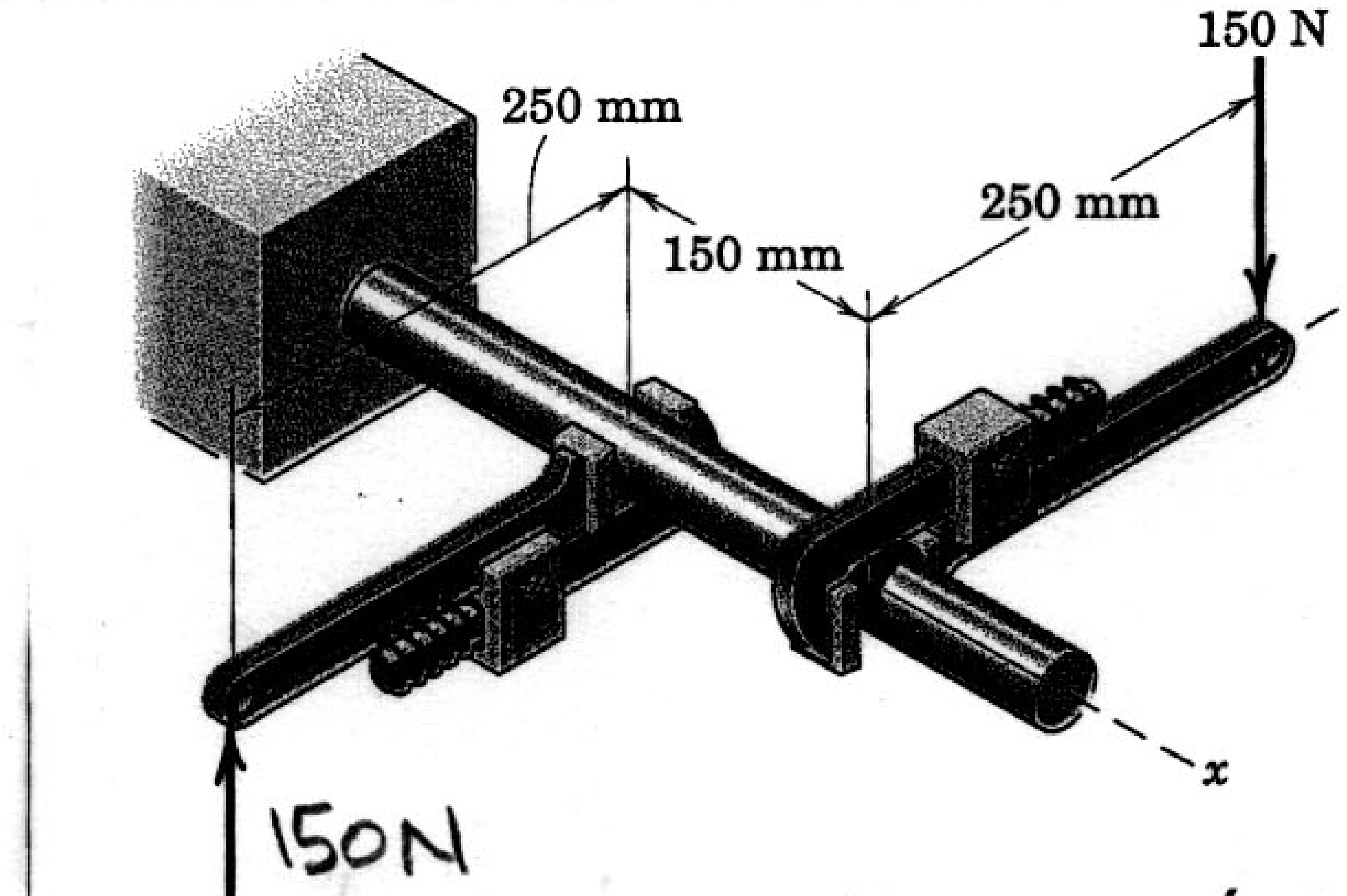
2/113
p. 75

HW #1
ENGR 202
DUE 9/~~8~~ 10/02
JOE BURNS



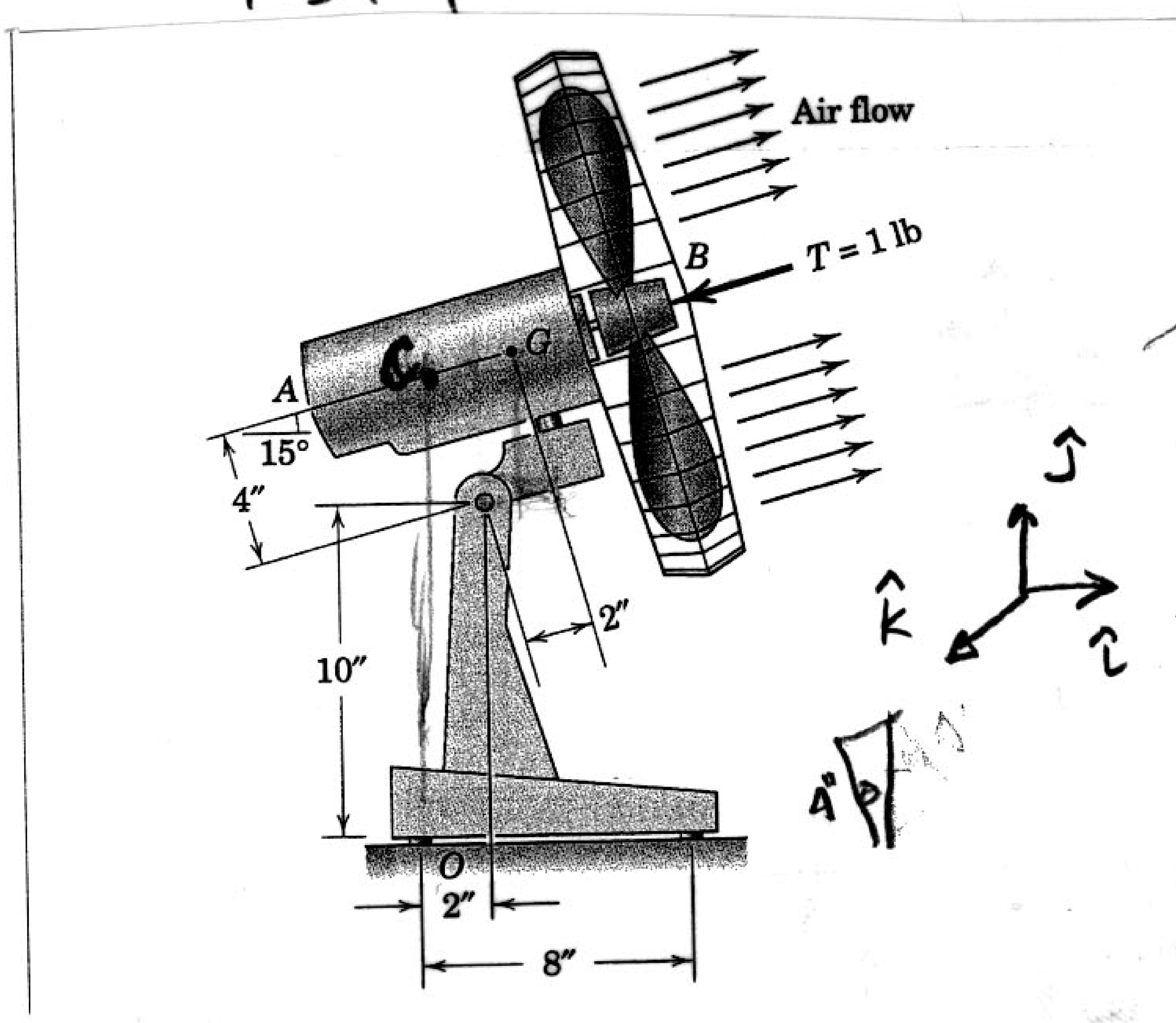
Since the two forces ($\underline{F} = \pm 150N\hat{k}$) are equal & opposite, they form a couple. The value of any couple is independent of the point about which it is measured. So we can compute the equivalent couple by taking the moment of one force around the point of application of the other force.

$$\underline{M} = \underline{r} \times \underline{F} = \left[(250+250)\hat{j} + 150\,\hat{i}\right] \times (-150\,\hat{k}) \text{ N-mm}$$

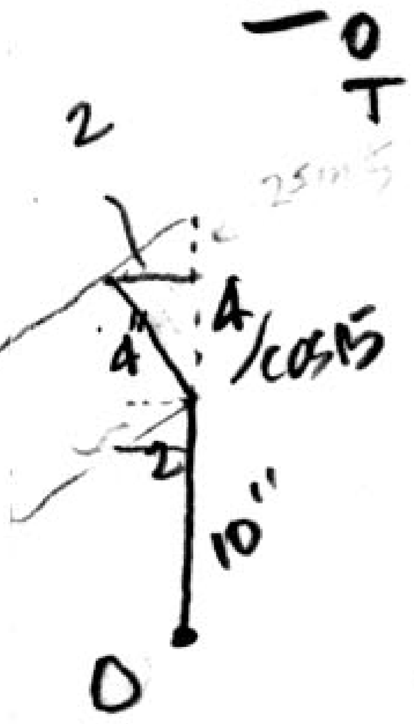
$$= -(.15\hat{i} + .5\hat{j})\text{m} \times 150\text{N}\,\hat{k} = \boxed{(-75\,\hat{i} + 22.5\,\hat{j})\text{ N-m}}$$

2/153
p. 97

To compute moments, we take $\underline{M}_o = \underline{r} \times \underline{F}$



$$\underline{M}_{O_T} = \underline{r}_{B/o} \times \underline{T} = (\underline{r}_{c/o} + \underline{r}_{B/c}) \times \underline{T}$$



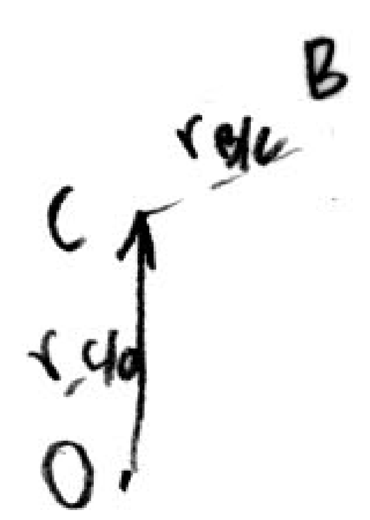
$$= r_{c/o}\hat{j} \times \underline{T} \quad \text{since } \underline{r}_{B/c} \parallel \underline{T}$$

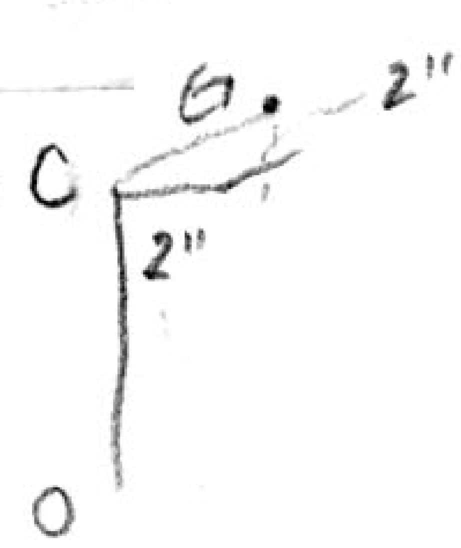
$$\therefore \underline{r}_{B/c} \times \underline{T} = 0$$

$$= \left(10 + \frac{4}{\cos 15} - \frac{2\sin 15}{\cos 15}\right)\hat{j} \times 1^{\#}(-\sin 15\,\hat{j} - \cos 15\,\hat{i})$$

$$= +(13.60)\cos 15\,\hat{k} = \boxed{13.14\,\hat{k} \text{ in-lb.}}$$

$$\underline{M}_{OW} = \underline{r}_{G/o} \times \underline{W} = \left[r_g\hat{j} + (2 - (4\sin 15 + 2\cos 15))\hat{i}\right] \times (-mg)\hat{j}$$





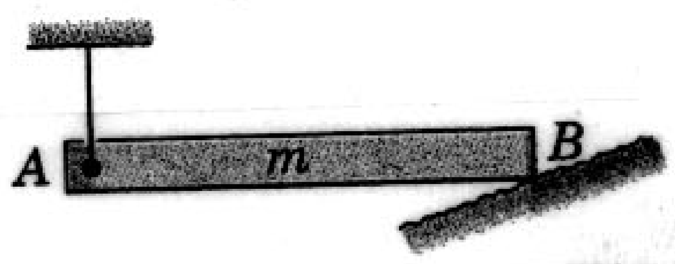
$$= -9(2.90)\,\hat{k}$$

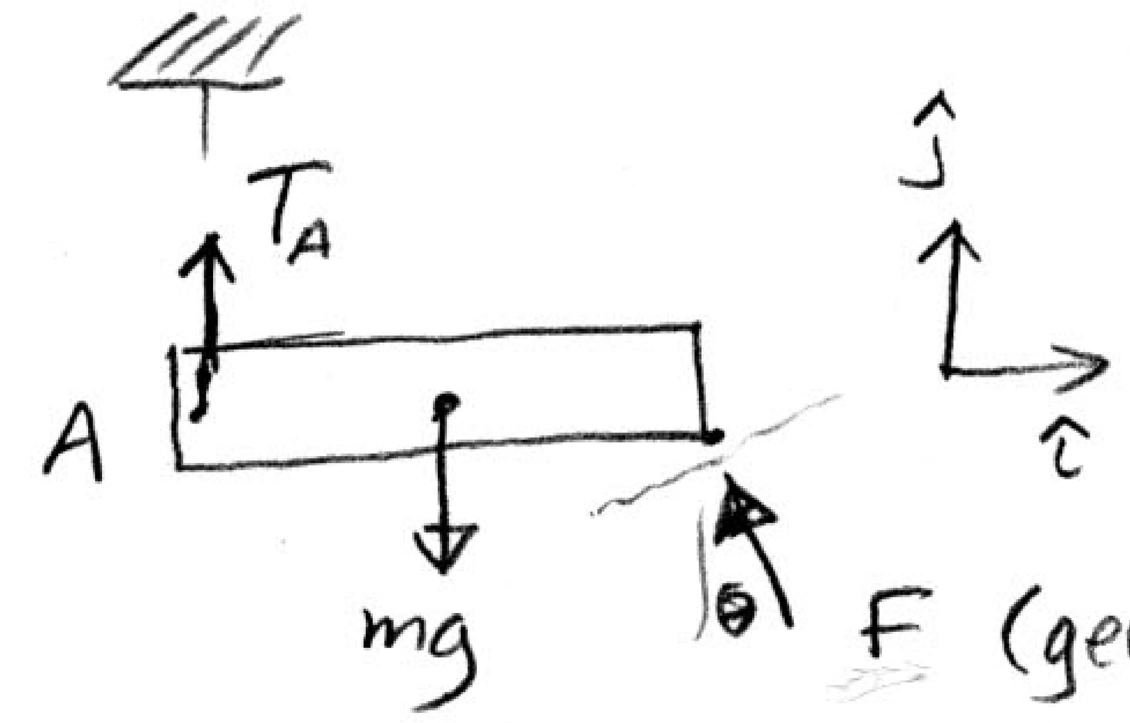
$$\boxed{\underline{M}_{OW} = -26.1\,\hat{k} \text{ in-\#}}$$

3C/p. 114

HW# X 1 cont'd
DUE 9/8/02
10
JOE BURNS
TAM 202

1. Uniform horizontal bar of mass *m* suspended by vertical cable at *A* and supported by rough inclined surface at *B*.





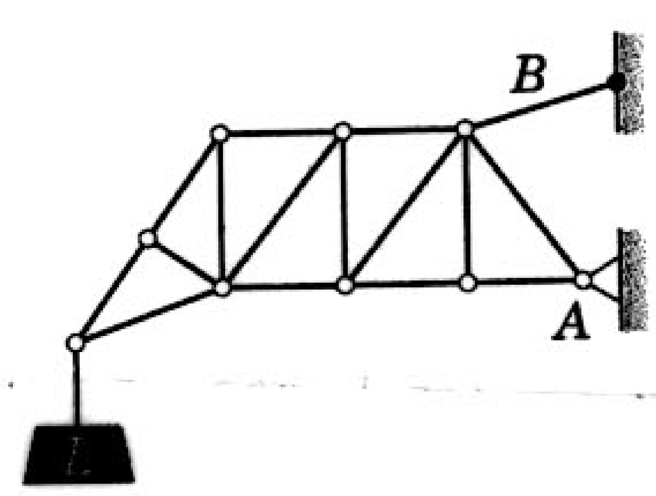
F (general direction)

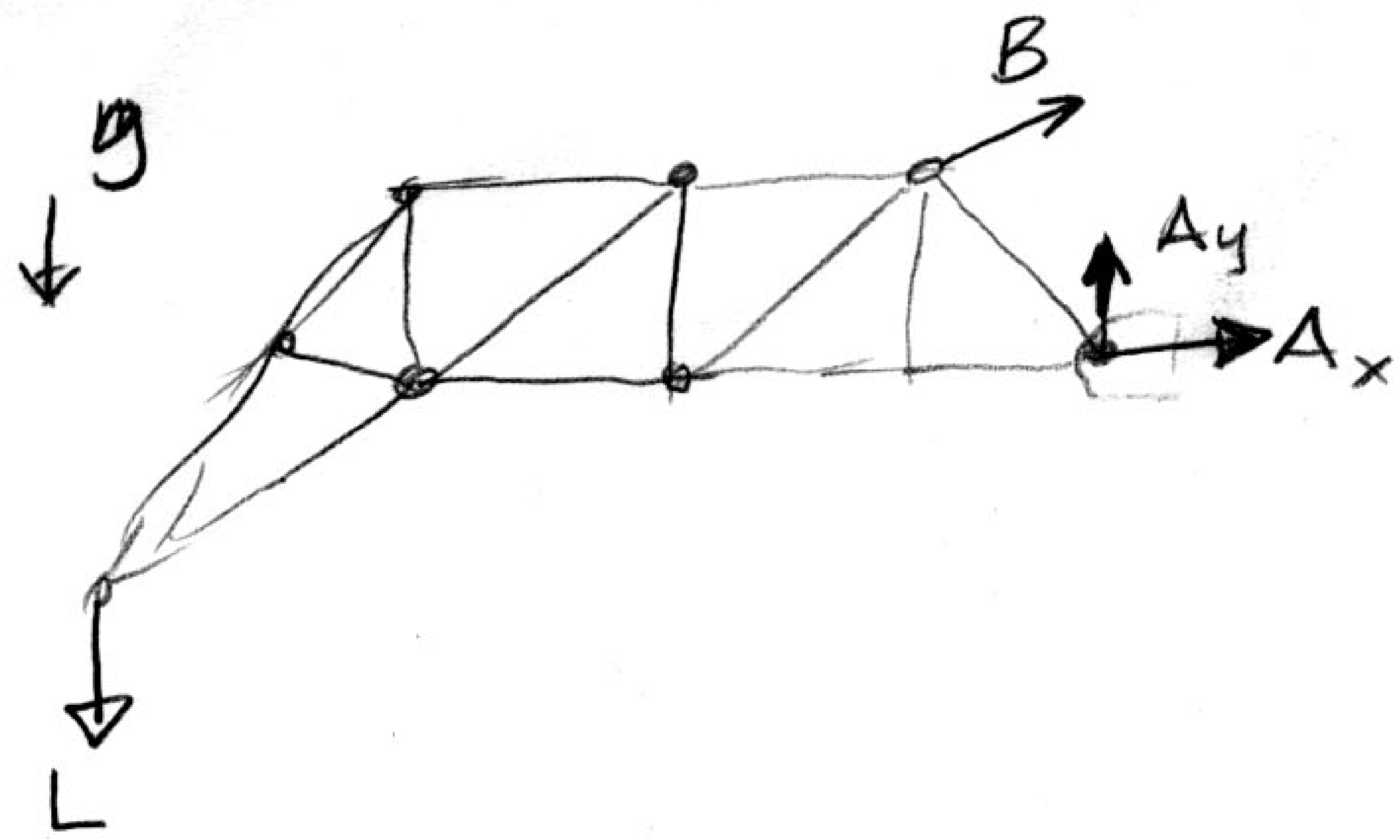
However, if write say system is in equilibrium

$\Sigma \underline{F} = 0 \Rightarrow \Sigma F_x = 0 \Rightarrow \underline{F}$ has no x component

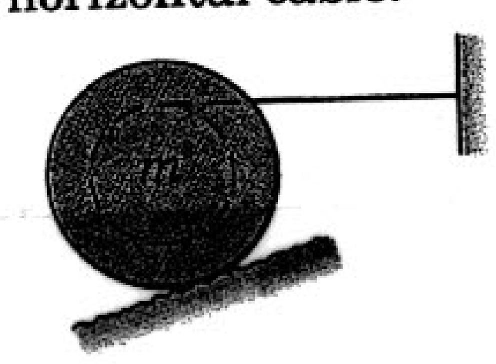
vertical only

3) Loaded truss supported by pin joint at *A* and by cable at *B*.



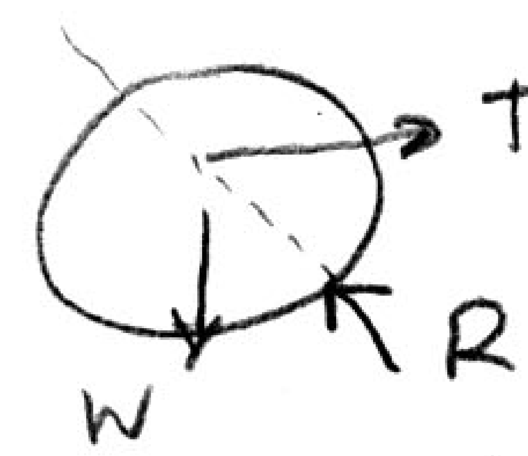


5. Uniform grooved wheel of mass *m* supported by a rough surface and by action of horizontal cable.



R (general direction)

but can argue that this is a 3-body member. Thus $\underline{T}$, $\underline{W}$ and $\underline{R}$ must be concurrent

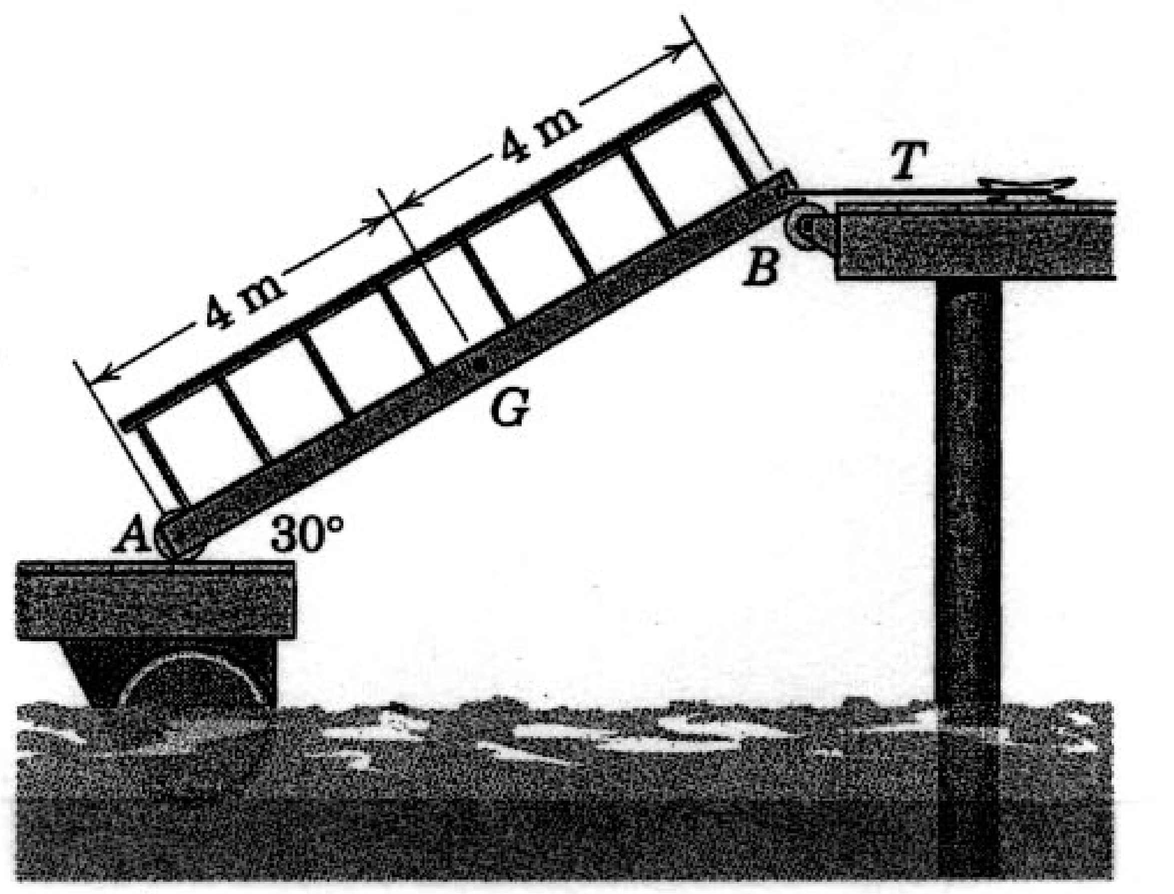


3/17
p.127

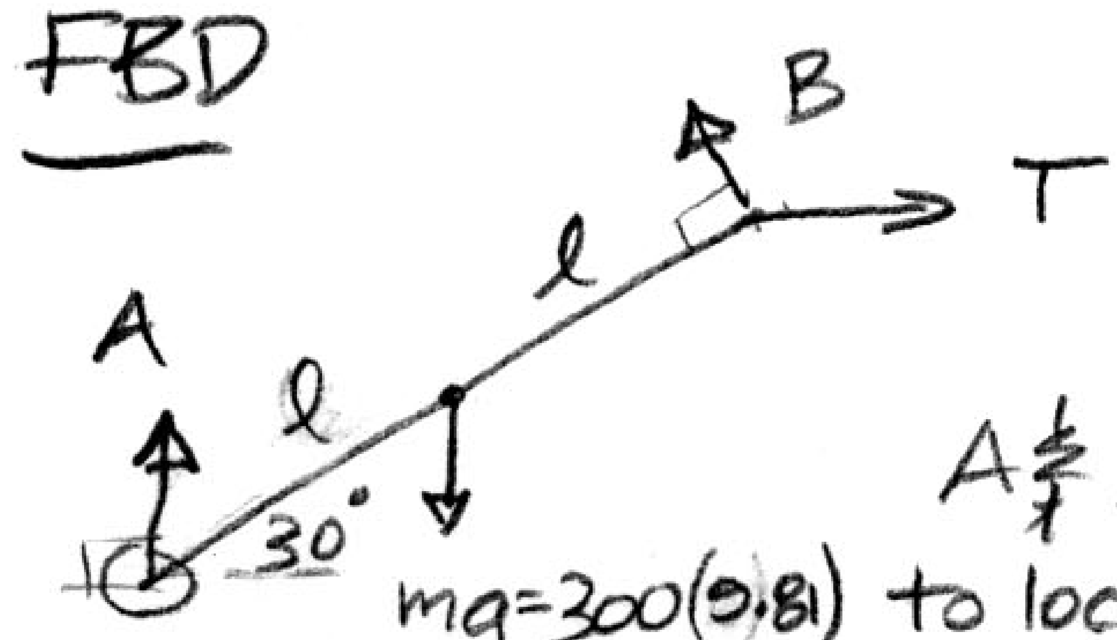
HW#2
ENGR 202
JOE BURNS
DUE 9/9/02

3/17 To accommodate the rise and fall of the tide, a walkway from a pier to a float is supported by two rollers as shown. If the mass center of the 300-kg walkway is at *G*, calculate the tension *T* in the horizontal cable which is attached to the cleat and find the force under the roller at *A*.

Ans. $T = 850$ N, $A = 1472$ N



FBD

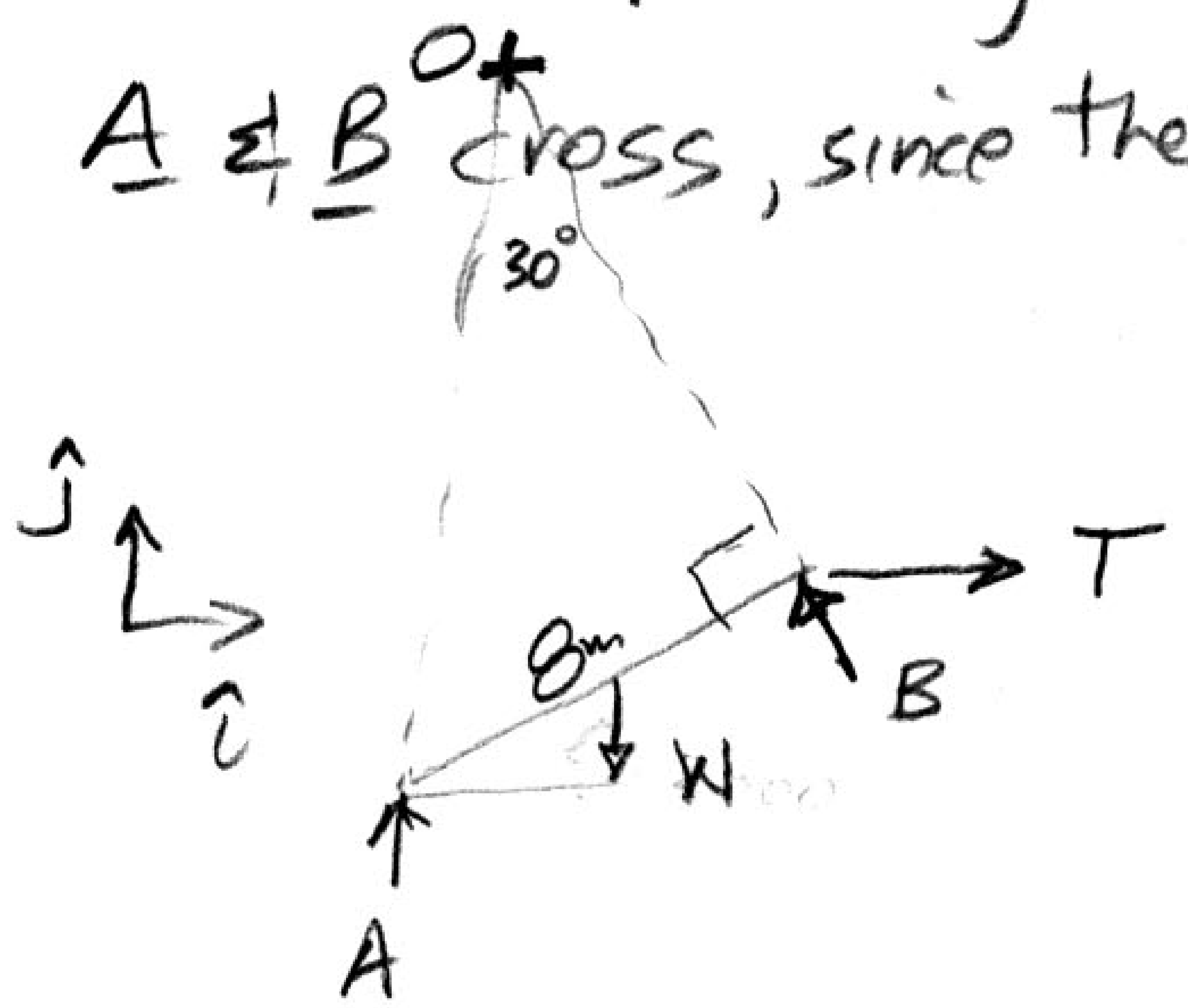


A & B are ⊥ to local flat

We don't know A, B or T but can solve for the 3 of them for this 2-D prob by $\Sigma \underline{F} = 0$, $\Sigma \underline{M} = 0$

We could solve systematically by finding $\Sigma M_B = 0$ to get A, compute B from $\Sigma F_y = 0$, and then use $\Sigma F_x = 0$ to evaluate T

However it is easier if we can write 1 eqn that contains only the unknown T. We'll get this if we sum moments about the point where $\underline{A}$ & $\underline{B}$ cross, since their moments there are zero



$$\Sigma \underline{M}_O = 0$$

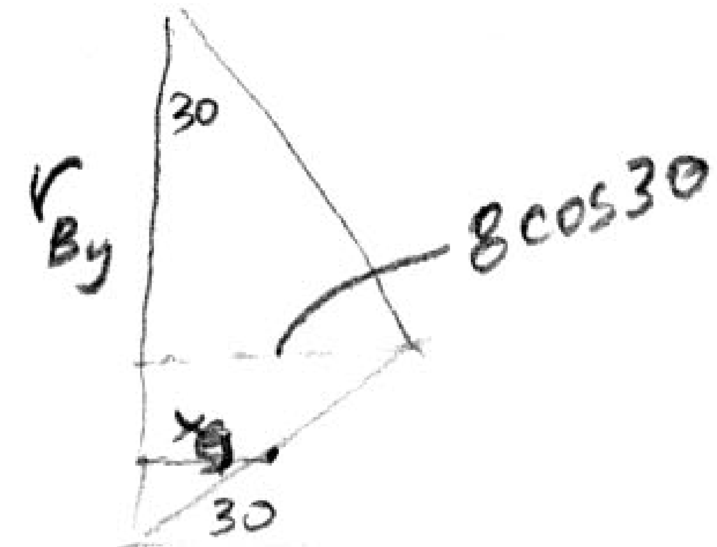
$$= \underline{r}_G \times (-mg\hat{j}) + \underline{r}_{B/O} \times T\hat{i}$$

$$= -x_G \hat{i} \times mg\hat{j} + (-r_{By})\hat{j} \times T\hat{i}$$

(y position of B)

where we've ignored $\hat{i} \times \hat{i}$ & $\hat{j} \times \hat{j}$ terms

$$0 = -x_G mg + r_{By} T$$



$$\therefore T = mg\left(\frac{x}{r_{By}}\right) = 300(9.81)\,\frac{4\cos 30}{8\cos 30/\tan 30}\ \text{N}$$

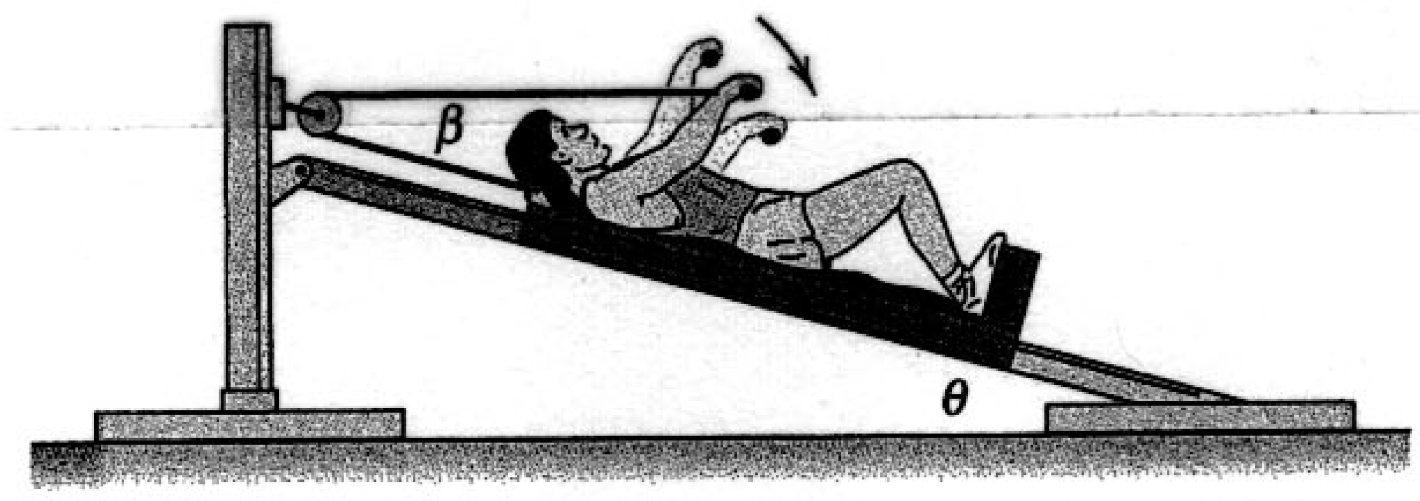
$$= 150(9.81)\tan 30\,\text{N} = \boxed{850\,\text{N} = T}$$

FORGOT THIS!

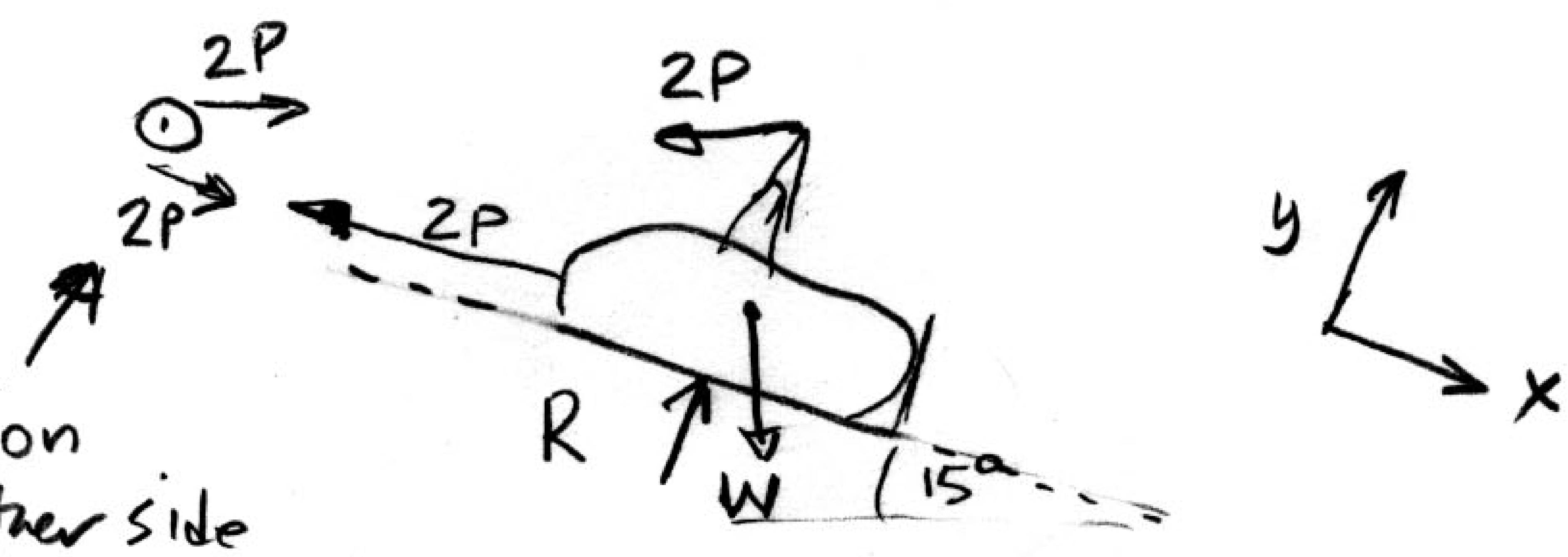
$$\Sigma M_B = 0 = -A(8\cos 30) + W(4\cos\theta) \Rightarrow A = W/2 = \frac{300(9.81)}{2}\text{N} \doteq \boxed{1472\,\text{N} = A}$$

3/33
p. 131

HW #2 - ENGR 202
JOE BURNS
DUE 9/9/02



Problem 3/33



Tension on either side of frictionless pulley is same by $\Sigma M = 0$

Our FBD shows only external forces (contacts with cables & bottom of cart + gravity)

We write $\Sigma \underline{F} = 0$ in tilted xy system as shown

$$\Sigma F_x = 0 = W \sin 15 - 2P - 2P\cos 18 \Rightarrow P = \frac{W \sin 15}{2 + 2\cos 18} = \frac{70(9.81)\sin 15}{2(1+\cos 18)}$$

$$\boxed{P = 45.5\,\text{N}}$$

$$\Sigma F_y = 0 = R - W\cos 15 - 2P\sin 18 \Rightarrow R = [70(9.81)\cos 15 + 2(45.5)\sin 18] \text{ N}$$

$$\boxed{R = 691\,\text{N}}$$