**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, $t = \{-30 \pm [900 - (4)(-100)]^{1/2}\} / 2 = [-30 \pm 1300^{1/2}]/2 = 3.03$ sec *or* $-33.03$ sec. It is unlikely that the bomb will hit the ground before it is released, so we reject the negative time and $t = 3.03$ 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.