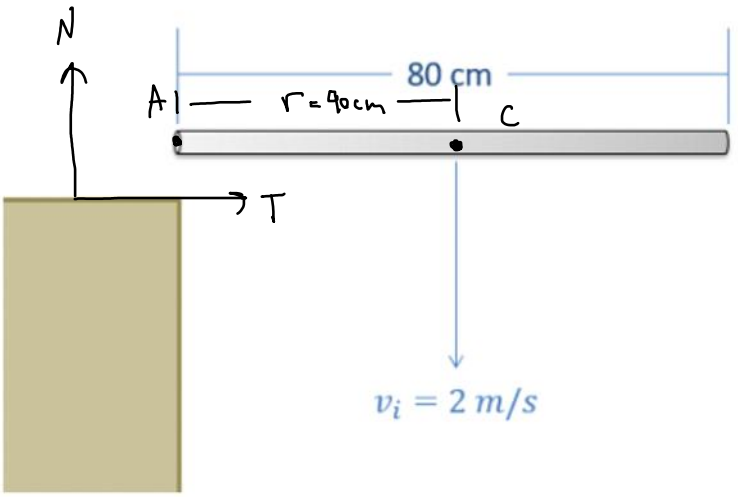
# Problem 1

An 80 centimeter long 1 kilogram metal bar falling at 2 meters per second strikes the edge of a table as shown below. Assuming a coefficient of restitution of .9, what is the expected velocity and angular velocity of the bar after impact?




$V_{CNi} = -2\ m/s$

$V_{CTi} = 0$

$\omega_i = 0$

$$V_{TCf} = V_{TCi} = 0$$

$$e = .9 = -\frac{V_{ANf}}{V_{ANi}} \quad V_{ANi} \leftarrow -2\ m/s$$

$$V_{ANF} = 1.8\ m/s = V_{CNF} - r\,\omega_f \quad (r = .4\ m)$$

$$1.8 = V_{CNf} - .4\,\omega_f$$

$$e^2 = \frac{KE_f}{KE_I}$$

$$.81 = \frac{\frac{1}{2}mV_{CNf}^2 + \frac{1}{2}\left(\frac{1}{12}m(.8)^2\right)\omega_f^2}{\frac{1}{2}m(2)^2}$$

$$3.24 = V_{CNf}^2 + \frac{.64}{12}\omega_f^2$$

Use equation solver on this equation & earlier equation

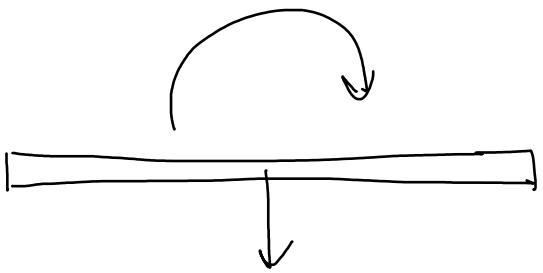
two solutions from equation solver

✓ $V_{CNf} = -.9$ & $\omega_f = -6.75$

✗ $V_{CNf} = 1.8$ & $\omega_f = 0$ ← would involve bar bouncing without rotation

After Impact

$\omega_f = 6.75 \text{ rad/s}$



$V_f = .9 \text{ m/s}$