Name:_____

M344: Calculus III (Su.19)
Final Exam, part I
Thursday, 25 July 2019

WICHITA STATE UNIVERSITY

Instructions. Complete all problems, showing enough work. All work must be done on this paper. You may use two 3×5 in^2 index cards of your own hand-written notes, but you may not use any electronic devices.

Each question is worth 20 points.

---

1. Use a $\delta - \varepsilon$ argument to prove that the limit exists. Show enough work.

$$\lim_{(x,y)\to(0,0)} \frac{9x^2y}{x^2+y^2}$$

2. Consider the space curve C parametrized by the vector function

$$\mathbf{r}(t) = \langle t^2 + 2t, 2t - 1, t^2 - 2t + 1 \rangle.$$

Find formulas for the unit tangent and unit normal vector fields along C: $\mathbf{T}(t)$ and $\mathbf{N}(t)$.

3. Find the maximum and minimum values of the function

$$f(x, y) = x^2 - y^2$$

subject to the constraint $x^2 + 4y^2 = 16$.

4. Reparametrize the curve with respect to arc length measured from the point $P(0, \pi, 1)$ in the direction of increasing t.

$$\mathbf{r}(t) = \langle \sin(4t),\ t,\ \cos(4t) \rangle$$

5. Compute the directional derivative $D_{\mathbf{v}} f(P)$ where $f(x,y) = e^x \sin y - \frac{1}{2} e^x \cos y$, P is the point $(0,\pi)$, and $\mathbf{v}$ makes an angle of $\frac{\pi}{4}$ with the positive x-axis.

scratch page