# Physics 161 Midterm 2

There are three (3) problems, worth 33 points each. You must show your work to receive full credit.

1. An airplane is flying horizontally at a speed of 75 m/s at 120 m above the ground when it releases a bomb. Neglect air resistance in this problem.

(a) (20 points) At what distance in front of the target should the plane release the bomb?

(b) (13 points) At what angle is the bomb going just before it hits the ground?

2. An amusement park ride consists of a car suspended from a rotating arm of radius 2.0 m by a metal cable of length 1.5 m. As the arm rotates, the car swings outward as shown below. The cable can hold a maximum tension of 8000 N before breaking. What is the maximum safe number of revolutions per second of the ride if the mass of the car with passenger is 200 kg?
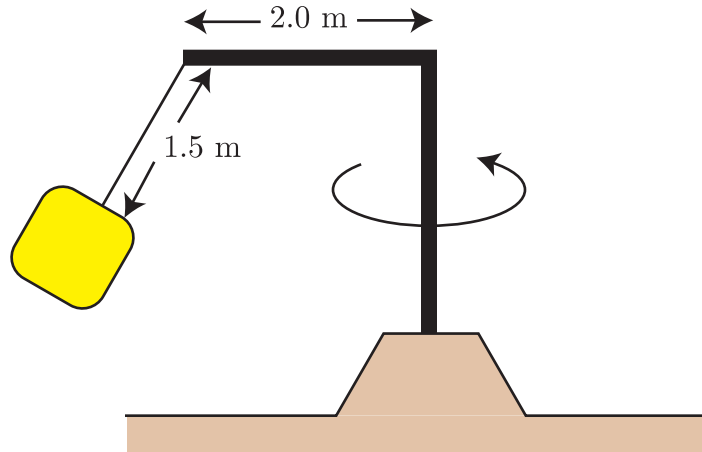
Problem 3 is on the back of this page.

3. An Atwood machine has masses m and $2m$ suspended over a massless frictionless pulley. The pulley is suspended from the ceiling by a string, as shown below.
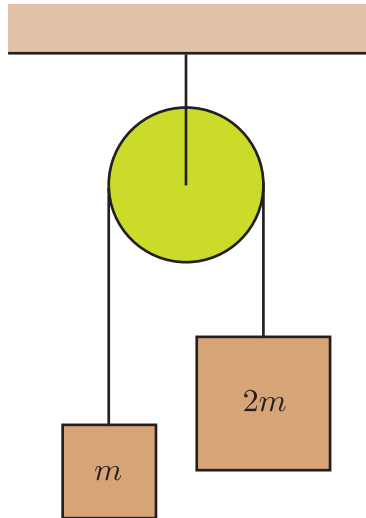
(a) (13 points) Draw three free-body diagrams: one for the mass m, one for the mass $2m$, and one for the pulley. Clearly indicate the physical origin of each of the forces, and indicate which forces on the different diagrams are equal to each other.

(b) (20 points) Find the tension in the rope that is holding up the pulley. Hint: the answer is not $3mg$!