Extended Bodies at Rest - Page #1

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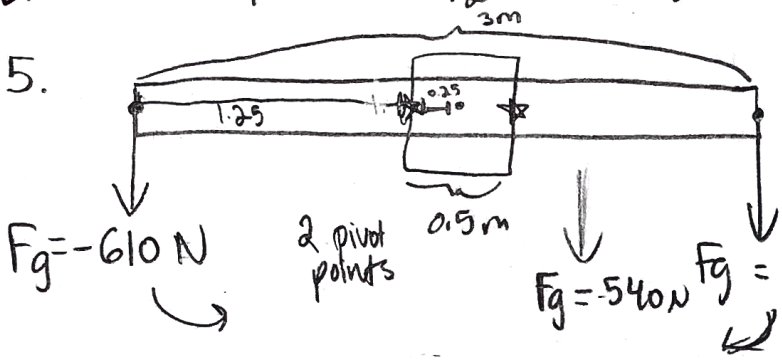
12. You tilt your body forward when hiking with a heavy backpack to move the center of mass of you/backpack to above your feet

12. Make it twice as massive (make everything twice as massive)

13. 200/1.5/1.5 > 100/1.5/1.5 = 100/0.75/0.75 > 100/1.5/0.75 > 100/1.5/0.5

14. $T_1 = F_1 \cdot R \quad T_2 = 2R \cdot F_2 \quad T_1 = T_2$ so $\boxed{F_1 = 2F_2}$

5.



$(500)(1.75) + (540)(r_1) = (610)(1.25)$

$(500)(1.25) + (540)(r_2) = (610)(1.75)$

$-.46$ /1.1

16. $\sum F_x = 0 = -T_1 \cos(\theta_1) + T_2 \cos(\theta_2)$

$\sum F_y = 0 = T_1 \sin(\theta_1) + T_2 \sin(\theta_2) - w$

$\sum \tau_{ref} = 0 = T_2 L \sin(\theta_2) - w x$

$w \cdot x = T_2 L \sin(\theta_2)$

$x = \dfrac{T_2 L \sin(\theta_2)}{w}$

$w = T_1 \sin(\theta_1) + T_2 \sin(\theta_2)$

$x = \dfrac{T_2 L \sin \theta_2}{T_1 \sin \theta_1 + T_2 \sin \theta_2}$

$T_1 \cos(\theta_1) = T_2 \cos(\theta_2)$

$\boxed{x = \dfrac{T_2 L \sin \theta_2}{\tan(\theta_1)\cot(\theta_2) + 1}}$

$\sin(a+b) = \sin(a)\cos(b) + \cos(a)\sin(b)$

17. 

$= 14.0°$ Center of mass is still above the bottom (less than 10 cm

$0.3 \cdot \sin 14° = 0.0726$

18. Applied force at a large distance = large torque

19. Center of mass of a donut = Center of the hole

11. Stick the blade close to the tip of the pencil to lower the mass of the system

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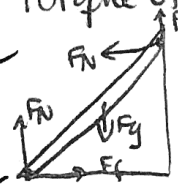
12. b) Equilibrium: $\Sigma F_{on\ ox} = 0$, $\Sigma F_{on\ oy} = 0$, $\Sigma \tau = 0$

b) Translational, rotational

13. Torque of a force is positive – none of these choices is necessarily correct

14. 

15. Center of mass, close to the pivot, the top

wrap wires ↓ clay/dough ↓

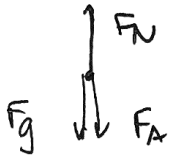
16. a) Distance between biceps/joint is smaller than palm/joint so the upward force must be greater

b)

17. Find fulcrum, separate into regularly shaped objects, push object in different directions

18. More difficult to do a situp with your hands behind your head (more rotational inertia)

19. CD, boy turning the wheel of a parked bicycle, two forces with same magnitude but in an opposite direction

20. 

21. $\Sigma \tau = 0$ Mass is heavier so fulcrum must be closer to the weight

90 cm (10 cm from weight)

22. other forces exerted on the leaf

23. Force is exerted at the axis of rotation, line parallel to and passing through the place where the force is exerted

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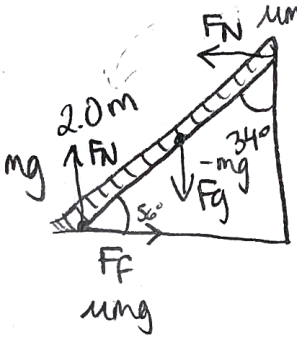
24. Two forces perpendicular to the rod exerted on its different ends with the same magnitude in opposite directions

26. a) Orientation of the ropes should be different

b) $\theta = 45°$ $\quad T_1 = mg\frac{L}{2}\cos\theta$ $\quad \theta = 56°$ $\quad T_2 = \mu mgL\sin\theta$ $\quad T_1 = T_2$

$T_1 = 89.47 = 265.3\mu$ $\quad \mu = 0.337$

9.



$m = 16\ kg$

b) $N_{w\ on\ L} = \mu mg = 53\ N$ $\quad$ c) $N_{s\ on\ L} = 160\ N\ (mg)$

d) $f_{s\ on\ L} = 53\ N$

25. $\tau = rF\sin\theta$ $\quad \tau_{cable} = \tau_{sign} + \tau_{pole}$

$rF\sin\theta = \tau_{sign} + \tau_{pole}$ $\quad F = \dfrac{\tau_{sign} + \tau_{pole}}{r\sin\theta}$

A: $\frac{1}{4}rF\sin 60° = 0.216rF$ $\quad$ B: $\frac{1}{4}\sin 90° = 0.25rF$ $\quad$ C: $\frac{1}{2}rF = 0.5rF$

D: $\frac{1}{4}rF\sin 45° = 0.177rF$ $\quad$ E: $F_T = mg$ (smallest) $\quad$ F: $\frac{1}{4}rF\sin 30° = \frac{1}{2}rF = 0.5rF$

$C = F > D > A > B > E$

27. a) Pivot point exerts a force, but zero torque

b) No torque because $r = 0$

c) $(0.1)(3) = (1.7)(10M_2)$ $\quad 0.3 = 17M_2$

$M_2 = 0.0176\ kg = 17.65\ g = 18\ g$

16. $\Sigma\tau = 0 = \tau_{bicep} + \tau_{palm} = Fd + mgl$ $\quad Fd = mgl$

$\dfrac{F}{mg} = \dfrac{l}{d}$