Problem Set 3

Stuyvesant Physics Team

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1   Basic Problems

Problem 1 *

A block rests on a table, and the normal force acting on the block has a magnitude of 25N. What is the mass of the block?

Problem 2 *

A ball with a mass of 10kg lies at the end of a swinging pendulum. Suppose it is in a position which makes an angle of $30°$ with the vertical, what is the tension on the cord?

Problem 3 *

A horizontal force of 10N acts on a block, which proceeds to slide along a flat surface. If the coefficient of friction between the block and the surface is $\mu_k = .2$, what is its velocity after 10s?

2   Let's Try Something A Bit Harder...

Problem 4 **

In a two-dimensional tug-of-war, Alex, Betty, and Charles pull horizontally on an automobile tire. The directions of Alex's and Betty's pulls are $137°$ apart. The tire remains stationary in spite of the three pulls. Alex pulls with force of magnitude 220 N, and Charles pulls with force of magnitude 170 N. Note that the direction of Betty's pull is not given. What is the magnitude of Betty's force?
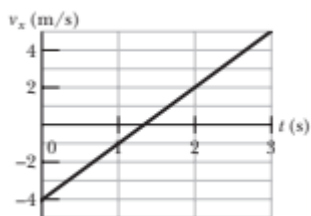
Problem 5 **

Refer to the diagram on the board. Let the mass of the block be 8.5kg and the angle be $30°$. Find

1. The tension in the cord, and

2. The normal force acting on the block.

3. If the cord is cut, find the magnitude of the resulting acceleration of the block.

3 Challenge Problems

Problem 6 ***

Two horizontal forces $\vec{F}_1$ and $\vec{F}_2$ act on a 4.0kg disk that slides over a frictionless ice, on which an xy coordinate system is laid out. $\vec{F}_1$ is in the positive direction of the x axis and has a magnitude of 7.0N, and $\vec{F}_2$ has a magnitude of 9.0N. The graph gives the x component of velocity (v_x) as a function of time during the sliding. What is the angle between the constant directions of $\vec{F}_1$ and $\vec{F}_2$?

Problem 7 ***

There are 2 blocks with masses $m_1 = 1.30kg$ and $m_2 = 2,80kg$ connected by a massless cord passing over a frictionless pulley of negligible mass. What is

a) The the magnitude of the blocks' acceleration and

b) the tension in the cord?