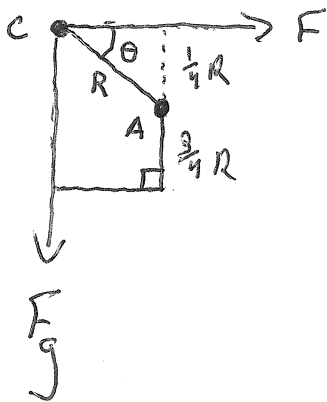
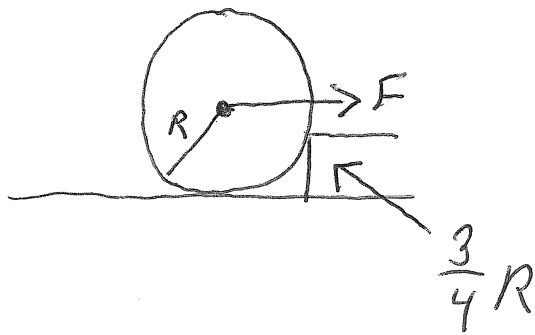


A bicycle wheel of radius R and mass M is at rest against a step as shown below. Calculate F such that the wheel will go up the step.

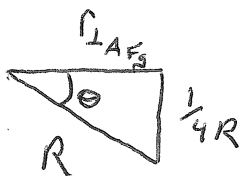


Calculate torque about A .

$$\sum \tau_A = F_g r_{\perp A F_g} + F r_{\perp A F} = 0$$

↑
condition just
prior to motion

$$F_g = Mg$$



$$r_{\perp A F} = \frac{1}{4}R$$

$$r_{\perp A F_g} = \sqrt{R^2 - \left(\frac{1}{4}R\right)^2}$$

2

$$r_{AFg} = \sqrt{R^2 - \frac{1}{16}R^2} = \sqrt{\frac{15}{16}R^2} = \frac{\sqrt{15}}{4}R$$

$$\Sigma \hat{T}_A = Mg \frac{\sqrt{15}}{4}R - F \left(\frac{1}{4}R \right) = 0$$

$$Mg \left(\frac{\sqrt{15}}{4} \right) R = F \left(\frac{1}{4}R \right)$$

$$\frac{Mg \left(\frac{\sqrt{15}}{4} \right) R}{\left(\frac{1}{4} \right) R} = F$$

$$\boxed{\sqrt{15} Mg = F}$$