Physics 303 Analytical Mechanics Quiz 1   Name SOLUTIONS.

1. Write down the rotation matrix that rotates the coordinate system 180° around an axis that is in the xy plane, at 45° to both the +x and +y axes.

2pt.

$$\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -1 \end{pmatrix}$$

$x \leftrightarrow y, \quad z \leftrightarrow -z.$

2. What is the numerical value of the sum $\sum_{i,j,k} \varepsilon_{ijk}\varepsilon_{jik}$?

2pb

-6

3. A particle moves in a path given by $\vec{r} = \dfrac{\sqrt{3}}{2 \text{ meters}} a^2 t^2 \hat{i} + at\hat{j}$.

8pb.

Find the velocity, acceleration, and speed when $t = 1$ meter $/a$.   2pb. e
Your answer might contain a (and other symbols.)

Then find the angle between the velocity and the acceleration at this time.   2pt.
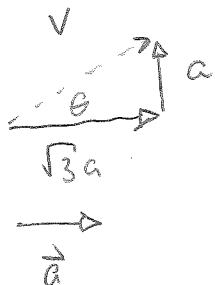
$\vec{v} = \dot{\vec{r}} = \dfrac{\sqrt{3}}{2_m} 2a^2 t \, \hat{i} + a\hat{j}$

$\rightarrow \sqrt{3}\, a\, \hat{i} + a\hat{j}.$

$\ddot{\vec{r}} = \dfrac{\sqrt{3}\, a^2}{m} \hat{i}$ (constant)

Speed $= |\vec{v}| = \sqrt{3a^2 + a^2} = 2a$.   @ $t = 1/a$.

4:

$\sin\theta = \dfrac{a}{2a} = \dfrac{1}{2}$ $\theta = 30°$