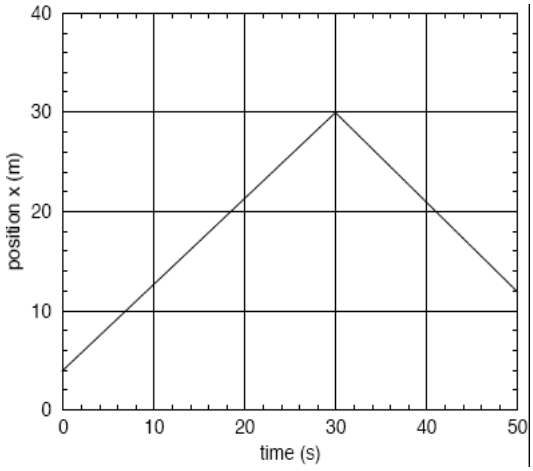
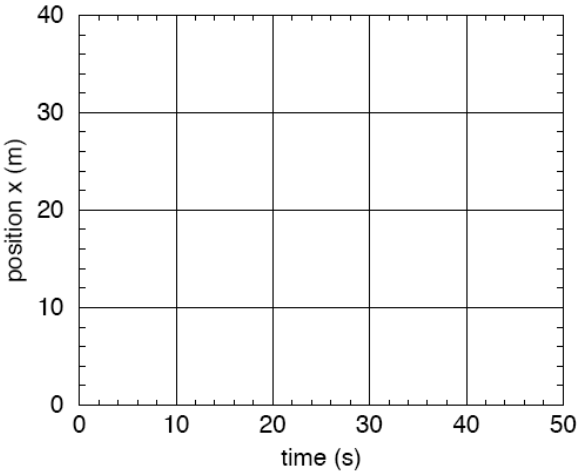
Physics 131.01 Monday September 13, 2010 Quiz number 1

Cooperative Learning: work together, and submit one solution to each problem. A "solution" is not just a number. The reasoning needs to be indicated. The units of the number need to be specified. If the answer is a vector, the vector needs to be specified. Magnitude alone is not usually enough. **Write all 3 names on each page you submit.** No more than one page per problem.

1. Graphs; speed versus velocity.



In the graph to the right:
a. What is the total distance travelled (the total length of the "path")? 26m + 18m = 44m
b. What is the total displacement? 12m – 4m = 8m
c. What is the speed during the first 30s? 0.87 m/s
d. What is the velocity during the last 20s? -0.90 m/s
e. What is the average speed? 44m/50s = 0.88 m/s
f. What is the average velocity? 8m/50s = 0.16 m/s



2. Graphs: accelerated motion.
A particle moves along the x axis. Its position as a function of time is given by $x=2.0t-t^2/30$. where t is in s (seconds) and x is in m (meters). By derivatives, $v(t)=2.0-t/15$. and $a(t)=-1/15$.
a. Graph this motion (on the graph to the left).
b. What is the velocity at time t=0? 2.0 m/s
c. What is the velocity at time t=50s? -1.33 m/s
d. What is the acceleration at time t=0? $-0.067 m/s^2$
e. What is the acceleration at time t=50s? same
f. What is the average velocity from t=0 to 50s? 16.7m/50s = 0.33 m/s

3. Let y designate vertical position, with y=0 being the ground. A ball is launched upwards at time t = 0, with v_y = 19.6 m/s, starting from a height y_0 = 2.0 m.
a. At what time is the ball at its maximum height? $t=(19.6m/s)/(9.8m/s^2)=2.00$ s
b. How high does the ball go? $v_{av}\, t=(9.8m/s)(2.00s)=19.6$ m
c. What is the velocity when it returns to the original height y_0 going down? -19.6m/s
d. What is the velocity of the ball when it is just about to hit the ground? $v^2 = v_0^2+2as$ where a = -9.8m/s2 and s=-2.0m, so v=-20.6 m/s (notice the negative root must be used.)
e. At what time does the ball hit the ground? To go from -19.6m/s to -20.6 m/s takes 1.0/9.8 = 0.10 s; The total time is 2 x 2.00s + 0.10 s = 4.10 s.
f. What is the average velocity of the ball from time t=0 until it hits the ground? Since acceleration is constant, $v_{av} = (v_0 + v_f)/2 = (19.6-20.6)/2 = -0.50$m/s. This is also the displacement -2.0m divided by the time 4.10 s = -0.49 m/s (expected round-off error!)