Quiz 5 Math 2202

Guidelines

- This quiz is for you to test yourself on what we've been studying recently.
- You can also use it as a. guide to the online quiz for this week.
- You have 10 minutes. As a section, we will go over the quiz (or part of it). Solutions will be posted online as well.

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1. Consider the curve $x^2 + y^2 = 9$. Find a vector function (a parameterization) of this curve describing a particle with $\mathbf{r}(0) = \langle -3, 0\rangle$ and traveling counterclockwise.

2. Consider the vector function $\mathbf{r}(t) = \langle e^{t^2}, -1, \sin t\rangle$.

   Find the tangent line to the curve at the point $P = (1, -1, 0)$. (Note: we're in $\mathbf{R}^3$, so you'll need to find parametric equations to describe this line.)

Please turn over.

3. Single Variable Calculus Derivative Recall:

   (a) $\frac{d}{dx}\ln(\sqrt{x^2+y^2})$

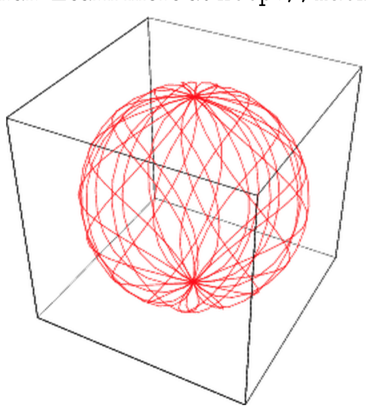
   (b) $\frac{d}{dt}\frac{e^{t^2}}{\sqrt{t}+1}$

   (c) $\frac{d}{dy}\sin^2(\cos y)$

Think about it... In #1, you can check directly using the parameterization that a particle moving around a circle in $\mathbf{R}^2$ will always have velocity $\mathbf{r}'$ perpendicular to position $\mathbf{r}$. Let's see what happens to a particle on a sphere.

Imagine a particle traveling on a sphere of radius R centered at the origin. Let $\mathbf{r}(t)$ describe the trajectory of the particle. Show that the the velocity vector of the particle is always perpendicular to the position vector of the particle, by considering the derivative of the function $\mathbf{r}(t)\cdot\mathbf{r}(t)$ and using the "product rule" for dot product: $\frac{d}{dt}(\mathbf{u}(t)\cdot\mathbf{v}(t)) = \mathbf{u}'(t)\cdot\mathbf{v}(t)+\mathbf{u}(t)\cdot\mathbf{v}'(t)$.

Here's an example of a curve on the sphere. This particular curve is known as the Seifferts Spherical Spiral. Learn more at `http://mathworld.wolfram.com/SeiffertsSphericalSpiral.`



`html`.

(For a solution, look at Stewart 10.2 p. 704-5, Example 4.)