

EXAM 2(Take Home)

Math 232

March 19, 2007

Name _____

1. Draw the curve $\vec{r}(t) = \langle 2 \cos(2t), 2 \sin(2t), 3t \rangle$. Now compute the curvature at both $t = 0$ and at $t = \frac{\pi}{2}$. On your maple output sketch in (by hand) the radius vector for the osculating circle at the two given points. (8 pts)
2. Find the Binormal vector $\vec{B}(t) = \vec{T}(t) \times \vec{N}(t)$ for the vector function $\vec{r}(t) = \langle t, 2t, t^3 \rangle$ at the point $t = 2$. Now graph the curve and sketch in (by hand) the tangential, normal and binormal vectors at that point. (9 pts)
3. Graph the function $f(x, y) = \frac{3xy}{y - x^2}$ then state the domain and the range for the function. (8 pts)
4. Consider the function $f(x, y) = 10xye^{-x^2-y^2}$. Graph the function choosing a viewpoint and limits that show the major components of the function. Create a contour plot with 15 contour lines (choose your x, y limits wisely) then create a contour plot with contour lines specifically at $z = \frac{1}{e^2}, z = \frac{1}{e}, z = \frac{4}{5}, z = 1, z = \frac{11}{10}, z = \frac{6}{5}, z = \frac{10}{e^2}, z = \frac{7}{5}, z = \frac{3}{2}$. The point $(1, 1, \frac{10}{e^2})$ is on the surface of $f(x, y)$. Place the point $(1, 1)$ on the proper contour line and sketch unit vectors in the x -direction and the y -direction from this point. Use these vectors to *estimate* the value of $f_x(1, 1)$ and $f_y(1, 1)$.

Create a new plot of the surface $f(x, y)$ together with the point $(1, 1, \frac{10}{e^2})$ and the trace (cross-section) for $f(x, y)$ at $x = 1$. Find and sketch the vector that indicates the maximum rate of ascent at $(1, 1)$. (You may draw that vector by hand or with maple but it must be drawn on the surface starting at $(1, 1, \frac{10}{e^2})$.) (15 pts)