



Roll of paper,

radius $R = 0.2 \text{ m}$

mass $M = 0.35 \text{ kg}$

$$\rightarrow I = \frac{1}{2}MR^2$$

Joe pulls free end
with force $F = 20 \text{ N}$.

Friction with the
spindle produces
torque $\tau_{\text{fric}} = 1.2 \text{ N}\cdot\text{m}$

How long must Joe pull to get a strip of
paper $L = 1.0 \text{ m}$ long?