

Name: _____

This test is administered under the rules and regulations
of the Honor Code of William & Mary.

Signature: _____

Problem Session (circle one):

Wed. 9:00 am (Prof. Cooke)

Wed. 3:00 pm (Prof. Aubin)

Thurs. 1:00 pm (Prof. Sher)

Thurs. 3:30 pm (Prof Krakauer)

Tues. 1:00 pm (Prof. Mikhailov)

Thurs. 2:00 pm (Prof. Vahala)

1. _____ (25 points)

2. _____ (25 points)

3. _____ (25 points)

4. _____ (25 points)

Total _____

Problem 1.

A William & Mary student throws a raw egg at President Reveley's house¹. The egg's initial speed is 20 m/s. The horizontal distance from the student to the house is 12 m. The egg hits the house 1 second after it is thrown. Assume the egg was released from the student's hand 2 m above the ground.

- a) At what initial angle θ (measured from the horizontal) was the egg thrown?
- b) At what height is the egg when it hits the house?
- c) How fast and in what direction was the egg travelling when it hit the house?

¹I don't recommend trying this.

Problem 2.

A car starts from rest and travels in a straight line for 12 seconds with a steady acceleration of 1.5 m/s^2 . The driver then applies the brakes, causing her car to slow with a deceleration of 2.0 m/s^2 , until it comes to a full stop.

- a) What was maximum speed the car reached?
- b) How far is the car away from its initial location when it stops?
- c) What is the total elapsed time from the start to the complete stop?

Problem 3.

A box of mass m is sitting on top of another box of mass M , which sits on a (frictionless) layer of ice. There is friction between the two boxes. A horizontal force of magnitude F is applied to the lower box (see diagram).

- a) Assume that the static friction is such that the two boxes will move together. What is the acceleration of the system?
- b) What is the minimum coefficient of static friction μ_s between the two boxes such that they move together?
- c) Now, assume that something is exerting an additional vertical (downwards) force F_2 on the upper box. What would the minimum μ_s now be such that the two boxes still move together?

Problem 4.

An airplane pilot wishes to travel directly North from her starting location, and to maintain a speed of 200 km/hr with respect to the ground. However, there is a strong wind blowing from the Northeast to the Southwest; the wind speed is 30 m/s. In what direction must she head, and with what airspeed (i.e. speed of the airplane relative to the air) in order to do this?