

AP/Honors HW: Inclined Planes and Analysis

Full Name, Period, AP/Honors:

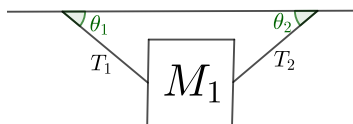
due: 12/5

Instructions: For short answer questions, work must be shown to receive credit. If you ever feel like you need a calculator, you are doing it wrong. AP only problems need to be completed by AP students and will be graded on correctness. Honors students are not required to do them, but will not be penalized for trying.

1 Stuff, and Things

1. Two objects with different masses but the same (non-zero) friction coefficient are placed on identical ramps that are kept at the same angle. The experiment is then repeated at another time on a different planet. Which object reaches the bottom first? There is no air resistance.
 - A. The object with higher mass
 - B. The object with lower mass
 - C. The answer could be different on a different planet
 - D. They arrive at the same time
2. An object is placed on a ramp at an angle θ from the horizontal. The object begins to move. Which of the following is definitely true?
 - A. The ramp is not on Earth
 - B. There is no friction
 - C. The angle of the ramp is at least 10°
 - D. None of the above
3. You and a friend travel to NoFrictionLand™, where there is no friction or air resistance. You tentatively inch your way onto the infinite frictionless flat plane.
 - (a) What happens to your velocity as a function of time once you step onto the plane and why?
 - (b) You realize that you have drifted too far into the darkness. What do you do to return and why?
 - (c) Some time later, you and your friend are at rest on the plane. Your friend, who has the same mass as you, makes you angry. Being a good physicist, but a bad friend, you punch him and blame him for running into your fist. Describe what happens to each of your velocities and why?
4. Write your name and AP status on the top of the paper... or don't if you enjoy doing work for no credit.

5. A mass M is held up by two string as shown.



- (a) If $\theta_2 > \theta_1$ which string will have higher tension? Explain your answer.
- (b) Find the tension in each string in terms of θ_1 , θ_2 and M .
- (c) (Optional Challenge) Prove that your solution behaves as expected when $\theta_2 \rightarrow \frac{\pi}{2}$ and $\theta_1 \rightarrow 0$. You will need to use small angle approximations to linearize the trig functions.
6. (AP Only) An object starts at the bottom of a ramp with an initial velocity of v_0 directed up the ramp. If the ramp has a kinetic friction coefficient of μ_k and makes an angle of θ with the horizontal, how long does the object take to stop? Assume we are on a planet with gravitational acceleration g .
7. (AP Only) The force resulting from air resistance is given by (using dimensional analysis) $F_R \propto \rho v^2 A$. An object with mass M is being accelerated by a constant force of 100 N. When the object was moving at $5 \frac{\text{m}}{\text{s}}$, the drag force was 25 N. No additional forces act on the object. What will be the approximate terminal velocity of the object?