Math 126 C - Spring 2007
Mid-Term Exam Number Two
May 10, 2007

Name: ________________________________        Section: ____________

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- Complete all questions.
- You may use a scientific, non-graphing calculator during this examination. Other electronic devices are not allowed, and should be turned off for the duration of the exam.
- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator, when an algebraic method is available, you will not receive full credit.
- You may use one hand-written 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 50 minutes to complete the exam.
1. Consider the curve defined by the vector equation

\[ \mathbf{r}(t) = \langle 4t, 5t^3, 2t^2 \rangle \]

(a) Find the unit tangent vector \( \mathbf{T}(t) \) at the point where \( t = 1 \).

(b) Find the parametric equations of the tangent line the curve at the point where \( t = 1 \).
2. Does the curve defined by the polar equation

\[ r = \sec \theta + \tan \theta \]

intersect the vertical line \( x = 2 \)? Explain.
3. Suppose a particle is moving in 3-dimensional space so that its position vector is 
\[ \mathbf{r}(t) = \langle t, t^2, \frac{1}{t} \rangle. \]

(a) Find the tangential component of the particle’s acceleration vector at time \( t = 1 \).

(b) Find all values of \( t \) at which the particle’s velocity vector is orthogonal to the particle’s acceleration vector.
4. Consider the curve in the \( xy \)-plane defined by the position vector function

\[
\vec{r}(t) = (t^2 - 3t, t^2 + 2t)
\]

Find the \( t \)-value of the point of maximum curvature on this curve.
5. Let \( f(x, y) = xe^y - \ln(x + y) \).

(a) Sketch the domain of \( f \).

(b) Find \( f_{xy}(x, y) \).