Arts & Science 2D06

Quiz #1 2013 Sept 19 **Name:**

NB: Mark values are given in brackets [ ] beside each problem. Write all your answers on the quiz paper. No books or notes allowed. Time to write quiz: 50 minutes.

Solution for quadratic equation: $x = (-b \pm \sqrt{b^2 - 4ac})/2a$

Uniform acceleration: $x = x_0 + v_0 t + \frac{1}{2}at^2$ $v^2 = v_0^2 + 2a(x - x_0)$

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1. [3] A car moves on a horizontal road with constant velocity v. Which of the following statements is **false**? (Ignore air resistance.) *Explain/derive* your choice in the space below.

(a) Its acceleration is zero at all times.

(b) A graph of its position *vs.* time yields a straight line.

(c) The slope of the graph in (b) is $v^2/2$.

(d) The velocity vector **v** points in the direction of the car's motion.

2. [3] A tennis ball is thrown upward with speed $v_\circ$, and takes a time T to reach its maximum height H. Which of the following statements is **true**? (Ignore air resistance.) *Explain/derive* your choice in the space below.

(a) It reaches $H/2$ in $T/2$.

(b) It has speed $v_\circ/2$ at $H/2$.

(c) It has speed $v_\circ/2$ at $T/2$.

(d) It has speed $v_\circ$ at $2T$.

3. [4] Suppose the equation of motion of an object is given by

$$x(t) = 35 - 6.5t - 1.3\ t^2$$

where x is measured in meters. Find (a) its average velocity between 1 and 3 seconds, and (b) its instantaneous velocity at $t = 4$ seconds.

4. [5] Two stones are thrown from the edge of a cliff of height 100 m. One is thrown straight up at 5 m/s, while the other is thrown straight down 2 seconds later at 20 m/s. Where and when will the two stones meet each other?

5. [5] A ball is launched from ground level and after 3 seconds its velocity is:

$$\mathbf{v} = 20\ \mathbf{i} - 4\ \mathbf{j}\ \text{m/s}.$$

Find how long the ball is in the air, *i.e.*, from the time it was launched until the time it lands.

[20] total marks