UNIVERSITY OF ALABAMA

Department of Physics and Astronomy

PH 125 / LeClair   13 Jan 2014

Quiz 1 Solution

1. The position x as a function of time t of a particle traveling along a straight line can be described by the function

$$x(t) = 2.0 + 4.0t - 4.9t^2$$

with $t \geq 0$, x in meters, and t in seconds. At what time is the position maximum?

Solution: The position will be maximum when its derivative, the velocity, is zero.

$$\frac{dx}{dt} = v_x = 0 = 4 - 9.8t \tag{1}$$

$$\implies t = \frac{4}{9.8} \approx 0.41\,\text{s} \tag{2}$$

2. You have two vectors:

$$\vec{\mathbf{a}} = 1\,\hat{\boldsymbol{\imath}} + 2\,\hat{\boldsymbol{\jmath}} + 3\,\hat{\mathbf{k}}$$
$$\vec{\mathbf{b}} = 3\,\hat{\boldsymbol{\imath}} + 6\,\hat{\boldsymbol{\jmath}} + 9\,\hat{\mathbf{k}}$$

Find the scalar product of the two vectors, $\vec{\mathbf{a}} \cdot \vec{\mathbf{b}}$

Solution: The scalar product of two vectors $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ is

$$\vec{\mathbf{a}} \cdot \vec{\mathbf{b}} = a_x b_x + a_y b_y + a_z b_z \tag{3}$$

In the present case, this gives

$$\vec{\mathbf{a}} \cdot \vec{\mathbf{b}} = (1)(3) + (2)(6) + (3)(9) = 3 + 12 + 27 = 42 \tag{4}$$