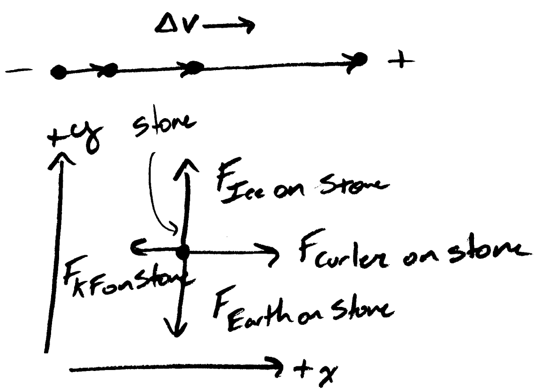
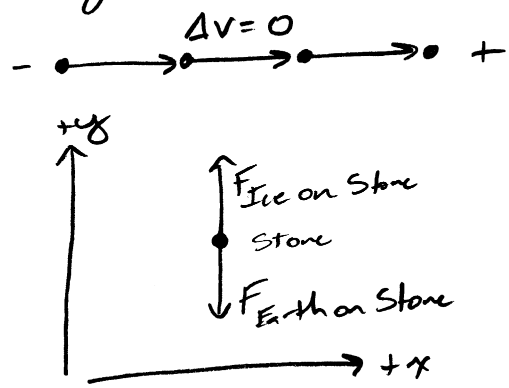
PROBLEM 1

a) Part 1 - Speeding up, friction (kinetic)



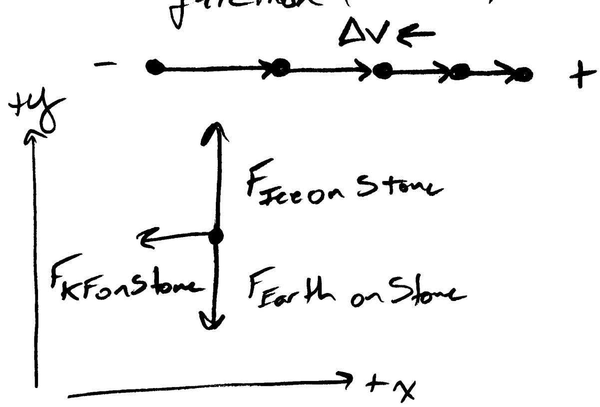
Part 2 - Constant speed no friction (smooth ice)



b) Consistent means that the ΔV is in the same direction as the unbalanced force exerted on the object.

Yes, my diagrams are consistent.

Part 3 - Slowing down friction (kinetic)



c) $a_x = \frac{\sum F_x}{m}$

$F_{KF\ on\ S} = \mu_K \bar{N}$

$\bar{N} = F_{Ice\ on\ Stone} = -F_{Earth\ on\ Stone}$

$\bar{N} = -(28\,kg)(-9.8\,\frac{m}{s^2})$

$F_{KF\ on\ S} = (0.11)(274.4\,N)$ ← $\boxed{\bar{N} = 274.4\,N}$

$F_{KF\ on\ S} = -30.184\,N$

↑ add negative because $F_{KF\ on\ S}$ is pointing negatively.

$a_x = \frac{F_{KF\ on\ S}}{m}$

$a_x = \frac{-30.184\,N}{28\,kg} = \boxed{-1.08\,\frac{m}{s^2}}$

$a_x = -1.08\,\frac{m}{s^2} = \frac{\Delta V}{\Delta t}$

$\Rightarrow -1.08\,\frac{m}{s^2} = \frac{0 - V_i}{4\,s}$

$\boxed{V_i = 4.312\ m/s}$

Problem 2

$$\frac{6.0\,m/s}{1.5\,s} = \frac{F_{cable\ on\ elevator} + \cancel{1000N}}{1000kg}$$ → $F_{Earth\ on\ elevator} = mg$ ↳ $(1000kg)(-9.8\frac{m}{s^2})$

Corrected!

$$\frac{6.0\,m/s}{1.5\,s} = \frac{F_{cable\ on\ elevator} + (1000N)(-9.8\frac{m}{s^2})}{1000\,kg}$$

$$(1000kg)\,4\,\frac{m}{s^2} = F_{cable\ on\ elevator} + -9800N$$

$$F_{cable\ on\ elevator} = 4000N + 9800N$$

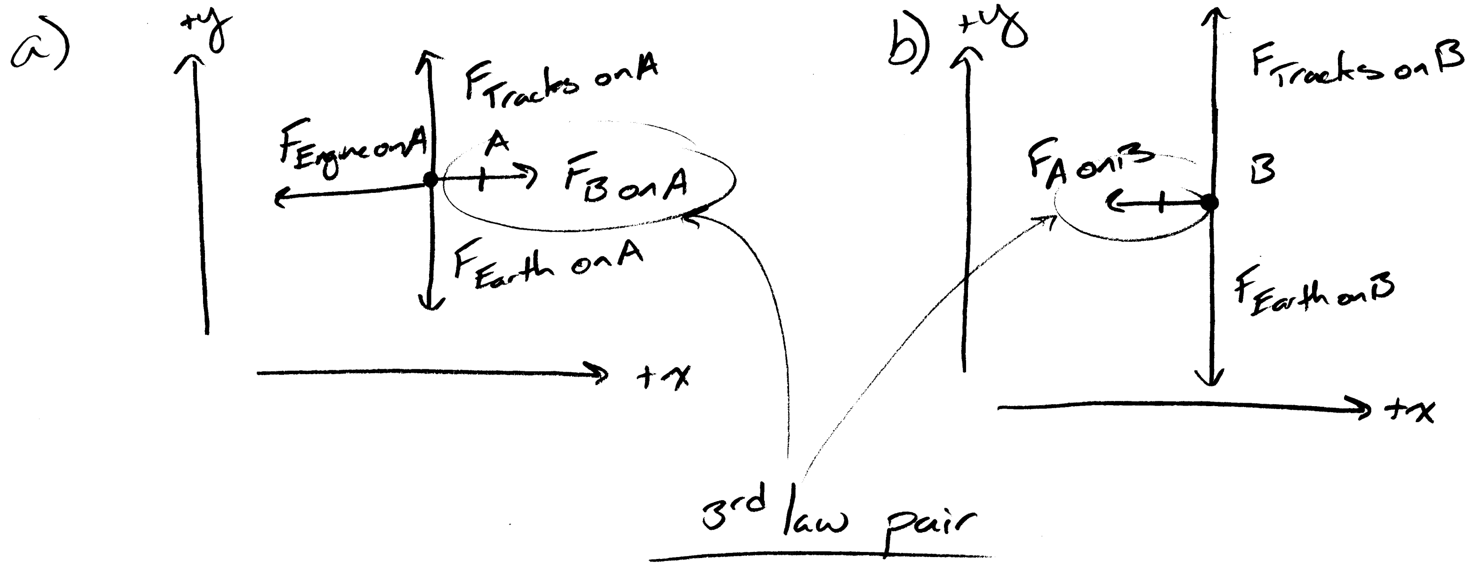
$$\boxed{F_{cable\ on\ elevator} = 13800N}$$

My friend mistook $F_{Earth\ on\ elevator}$ to be the same as mass, you need to multiply mass by $-9.8\frac{N}{kg}$ $(\frac{m}{s^2})$ to find the correct $F_{Earth\ on\ elevator}$!

PROBLEM 3

Accelerating in the negative direction, $\Delta v \leftarrow$

a) b)



c) Find $F_{A\,on\,B}$ first since you need $F_{B\,on\,A}$

$$a_{carB,x} = \frac{\Sigma F_x}{m_B} \Rightarrow a_{carB,x} = \frac{F_{A\,on\,B}}{m_B} \Rightarrow F_{A\,on\,B} = a_{carB}\, m_B$$

$$F_{A\,on\,B} = (-0.5\,m/s^2)(15000\,kg) = -7500\,N$$

↳ By Newton's 3rd $F_{B\,on\,A} = +7500\,N$

$$a_{carA,x} = \frac{\Sigma F}{m_A} \Rightarrow a_{carA,x} = \frac{F_{Engine\,on\,A} + F_{B\,on\,A}}{m_A}$$

$$F_{Engine\,on\,A} = a_{carA,x}\, m_A - F_{B\,on\,A}$$

$$= (-0.5\,\tfrac{m}{s^2})(10000\,kg) - 7500\,N$$

$$\boxed{F_{Engine\,on\,A} = -12500\,N}$$

d) Your friend is in a non-inertial reference frame, he can't explain what's going on, you must be outside the train to understand!