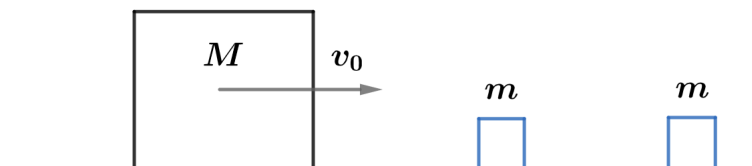# 2020B F=ma Exam: Problem 14

Kevin S. Huang

After n meters, the total mass of the object is

$$M_{tot} = M + nm$$

By conservation of momentum,

$$Mv_0 = (M + nm)v_f$$

$$v_f = \frac{Mv_0}{M + nm}$$

The distance traveled for v_f to become v_c is

$$M + nm = \frac{Mv_0}{v_c}$$

$$n = \frac{M}{m}\left(\frac{v_0}{v_c} - 1\right) = \frac{5\,\text{kg}}{1\,\text{kg}}\left(\frac{10\,\text{m/s}}{3\,\text{m/s}} - 1\right) = 12\,\text{m}$$

so the answer is $\boxed{\text{C}}$.