OA 3302 Summer 2004 Assignment 4
Due: 19 August 2004

1. Assume that a Mover accelerates at a constant rate given by $\mathbf{a}$, where $\mathbf{a}$ is a vector.

a. Suppose that the Mover is at rest at position $\mathbf{x}_0$. What is the equation of motion for the Mover? That is, what is the Mover's location at time t if it starts moving at time 0?

b. If the maximum speed of the Mover is s, at what time does the Mover reach its maximum speed?

c. If a cookie-cutter sensor is located at the origin, what is the expression that represents the time that the sensor's range is entered/exited?

d. Suppose a Mover located at $(30, -50)$ starts accelerating at time 0 with $\mathbf{a} = (-10, 20)$. A sensor at the origin has range 20. When does the target enter the sensor's range? When does it exit the sensor's range? What are the Mover's locations when it enters/exits the sensor's range?.

2. At time 0 hrs a unit located at (-10,20) (km) starts moving to destination (70,60) at speed 40km/hr. A stationary sensor with range of 20km is located at (50,30).

a. What is the minimum necessary range of the sensor that will detect our target?

b. For this question suppose that the range of the sensor is uniformly distributed in [2,20]. Find the probability that the target will ever be detected.

c. Give the range of directions of the velocity vector of the target that will make it detectable

3. Consider the setting of problem 2. Suppose that the sensor monitors its area of coverage every $\Delta t = 0.1$ hrs, and that every Δt it detects a target with probability $0 < p < 1$ if the target is within the range of the sensor and has not yet been detected. Find the probability, as a function of p, that the target is detected. Repeat the last question after supposing that $p/\Delta t \to k > 0$ as $\Delta t \to 0$.