Name_____

Physics 120 Quiz #2, January 12, 2006

$x_f = x_i + v_{i,x}t + \frac{1}{2}a_x t^2$

$v_f = v_i + a_x t$

$v_f^2 = v_f^2 + 2a_x \Delta x$

$\vec{F} = m\vec{a}$

$g = 9.8\frac{m}{s^2}$

$1hr = 3600s$

$1mi = 1600m$

Solutions to $Ax^2 + Bx + C$ are given as $x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$

Please show all work in order to receive partial credit. The quiz is worth 10 points total.

1. To stop a car, you first require a certain reaction time to begin braking; then the car slows under the constant braking deceleration. Suppose that you have a reaction time of 0.50s and that the maximum deceleration of your car is 6.0m/s^2. Suppose further that you are traveling at 20m/s when you see a road hazard 50m in front of you.

   a. How long does it take the car to come to rest, *once* the breaks are applied? This is called the breaking time. (2 points)

$$v_{fx} = v_{ix} + a_x t \rightarrow 0\frac{m}{s} = 20\frac{m}{s} - 6.0\frac{m}{s^2}t_{breaking} \rightarrow t_{breaking} = \frac{20\frac{m}{s}}{6.0\frac{m}{s^2}} = 3.33s$$

   b. How far does the car travel from the time you *first see* the obstacle to when the car comes to rest? (4 points)

$$x_{traveled} = x_{reaction\ time} + x_{breaking\ time} = v_i t_{reaction} + v_i t_{breaking} - \frac{1}{2}at_{breaking}^2$$
$$\therefore x_{traveled} = \left(20\frac{m}{s} \times 0.5s\right) + \left(20\frac{m}{s} \times 3.33s\right) - \frac{1}{2}\left(6\frac{m}{s^2}\right)\left(3.33s\right)^2 = 43.4m$$

   c. Does the car stop in time? If so, by what distance do you miss the object? If the car does not stop in time, what maximum deceleration would you have needed in order to avoid the object, everything else remaining the same? (2 points)

   Yes the car stops in time and misses the object by 50m – 43.4m = 6.6m.

   d. If the car has a mass of 1200kg, what constant force is needed to bring the car to rest? (2 points)

$$F = ma = 1200kg \times \left(-6.0\frac{m}{s^2}\right) = -7200N$$