RUTGERS
UNIVERSITY | NEWARK

Math 235
Calculus III

Spring 2018

Quiz #4

Monday, Febuary 19 2018

Duration: 20 min

NAME: ________________________

Please write clearly and properly.

Explain your answers appropriately.

Problem	**Grade**
1	
2	
Total	

Problem 1 (~ 8 points.)**.**

Consider the parametrized curve in 3-dimensional space given by the following function:

$$\begin{aligned} f : \mathbb{R} &\to \mathbb{R}^3 \\ t &\mapsto \big(x(t), y(t), z(t)\big) \end{aligned}$$

where:

$$\begin{aligned} x(t) &= \sqrt{3}\cos(t) \\ y(t) &= 2\sin(t) \\ z(t) &= \cos(t)\ . \end{aligned}$$

Let $M(t)$ denote the moving point in 3-dimensional space with coordinates $\big(x(t), y(t), z(t)\big)$, and denote $\vec{r}(t) = \overrightarrow{OM(t)} = \big(x(t), y(t), z(t)\big)$.

(1) Compute the velocity $\vec{v}(t)$, the speed $v(t)$, and the unit tangent vector $\vec{T}(t)$ for this motion.

(2) Compute the acceleration $\vec{a}(t)$ for this motion.

(3) Show that the path lies in a sphere centered at the origin.

(4) Show that the path lies in the plane with Cartesian equation $x - \sqrt{3}z = 0$.

(5) Derive the nature of the curve from the two previous questions.

Problem 2 ($\sim$ 4 points.)**.**

Consider a moving point $M(t)$ in 3-dimensional space whose acceleration is given by:

$$\vec{a}(t) = (6t, 0, -2) \ .$$

Find the velocity $\vec{v}(t)$ and the position $\vec{r}(t)$ for this motion, assuming the initial conditions:

$$\begin{cases} \vec{r}(0) &= (0, 0, 1) \\ \vec{v}(0) &= (-1, 2, 0) \end{cases}$$

Where is the moving point $M(t)$ at $t = 1$?