz$$

$$\int_0^h \int_0^{2\pi} \frac{1}{4} R^4 \rho\,d\theta\,dz$$

$$\int_0^h \frac{1}{4} R^4 \rho \theta \Big|_0^{2\pi} dz$$

$\int x^0 dx$

x

$$\int_0^h \frac{1}{4} R^4 \rho 2\pi\,dz$$

$$\frac{1}{4} R^4 \rho 2\pi z \Big|_0^h$$

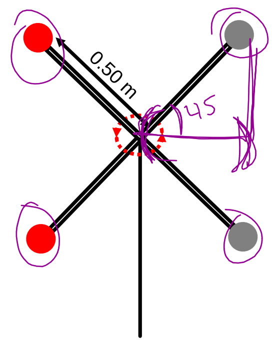
$I = \frac{1}{4} R^4 \rho 2\pi h$ $\qquad \rho = \frac{M}{V}$

$= \frac{1}{2} R^2 M$ $\qquad \rho = \frac{M}{\pi r^2 h}$

$= \frac{1}{2} R^2 M$

● -0.30 kg
● -0.20 kg

What is the Moment of Inertia for the object below?



$I = \sum mr^2$

$I = m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 + m_4 r_4^2$

$I = r^2 (m_1 + m_2 + m_3 + m_4)$

$I = r^2$

$= (0.50 \cos 45)^2$

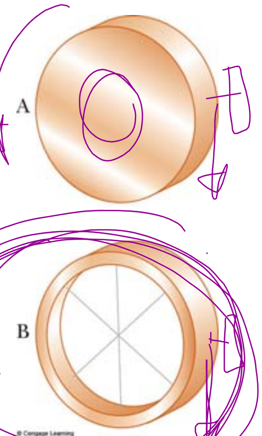
$I = 0.123 \text{ kgm}^2$

3 Two rigid objects shown have the same mass, radius, and angular speed. If the same braking torque is applied to each, which takes longer to stop?

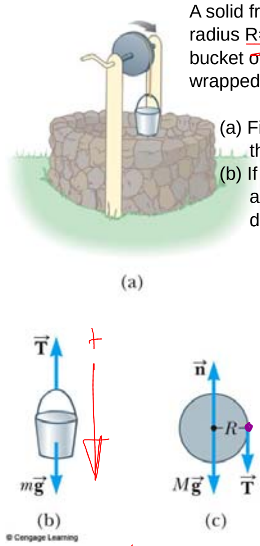
A A
B B
C Have No Clue

B = Same

$I = \frac{1}{2} mr^2$



$I = mr^2$



A solid frictionless cylindrical reel of mass M=3.00 kg and radius R=0.400 m is used to draw water from a well. A bucket of mass m=2.00 kg is attached to a cord that is wrapped around the cylinder.

(a) Find the tension T in the cord and acceleration a of the bucket.
(b) If the bucket starts from rest at the top of the well and falls for 3.00 s before hitting the water, how far does it fall?

I = moment of Inertia

Bucket

$\Sigma F = ma$

$mg - T = ma$

$\Sigma \tau = I\alpha$

$\Sigma \tau = \frac{1}{2} mr^2 \alpha$

$TR = \frac{1}{2} mr^2 \alpha$

$TR = \frac{1}{2} mr^2 \frac{a_T}{r}$

$a_T = \alpha r$

$\alpha = \frac{a_T}{r}$