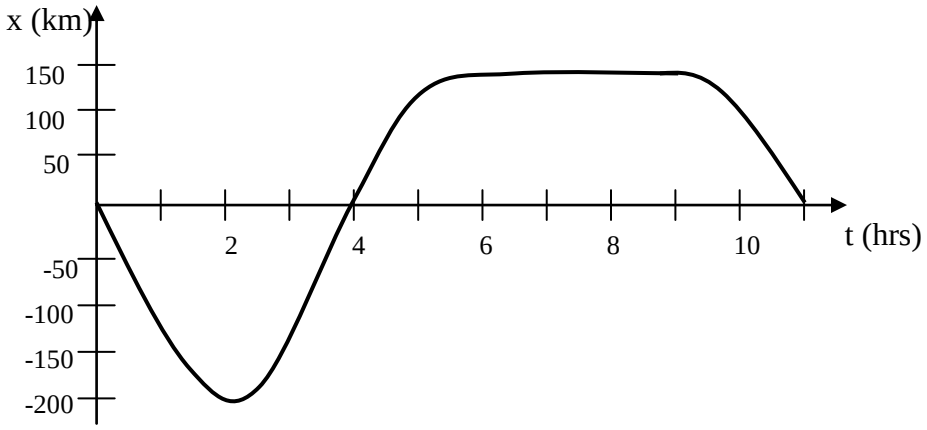
Physics 113 - Fall 2012 - workshop module 1
1-d kinematics

1. The position of your car during a recent road trip on the interstate highway (essentially a straight line) is described by the position-time graph below, where North is assigned to be positive. You should begin this problem by redrawing the graph on a whiteboard or blank sheet of paper. Draw it large!

(a) When is the car's *speed* zero?
(b) Determine the car's approximate *average velocity* for the intervals
  (i) from 0 to 6 hrs
  (ii) from 2 to 4 hrs
  (iii) from 4 to 11 hrs
(c) Determine the car's approximate *average speed* for its entire 11-hour motion.
(d) Roughly sketch the velocity versus time graph corresponding to this motion.
(e) From the graph below, estimate the average acceleration in the interval from 1 to 3 hours.
(f) At what times is the magnitude of the acceleration large. When is it positive? When is it negative?



2. Smoky the cat is relaxing on the arm of a couch, one meter above the ground, when he is startled by something and jumps straight up in the air with initial speed 4 m/s. Coming down, he misses the couch because someone moves it while he is in the air so that Smokey lands on the ground. You can neglect air resistance in your answers below.

(a) What is Smoky's *acceleration*…
  (i) …just after his paws leave the couch and he is on his way up?
  (ii) …at the exact instant when he is at his maximum height?
  (iii) …just before he hits the ground on his way back down?

(b) What is Smoky's maximum height above the ground during his motion?
(c) What is Smoky's velocity just before he hits the ground?
(d) How long is Smoky in the air?

3. You are on the roof of the lecture hall, 50 m above the ground. As your physics professor, who is 1.8 m tall, walks toward the hall at a constant speed of 1.20 m/s. If you wish to drop an egg on your professor's head (and possibly put your "A" in P113 at risk), where should the professor be when you release the egg? Assume the egg is in free fall (i.e., you can ignore air resistance). (*Actual experimentation is discouraged*.)

4. A cat hears a member of the house staff opening a can of tuna and takes off at a run from its favorite sleeping spot on the couch. The magnitude of the velocity of the cat is given by Ct^2, where $C = 2\ m/s^3$. Assuming the cat runs in a straight line, how far does the cat run in two seconds?

5. A particle travels in one dimension. The graph below shows the velocity of a particle as a function of time. In the 12 seconds shown, the particle travels a distance of

a) 0 m
b) 1200 m
c) 640 m
d) 440 m
e) 200 m