Please PRINT your name _____

No calculators, cell phones, computers, notes, etc.

Circle your answer. Make your work correct, complete and coherent.

The quiz is worth 5 points. The solutions will be posted on my website later today.

Quiz 3, February 19, 2019

At time $t = 0$, a particle is located at the point $(1,2,3)$. It travels in a straight line to the point $(4,1,4)$, has speed 2 at $(1,2,3)$, and has constant acceleration $3\vec{i} - \vec{j} + \vec{k}$. Find an equation for the position vector $\vec{r}(t)$ of the particle at time t.

ANSWER: We are told that

$$\vec{r}''(t) = 3\vec{i} - \vec{j} + \vec{k}$$
$$\vec{r}(0) = \vec{i} + 2\vec{j} + 3\vec{k}$$
$$\vec{r}'(0) = \frac{2}{\sqrt{11}}\left(3\vec{i} - \vec{j} + \vec{k}\right)$$

Integrate to learn that

$$\vec{r}'(t) = 3t\,\vec{i} - t\,\vec{j} + t\,\vec{k} + \vec{c}_1.$$

Plug in $t = 0$:

$$\frac{2}{\sqrt{11}}\left(3\vec{i} - \vec{j} + \vec{k}\right) = \vec{r}'(0) = \vec{c}_1.$$

Thus,

$$\vec{r}'(t) = \left(3t + \frac{6}{\sqrt{11}}\right)\vec{i} + \left(-t - \frac{2}{\sqrt{11}}\right)\vec{j} + \left(t + \frac{2}{\sqrt{11}}\right)\vec{k}.$$

Integrate again:

$$\vec{r}(t) = \left(3\frac{t^2}{2} + \frac{6}{\sqrt{11}}t\right)\vec{i} + \left(-\frac{t^2}{2} - \frac{2}{\sqrt{11}}t\right)\vec{j} + \left(\frac{t^2}{2} + \frac{2}{\sqrt{11}}t\right)\vec{k} + \vec{c}_2.$$

Plug in $t = 0$:

$$\vec{i} + 2\vec{j} + 3\vec{k} = \vec{r}(0) = \vec{c}_2.$$

Thus,

$$\boxed{\vec{r} = \left(3\frac{t^2}{2} + \frac{6}{\sqrt{11}}t + 1\right)\vec{i} + \left(-\frac{t^2}{2} - \frac{2}{\sqrt{11}}t + 2\right)\vec{j} + \left(\frac{t^2}{2} + \frac{2}{\sqrt{11}}t + 3\right)\vec{k}.}$$