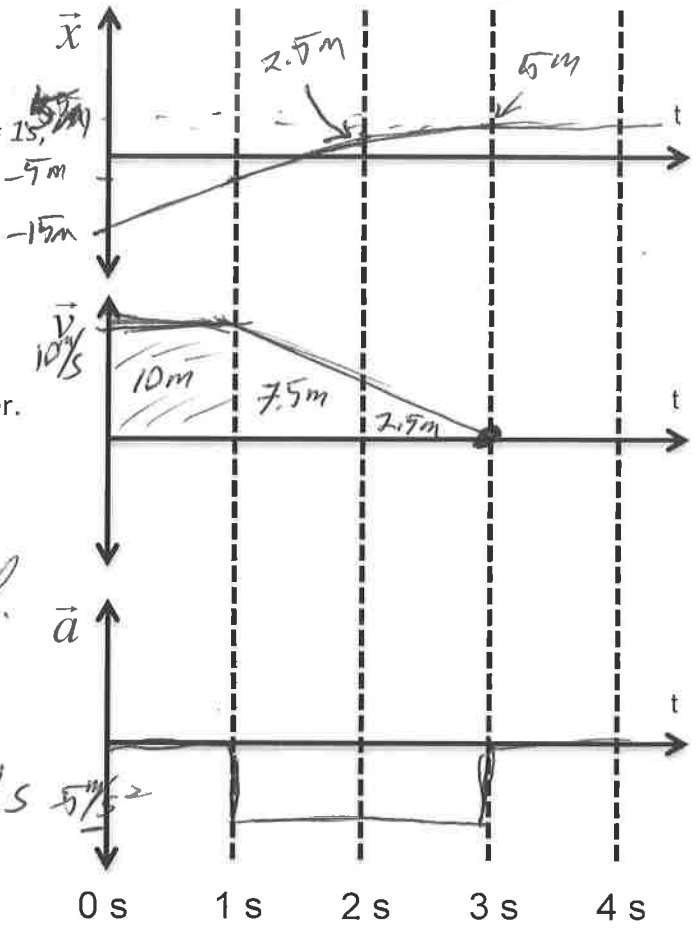
Pete

Big Exam #1 Use both sides. Put your name at the end

#1: My mass is *70 kg*, and the mass of my bike is *10 kg*. I'm riding my bike at a speed of *10 m/s* on flat ground. At *t = 0s*, my position is *x = -15 m*, then I see a car. At *t = 1s*, I apply my breaks, and <u>smoothly</u> slow to a stop over a period of two seconds.

a) Please graph my acceleration, velocity, and displacement as a function of time. Label the axes correctly. *Then* please also find:
b) The force exerted by my breaks;
c) the work done by my breaks and the average power.
d) Was energy conserved in this process? How?
e) Was momentum conserved in this process? How?



a) Kinematics because I have motion as an explicit funct. of time. make a drawing (below)

$x_0 = -15m$ $V_0 = 10 m/s$ $t = 0$

$t = 0.9s$ $a = 0$ $V = 10 m/s$ ⇒

$t = 1.1s$ $5 m/s^2$ ⇐ a

$V < 10 m/s$

$V_{f_0} = 0$ $t = 3s$

I slow down

$m = 80 kg$ to bi

$t = 1s$ ⇐ a

$$a = \frac{\Delta V}{\Delta t} = \frac{-10 m/s}{2s} = -5 m/s^2$$

b) Dynamics because there's a force causing $\vec{a}$ ⇐

$$\Sigma \vec{F} = m\vec{a} = 80kg \cdot 5 m/s^2 = 400N$$

c) Energy loss because $W = \Delta E = -\frac{1}{2} m v_0^2 = -4000J$

$$P = \frac{\Delta E}{\Delta t} = \frac{-4000J}{2s} = -2000W$$

d) yes. energy was conserved but changed form from Kinetic to thermal energy ~~(Bere~~ Breaks get hot.

e) Yes! $\vec{p}$ was conserved. The Force slowing me was between my bike + the earth. my $\vec{p}$ was transfered to the earth, However, the earth is very large, big mass, so we don't notice the change in the earth's velocity.

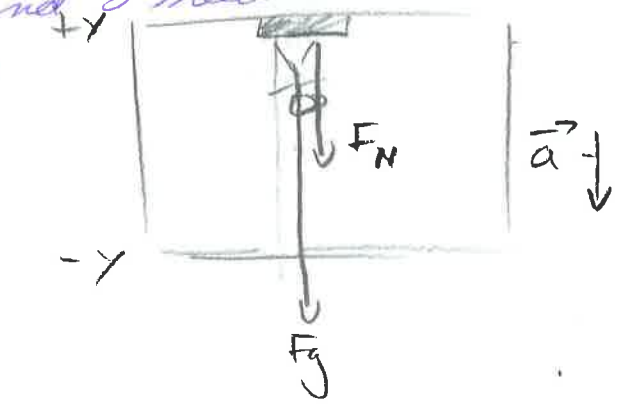
#2. On your trip to Dubai, you visit the tallest building in the world and select the "extreme" elevator. Near the end of the assent, you find yourself standing on the ceiling of the elevator, upside down, on your scale, which reads 100 N. This is surprising to you because your mass is 50 kg.

D⁴/A

a) What does the scale usually read when you stand on it?
b) What is your acceleration at this moment standing on the ceiling of the elevator?

a.) Dynamics: ~~F = ma~~ why? because there are forces and I need acceleration

$F = 50\,kg \cdot 10\,m/s^2 = 500\,N$ ✓



b.) Dynamics: $\Sigma \vec{F} = m\vec{a}$

$\Sigma \vec{F} = m\vec{a} = -F_g - F_N$

$\vec{a} = -10\,m/s^2 - 2\,m/s^2$

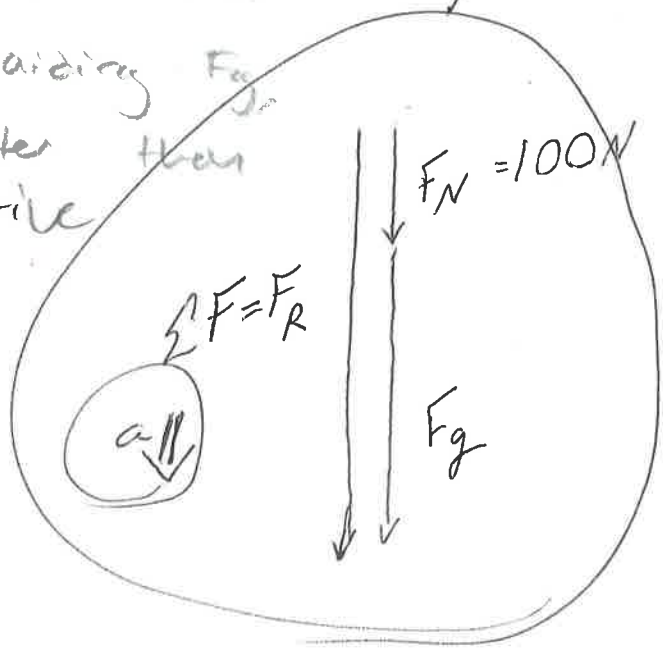
$\vec{a} = -12\,m/s^2$ ✓

$F_N = 50kg \cdot a = 100\,N$

$a = 2\,m/s^2$

show vectors addition

Even though the elevator is traveling in a positive direction, the acceleration is negative. Since I'm on the ceiling, F_N is aiding F_g so $\vec{a}$ must be greater than $10\,m/s^2$ in the negative direction. Yes!



Name William McTaggart