University of Alabama
Department of Physics and Astronomy

PH 105 LeClair Summer 2012

Problem Set 1

Instructions:

1. Answer all questions below. All questions have equal weight.
2. Show your work for full credit; using the problem template is recommended.
3. All problems are due Wednesday 30 May 2012 at the start of lecture.
4. You may collaborate, but everyone must turn in their own work.

Note: you will have time during Wednesday's lab period to ask questions about these problems.

1. *HRW 2.2* Compute your average velocity in the following two cases: (a) You walk 73.2 m at a speed of 1.22 m/s and then run 73.2 m at a speed of 3.05 m/s along a straight track. (b) You walk for 1.00 min at a speed of 1.22 m/s and then run for 1.00 min at 3.05 m/s along a straight track. (c) Sketch a graph x versus t for both cases and indicate how the average velocity is found on the graph.

2. *HRW 2.7* Two trains, each having a speed of 30 km/h, are headed at each other on the same straight track. A bird that can fly 60 km/h flies off the front of one train when they are 60 km apart and heads directly for the other train. On reaching the other train, the bird flies directly back to the first train, and so forth. (We have no idea *why* a bird would behave in this way.) What is the total distance the bird travels before the trains collide?

3. *HRW 2.16* The position function $x(t)$ of a particle moving alone an x axis is $x = 4.0 - 6.0t^2$, with x in meters and t in seconds. (a) At what time and (b) where does the particle (momentarily) stop? At what (c) negative time and (d) positive time does the particle pass through the origin? (e) Sketch a graph x versus t for the range -5 s to $+5$ s. (f) To shift the curve rightward on the graph, should we include the term $+20t$ or $-20t$ in $x(t)$? (g) Does that inclusion increase or decrease the value of x at which the particle momentarily stops?

4. *HRW 2.20* (a) If the position of a particle is given by $x = 20t - 5t^3$, where x is in meters and t is in seconds, when, if ever, is the particle's velocity zero? (b) When is its acceleration a zero? (c) For what time range (positive or negative)is a negative? (d) Positive? (e) Sketch graphs of $x(t)$, $v(t)$, and $a(t)$.