

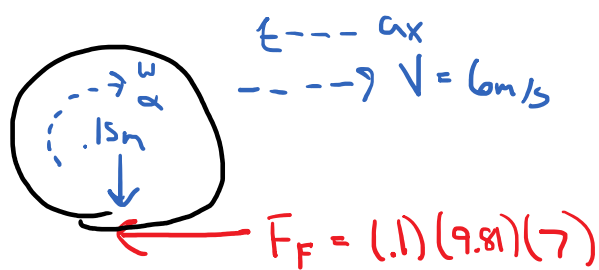
Problem 2

A bowling ball is modeled as a 7 kg uniform sphere 300 mm in diameter. The ball is released with an initial velocity of 6m/s on a horizontal wooden floor ($\mu_k = .1$) with zero angular velocity.

- How long does it take before the ball begins to roll without slipping?
- What is linear velocity of the ball at this time?



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roll without
slipping

$$V_f = -r \omega_f$$

$$(F)(t) = m(v_f - v_i)$$

$$(M)(t) = I(\omega_f - \omega_i)$$

$$(-6.867 \text{ N})(t) = 7 \text{ kg} (V_f - 6)$$

$$(-1.03 \text{ kg s N m})(t) = \frac{2}{5} (7 \text{ kg}) (.15 \text{ m})^2 \left(-\frac{V_f}{.15 \text{ m}} - 0\right)$$

$$t = .4077 V_f$$

$$(-6.867) (.4077 V_f) = 7 V_f - 42$$

$$\boxed{V_f = 4.29 \text{ m/s}}$$

$$\boxed{t = 1.75 \text{ s}}$$