Applied Physics – Problem set #2

1. An object is moving along a straight line with constant acceleration. It covers 10 meters in 1.06 seconds, then it covers the next 10 meters in 2.20 seconds. What is the acceleration of the object? What is the initial speed of the object at the very beginning?

2. A ball is thrown from a 15m high tower at 20m/s speed, directed downwards at $30°$ to the horizontal. How long will it take for it to hit the ground, and how far will it land from the base of the tower? ($g = 10\text{m/s}^2$ can be used)

3. In still water a boat is started with 6m/s initial speed, and its speed decreases to 3m/s in 69 seconds. The water exerts a braking force that is proportional to the speed of the boat. Determine the distance traveled by the boat as a function of time!

4. The potential energy of an object as it is moving along the x-y plane is given as
$$E_P(x, y) = 2x^2 - 3xy + y^2.$$
What is the force acting on the object at the point $P\,(3, 2)$?

5. How fast should an object start from the surface of the Earth, so that it defeats the gravitational pull of the Earth, and never falls back? Ignore the effect of the air resistance!

Homework #2

1. A rock is dropped from a height of 125m without any initial speed. Then 1 second later we throw another rock with an initial speed of v_0 directed vertically downward. What should be v_0 so that they reach the ground at the same time?

2. A 700 kg Formula-1 car travels at 50m/s when it switches to neutral and cleanly rolls on the horizontal track. All the forces acting on the car cancel out or can be ignored, except the drag, which is given as $F_d = bv^2$, where $b = 1.1$ kg/m. How long will it take for the car to slow down to half of its initial speed, and how far does it travel in the meantime?

3. The potential energy of an object as moving along the x-y plane is given as $E_P = 5x^3 - 3y^2$. What is the magnitude of the force acting on the object at the (-2, 8) point and what angle does it make with the negative x-axis?