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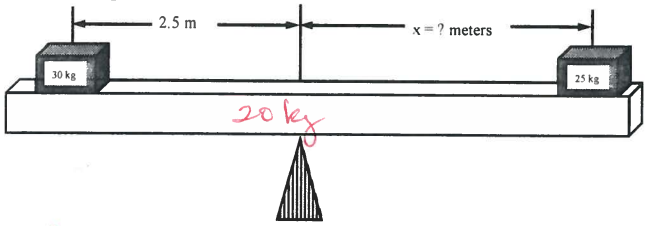
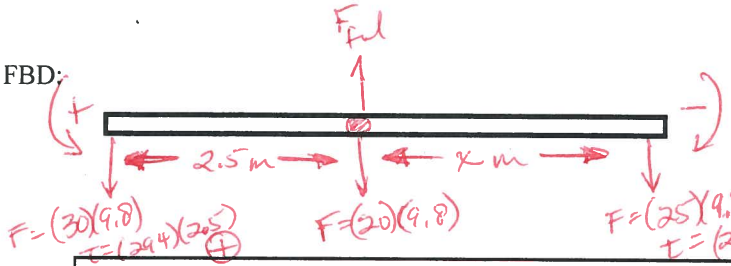
Lab 9.1 HW questions

Per _____ Name _____

1. A 20 kg board serves as a seesaw for two children, as shown in the figure. One child has a mass of 30 kg and sits 2.5 m from the pivot point. a.) Calculate the force the fulcrum must provide. b.) At what distance, x, from the pivot must a 25 kg child place herself to balance the seesaw? Assume the board is centered over the pivot.



FBD:



ΣF_Y: $F_{ful} - (30)(9.8) - (20)(9.8) - (25)(9.8) = 0$

$F_{ful} = 735\ N$

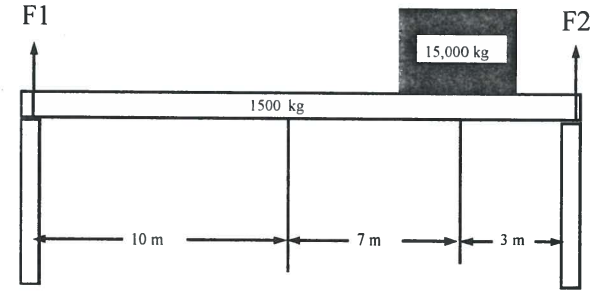
$\Sigma \tau$: $(294)(2.5) - (245)(x) = 0$

$x = \frac{(294)(2.5)}{245} = 3\ m$

$F = 735\ N$

$x = 3\ m$

2. A uniform 1500 kg beam, 20.0 m long, supports 15,000 kg of bricks. Calculate the force on each of the supports.



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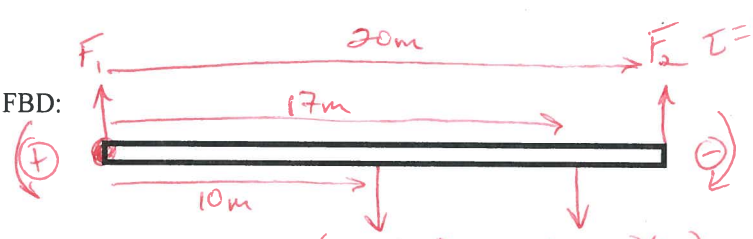


ΣF_Y: $F_1 + F_2 - 14{,}700 - 147{,}000 = 0$

$F_1 + 132{,}300 - 14{,}700 - 147{,}000 = 0$

$\Sigma \tau$: $20F_2 - (14700)(10) - (147{,}000)(17) = 0$

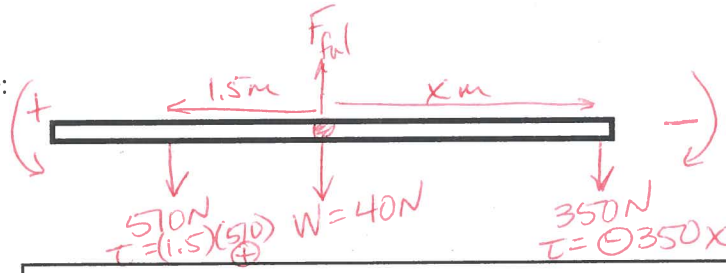
$F_2 = \frac{147000 + 2499000}{20} = 132{,}300\ N$

$F_1 = 29{,}400\ N$

$F_2 = 132{,}300\ N$

3. A uniform board with a weight of 40 N supports two children, one weighing 510 N and the other weighing 350 N. The support for the beam is directly under the beam's center of mass. The 510 N child is 1.5 meters from the center of the board. Where should the 350 N child sit to balance the board? How much force must the support exert on the board?

FBD:



ΣF_Y: $F_{ful} - 570 - 40 - 350 = 0$

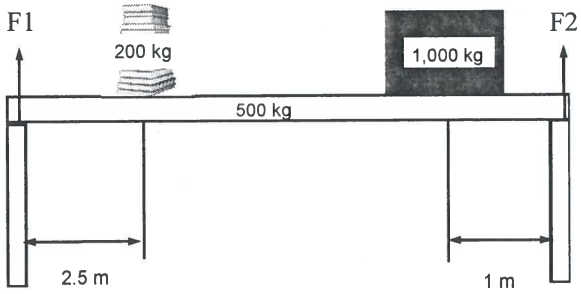
$F_{ful} = 900\,N$

$\Sigma \tau$: $(1.5)(510) - 350x = 0$

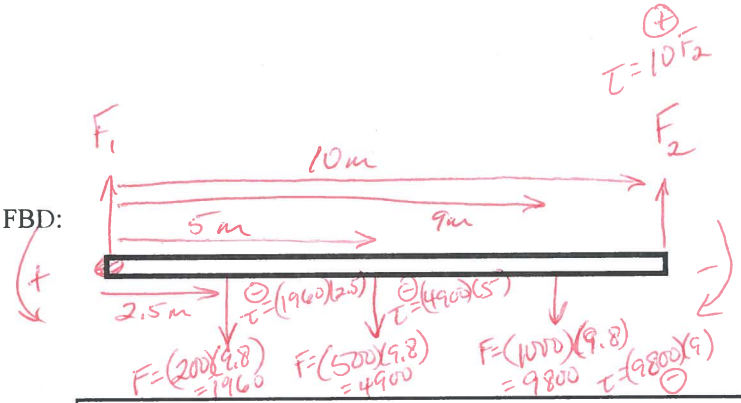
$\frac{350x}{350} = \frac{765}{350} = 2.19\,m$

900 N
2.19 m

4. A uniform 500 kg beam, 10.0 m long, supports 1,000 kg of bricks and a 200 kg stack of reference books about gazelles. Calculate the force on each of the supports.



FBD:



ΣF_Y: $F_1 + F_2 - 1960 - 4900 - 9800 = 0$

$F_1 = 1960 + 4900 + 9800 - F_2$

$\Sigma \tau$: $10F_2 - (1960)(2.5) - (4900)(5) - (9800)(9) = 0$

$F_2 = \frac{4,900 + 24500 + 88,200}{10} = 11,760\,N$

$F_1 =$	4,900 N
$F_2 =$	11,760 N