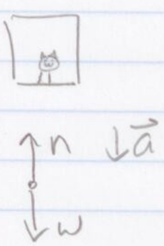
Ch 5 HW

MC 24, P: 74, 77, 78

MC 24 A 5.0 kg dog sits on the floor of an elevator that is accelerating downward at $1.20\,m/s^2$

a. What is the magnitude of the normal force of the elevator floor on the dog?



$m = 5.0\,kg$

$a = 1.20\,m/s^2$

$\Sigma F = n - w = -ma$

$n = w - ma$

$= m(g - a)$

$= 5.0\,kg\,(9.8\,m/s^2 - 1.2\,m/s^2)$

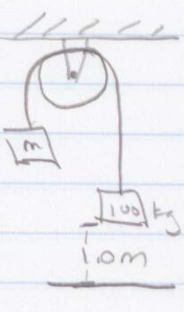
$= \boxed{43\,N}$

b. What is the magnitude of the force of the dog on the elevator?

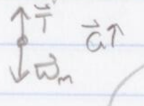
Force elevator on dog = - Force dog on elevator

$= \boxed{43\,N}$

7. The 100 kg block takes 6.0 s to reach the floor after being released from rest. What is the mass of the block on the left?



FBd for "m"

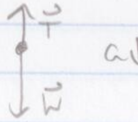


$\Sigma F = T - w_m = ma$

$\Sigma F = T - w_M = -Ma$

$T = w_M - Ma$

FBd for 100 kg



$w_M - Ma - w_m = ma$

$w_M - Ma = mg + ma$

$\frac{w_M - Ma}{(g + a)} = m$

$\frac{100\,kg\,9.8 - 100\,kg\,0.056\,m/s^2}{(9.8 + 0.056)} = m = \boxed{99\,kg}$

$y = \frac{1}{2}at^2$

$1\,m = \frac{1}{2}a(6.0\,s)^2$

$\therefore a = 0.056\,m/s^2$

77. In problems 77 & 78 you are given the dynamics equations that are used to solve a problem. For each of these you are to
a. write a realistic problem for which these are the correct equations.
b. Draw the free body diagram and the pictoral representation of your problem.
c. Finish the solution to the problem

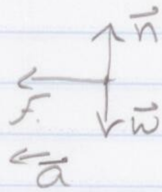
77. $-0.80n = (1500\,kg)a_x$

$n - (1500\,kg)(9.8\,m/s^2) = 0$

I prefer to put in the variables for each # so I can see the equation.

$-\mu n = ma_x$

$n - mg = 0$



Now I see there's a friction in the −x direction so a_x must also be in the − direction.
In the y there's normal & weight so it's a flat horizontal surface.

A range of scenarios fit those equations. A car being accelerated by friction. Could be it's being sped up to the left or slowed down when it's traveling to the right. Because "the mass is 1500 kg", I'm going to stick w/ the car idea

weight $\vec{w}$
static friction f_s
normal $\vec{n}$

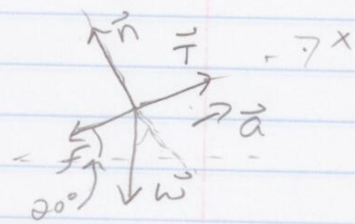
$n = 1500 \cdot 9.8 = 14{,}700\,N$

$-.8 \cdot 14{,}700\,N = 1500\,a_x$

$a_x = 7.84\,m/s^2$

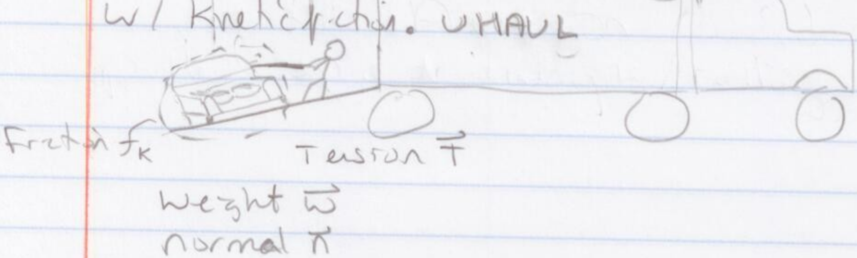
78. $T - 0.2n - (20kg)(9.8^{m}/s^2)\sin 20° = 20kg(2.0^{m}/s^2)$
$n - (20kg)(9.8^{m}/s^2)\cos 20° = 0$

Again I'll put in the variables so I can see what I have.



$T - \mu n - mg\sin 20° = ma$
$n - mg\cos 20° = 0$

This must be on a slope since the coordinate system was rotated and gravity was broken into components.
There's a tension and friction along the slope. The mass is relatively small (~44 lbs)
A loveseat could be being pulled up a ramp w/ Kinetic friction.



$n = 20kg\ 9.8^{m}/s^2 \cos 20° = 184N$

$T = 0.2(184N) + (20kg)(9.8^{m}/s^2)\sin 20° + 20kg\ 2.0^{m}/s^2$
$= 36.8N + 67N + 40N$
$= \boxed{144N}$