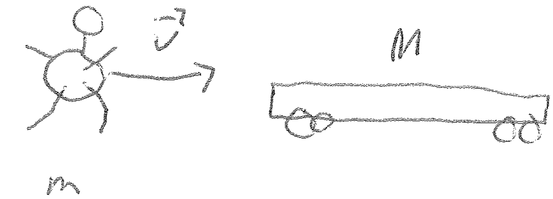
9-106 $M_{flatcar} = 2140\,kg$

$m_{sumo} = 242\,kg$

$\vec{v} = 5.3\,m/s$



a) Conserve momentum: (if he jumps up + stops)

$$m\vec{v} + M(0\,m/s) = (m+M)\vec{v}_f$$

$$\text{so } \vec{v}_f = \frac{m\vec{v}}{m+M} = \frac{(242\,kg)(5.3\,m/s)}{(2140+242)\,kg} = 0.54\,m/s$$

b) if he's running on it still (ie, hops up like Mario but keeps running rather than stopping; his $(v_f)_{sumo} = 5.3\,m/s$

$$m\vec{v} + M(0\,m/s) = (m\vec{v}_f)_{sumo} + (M\vec{v}_f)_{car}$$

$$m(5.3) + 0 = m(5.3) + M v_{f\,car}$$

$0 = (v_f)_{car}$ – train car stays still!

c) What if he not only stops, but turns around and runs the other way?

$$m\vec{v} + M(0\,m/s) = -m\vec{v} + (M+m)\vec{v}_f$$

$$2m\vec{v} = (M+m)v_f$$

$$v_f = 2\cdot\frac{(242\,kg)(5.3\,m/s)}{(2140+242)\,kg} = 1.1\,m/s$$

Note: This is with new $\vec{v}$ compared to ground.
if new v is compared to train, it's a lot harder (as discussed in class)