

Physics 321
Homework 1

Due at midnight on the day of Hour 3.

The purpose of this homework is to familiarize you with the procedure of doing and submitting homework and to give you review in doing basic mechanics problems such as those from Physics 121.

To do this assignment, you will need

1) access to Maple and/or Mathematica. You will probably want to be sure that you can access them both in N-212 ESC and on <http://remote.byu.edu>. Please contact the CSRs about this if you do not already have access.

2) $\vec{F} = m\vec{a}$.

3) $\vec{\tau} = I\vec{\alpha} = \vec{r} \times \vec{F}$, $I = \frac{2}{5}mR^2$ for a sphere.

4) $F_f = \mu N$ for static or sliding friction.

1. A block of mass m slides down an inclined plane that makes an angle θ with respect to the horizontal. The coefficient of kinetic friction is μ . What is the acceleration of the block? Use coordinates where x increases as you go down the plane.

- Use Newton's Second Law to find equations of motion for the x and y directions.
- Combine these equations to find the acceleration.
- Let $m = 1\text{kg}$, $\theta = 30$ degrees and $\mu = 0.12$. If $x(0) = v(0) = 0$, find $x(t)$ and $v(t)$. Plot these functions over the time interval 0 to 1 sec.

2. A sphere of mass m and radius R rolls without slipping down an inclined plane that makes an angle θ with respect to the horizontal. The sphere has uniform mass density. What is the acceleration of the sphere? Use coordinates where x increases as you go down the plane.

- Is there a frictional force? How do you know?
- Is there any energy loss to frictional forces? Why?
- Use Newton's Second Law to find equations of motion for the x and y directions.
- Use the torque equation to find the frictional force.
- Combine these equations to find the overall acceleration.