Solutions **Physics 135-1, Summer 2010, Quiz 1**

1) An antique dive-bomber is flying straight down at 147 m/s when it releases its bomb. If the airplane is 490 m above the ground at the instant it releases the bomb, then:

a) (5 pts) How long will it take the bomb to hit the ground once it is released?
b) (5 pts) How fast will the bomb be moving when it hits the ground?

We have the basic equation: $y = y_o + v_o t + \frac{1}{2} a t^2$. If we put the origin at the point where the bomb starts falling, then $y_0 = 0$, $y = -490$ m, $v_0 = -147$ m/s, and $a = -9.8$ m/s^2. This gives $-490 = -147\ t - 4.9\ t^2$. Dividing by -4.9 yields $t^2 + 30\ t - 100 = 0$. From the quadratic equation, $t = \{-30 \pm [900 - (4)(-100)]^{1/2}\} / 2 = [-30 \pm 1300^{1/2}]/2 = 6.06$ sec *or* -66.06 sec. It is unlikely that the bomb will hit the ground before it is released, so we reject the negative time and $t = 6.06 / 2 = 3.03$ sec.

The bomb's landing speed will be $v = v_o + at = 147 + (9.8)(3.03) = 176.7$ m/s.

2) A nervous man walks at 2 m/s for 6 sec to the East. Then he walks at 1.5 m/s for 8 sec to the West. Then he walks at 1.25 m/s for 3 sec to the East.

a) (5 pts) What was his average speed?
b) (5 pts) What was his average velocity?

The distance the man moves during each segment is: (2 m/s) x 6 sec = 12 m, (1.5 m/s) x 8 sec = 12 m, and (1.25 m/s) x 3 sec = 3.75 m. The total distance covered is thus 27.75 m, and the total time it took was 17 sec, so his average speed was 27.75 / 17 = 1.63 m/s. The *net* distance he covers is $d = +12 - 12 + 3.75 = 3.75$ m, where I have taken "East" to be positive. His average velocity is then 3.75 / 17 = 0.22 m/s, to the East.