

Physics I w/Calculus

Exam I

February 23, 2000

Name:

Signature:

You have 75 minutes to complete the exam.

Remember the difference between vectors and scalars and remember your units. Do three of the first four problems. Circle below which of the three you want me to grade. Problems 5 and 6 are required parts of the exam.

Problems to grade: 1      2      3      4

Formulas:

$$x-x_0 = v_0t + 1/2 at^2$$

$$v = v_0 + at$$

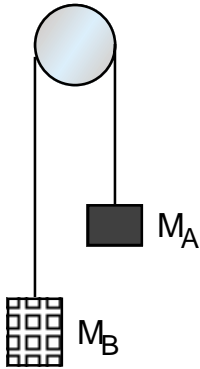
$$v^2 - v_0^2 = 2a(x-x_0)$$

$$R = \frac{v_0^2 \sin 2\theta}{g}$$

$$a_c = v^2/r$$

Good luck!

1. The consider the following pulley system. The pulley and the rope are massless.



(a) Draw the free body diagram for mass  $A$ . What are the forces on mass  $A$ ?

(b) Draw the free body diagram for mass  $B$  What are the forces on mass  $B$ ?

(c) What is the relationship between the acceleration of mass  $A$  and mass  $B$ ?

(d) What is the acceleration of mass  $A$ ?

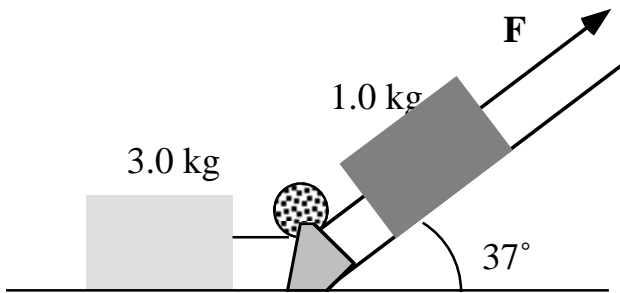
2.

The wind blows at 50 m/s due east. We want to travel due north 500 km in our private jet, which has an airspeed of 800 km/h.

a) What is the direction we need to fly the plane?

b) How long does it take to get there?

3.



A 1.0-kg mass on a  $37^\circ$  incline is connected to a 3.0-kg mass on a horizontal surface. The surfaces and the pulley are frictionless. The magnitude of  $F$  is 12 N.

a) Draw the free body diagram for both masses.

b) What is the tension in the connecting cord?



4. A ferris wheel completes 3.00 revolutions in 5.00 min. Its radius is 10.0 m.

(a) What is the speed of the seat?

(b) What is the centripetal acceleration?

(c) What would be the speed if the magnitude of the acceleration were doubled?

5. A stuntwoman is shot from a cannon at a speed of 100 km/h and she travels 50 m.

a) What is the angle from which was launched?

b) At what angle should she be launched for the maximal distance?

c) What is the maximal distance she could be launched?

6.

True or false. If false, give a reason why.

1. Weight is always parallel to the normal force. T F

2. In circular motion, the force is directed toward the center. T F

3. Newton's Third Law says that forces come in pairs in the same direction. T F

4. For all projectiles, the velocity is zero at the top of the trajectory. T F

5. Mass does not change. T F