1. **(5 points)** Classify the surface described by the equation $x^2 + 4y^2 - 3z^2 - 6x + 8y + 12z = 10$; if applicable, identify its center and orientation.

2. **(6 points)** Find the arclength of the curve described by $\mathbf{r}(t) = (t^2 - 2t)\mathbf{i} + \frac{8}{3}t^{3/2}\mathbf{j}$ between the values $t = 0$ and $t = 4$.

3. **(5 points)** Find an equation (in either parametric or symmetric form) for the *line* tangent to the curve described by $\mathbf{r}(t) = \langle 6\sqrt{t}, \frac{t^2}{3}, 4t\rangle$ at the point $t = 9$.

4. **(4 points)** Find a vector function which represents the curve of intersection of the surfaces $z = 4x^2 + y^2$ and $y = x^2$.

5. **(2 point bonus)** Prove on the back of the page that the binormal $\mathbf{B}(t)$ is given by $\frac{\mathbf{r}'(t)\times\mathbf{r}''(t)}{|\mathbf{r}'(t)\times\mathbf{r}''(t)|}$.

Friday, September 17, 2010