QUIZ 9, PHY 191 B, Blue, Monday, Nov 14, 2016 (20 pts)

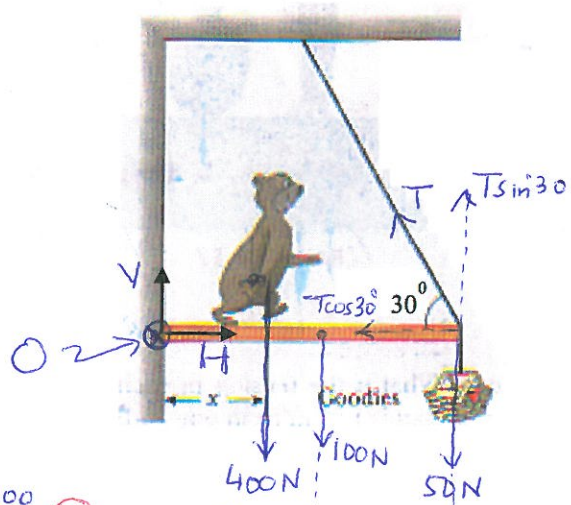
[see both sides of sheet!]

SHOW WORK CLEARLY OTHERWISE ZERO CREDIT!!

Question 1:

i) A hungry 400*N* baby bear walks out on a hinged beam in an attempt to retrieve some "goodies" hanging at the end, as shown below. The beam is uniform, weighs 100*N*, and is 4m long; the goodies weigh 50*N*. The horizontal and vertical components of the reaction force at the hinge are indicated as *H* and *V* in the figure. If the maximum tension the rope can withstand before breaking is 400*N*, the maximum distance *x* the bear can walk before the wire breaks is (9pts)

a) 2.0 m b) 1.7 m
c) 1.5 m d) 1.3 m e) 1.0 m



$\tau_{net\ about\ O} = 0$ (1)

$(-400x) + (-100 \times 2) + (-50 \times 4) + (T\sin 30 \times 4) = 0$ (2) (2) (2) (2)

$\Rightarrow x = \dfrac{400\sin 30\,(4) - 200 - 200}{400} = 1\ m$ (1)

RED: 1.5 m
GREEN: 0.6 m

SORRY FOR TYPOS IN MULTIPLE CHOICE ANSWERS PROVIDED!

ii) Determine the value of *H* at this maximum tension. (3pts)

$F_{net_x} = 0$ (1)

$\Rightarrow H - T\cos 30 = 0 \Rightarrow H = 400\cos 30 = 346\ N$ (2)

GREEN: 346 N RED: 433 N

iii) Determine the value of *V* at this maximum tension. (3pts)

$F_{net_y} = 0$ (1)

$\Rightarrow V + T\sin 30 - 400 - 100 - 50 = 0$

$\Rightarrow V = 550 - 400\sin 30 = 350\ N$ (2)

GREEN: 670 N RED: 510 N

Question 2: A particle located at $\vec{r} = (3\hat{i} + 5\hat{j})$ m experiences a force $\vec{F} = -7\hat{i}$ N. What is the torque (magnitude and direction) on the particle about the origin? (5pts)

$\vec{\tau} = \vec{r} \times \vec{F}$ (1)

$= (3\hat{i} + 5\hat{j}) \times (-7\hat{i})$ Nm

$= (-3\hat{i} \times 7\hat{i}) + (5(-7)\,\hat{j} \times \hat{i})$

b/c $\hat{i} \times \hat{i} = 0$ (1) (2)

$= -35(-\hat{k}) = 35\hat{k}$ (1)

GREEN: $-44\hat{k}$ RED: $15\hat{k}$