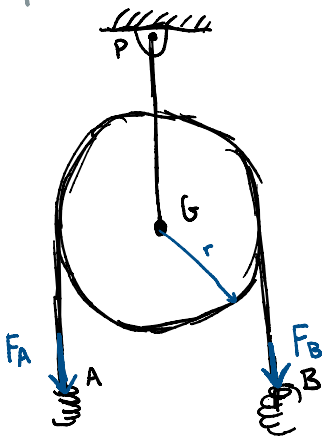
20-R-KIN-DK-37 Intermediate Rotation (RBK)

Inspiration: 17-79 Hibbeler



Two rowdy kids are having a strength competition. Anastasia pulls with a force of ***F_A = 20 N*** and Brian, who has been hitting the gym recently, pulls with a force of ***F_B = 45 N***. If the pulley can be modelled as a disk of mass ***m = 5 kg*** with a radius ***r = 15 cm***, determine the acceleration of Anastasia's hand at A and the tension in the cable PG at that instant. Assume the mass of the cable is negligible and no slipping occurs.

$$I_G = \frac{1}{2}mr^2 = \frac{1}{2}(5)(0.15)^2 = 0.05625$$

$$\sum F_x = 0 \qquad \sum F_y = T - F_A - F_B - F_g = 0$$

$$T = F_A + F_B + mg = 20 + 45 + (5)(9.81) = \boxed{114.05}$$

$$\sum M_G = F_A(0.15) - F_B(0.15) = I_G \alpha$$

$$= 20(0.15) - 45(0.15) = -3.75 = 0.05625\,\alpha$$

$$\boxed{\alpha = -66.\overline{66}\ \text{rad/s}^2}$$

Pinned at G $\rightarrow$ $a = \alpha \times r = -66.66\,\hat{k} \times (-0.15\,\hat{i}) = \boxed{10\,\hat{j}\ \text{m/s}^2}$