Statics Quiz

Full Name, Period, AP/Honors:

1 Problem

1. (5 pt, **AP**) Two ladders with the same length and made of the same material are placed side by side so they lean against the same (frictionless) wall. Both have negligible mass. If one makes an angle of θ_1 with the floor and the other make an angle of $\theta_2 > \theta_1$ with the floor. If we let h_1 be the maximum height you can reach on the less steep ladder, and h_2 be the maximum height reached on the more steep ladder, what is $\frac{h_2}{h_1}$? Assume that you cannot reach the end of either ladder, and that your mass is not negligible.

   A. $\frac{\sin\theta_2}{\sin\theta_1}$

   B. $\frac{\cos\theta_2}{\cos\theta_1}$

   C. $\frac{\sin^2\theta_2}{\sin^2\theta_1}$

   D. $\frac{\cos^2\theta_2}{\cos^2\theta_1}$

   E. $\frac{\tan\theta_2\sin\theta_2}{\tan\theta_1\sin\theta_1}$

2. (5 pt, **Honors**) A ladder with length L and negligible mass is placed against a wall at an angle θ from the floor. A person of mass m can climb to a point $\frac{2}{3}$ of the way along the ladder before it falls. Find the coefficient of static friction between the ladder and the ground.

   A. $\frac{2}{3}\cot\theta$

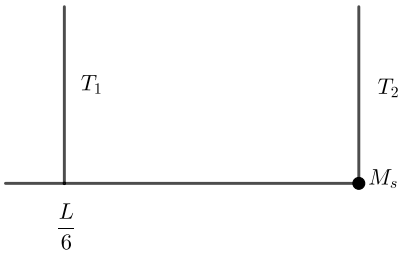
   B. $\frac{1}{2}\cos\theta$

   C. $\frac{3}{2}\sin\theta$

   D. $\frac{1}{6}\tan\theta$

   E. $\cos\theta\sin\theta$

3. (5 pt **All**) A student with mass M_s sits on the far end of a beam (also mass M_s) of length L. The beam is supported by two massless cables at $\frac{L}{6}$ and L. Find the tension in each cable.



4. (5 pt **All**) You mass M and your younger sister mass $\frac{M}{2}$ are on a teeter-totter. When the beam reaches an angle of 30°, what is the net torque on the system? Note: $\cos 30° = \frac{\sqrt{3}}{2}$ and $\sin 30° = \frac{1}{2}$. The bar has length L and the torque should be calculated around the pivot.

$\tau = MgL\cos\theta - \frac{MgL}{2}\cos\theta$

$\tau = \boxed{\frac{MgL\sqrt{3}}{4}}$

5. (5 pt **All**) You build the system shown below. M_1 has no friction with the surface. The pulley consists of a disk with radius R mounted on an axle with radius $r < R$. If the system is not accelerating, what is the frictional force between the pulley and the axle. Hint: the pulley is not rotating.