SCORE_____ 1. Find the derivative of $\left(\frac{d}{dt}\mathbf{r}(t)\right)$ and evaluate the integral on $t \in [0,1]\left(\int_0^1 \mathbf{r}(t)dt\right)$ of the following function: the following function: $\mathbf{r}(t) = 16t^3\mathbf{i} - 9t^2\mathbf{j} + 25t^4\mathbf{k}$

[10 points]

2. Find the length of the curve $\mathbf{r}(t) = t\mathbf{i} + \frac{2}{3}t^{3/2}\mathbf{k}$ for $0 \le t \le 8$.

3. Find $\mathbf{T}(t)$, $\mathbf{N}(t)$ and curvature κ of $\mathbf{r}(t) = \langle 3 \sin t, 3 \cos t, 4t \rangle$.

[15 points]

4. Find and sketch the domain of the function $f(x, y) = \sqrt{1 + x - y^2}$. Determine its range.

[15 points]

5. Find the following limit, if it exists, if it does not exist explain why.

$$\lim_{(x,y)\to(0,0)}\frac{2x^2y}{x^4+y^2}$$

6. Find all of the first and second partial derivatives of:

$$f(x,y) = x^2y + \cos y + y\sin x$$

[10 points]

7. Find
$$\frac{\partial^3 z}{\partial y \partial x^2}$$
 where $z = \ln (2x + 3y)$.

8. An athlete throws a shot at an angle of 45° to the horizontal at an initial speed of 43 ft/s. It leaves his hand 7ft above the ground. (a)Where is the shot 2 seconds later? (b) How high does the shot go? (c) Where does the shot land? (Assume air resistance is negligable and the only external force is due to gravity, 32 ft/s^2)

9. Draw a contour map for the following function showing at least five level curves.

f(x,y) = 1 - |y|

[5 points]

10. Sketch the curve given by the vector equation.

 $\mathbf{r}(t) = \langle t, \cos 2t, \sin 2t \rangle$

[5 points]