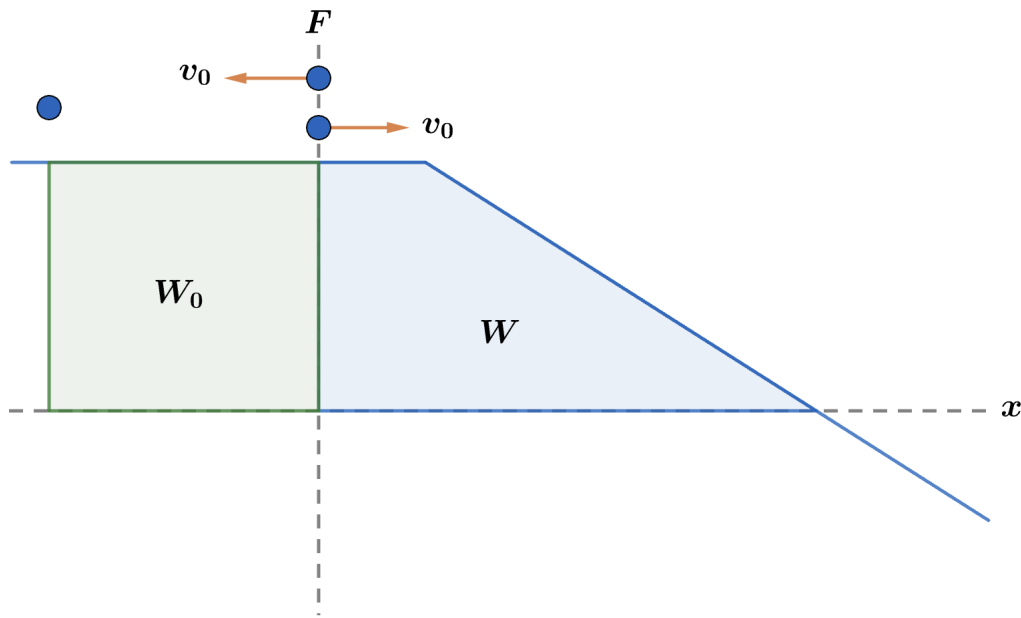


2012 F=ma Exam: Problem 13

Kevin S. Huang

The cart initially starts with speed v_0 in the negative direction under the influence of a positive force, so negative work $-W_0$ is done on it until it comes to rest. Then the cart reverses direction and has positive work W_0 done on it when it returns to the starting point. No net work is done so the cart has the same starting speed v_0 in the positive direction.



The maximum speed of the cart is obtained when the maximum positive work is done on it. Since work done is given by the signed area in a F - x plot, we see from the graph that this occurs at $x = 6$ m with $W = 17.5$ J. By the work energy theorem,

$$\frac{1}{2}mv_f^2 = W + \frac{1}{2}mv_0^2$$

$$v_f = \sqrt{\frac{2W}{m} + v_0^2} = \sqrt{\frac{2(17.5 \text{ J})}{4 \text{ kg}} + (3 \text{ m/s})^2} = 4.2 \text{ m/s}$$

so the answer is .