MATH 213 – QUIZ 3 – 14 FEBRUARY 2008

Answer all of the following questions in the space provided. Show all work as partial credit may be given. Answers without justification, even if they are correct, will earn no credit.

1. (2 pts.) The equation $x^2 + 2y^2 = 3z^2 + 1$ defines a (circle one)

HYPERBOLIC PARABOLOID (HYPERBOLOID (ONE SHEET))

HYPERBOLOID (TWO SHEETS) CYLINDER

2. (3 pts. each) Suppose that $\mathbf{r}(t) = t^3\,\mathbf{i} + 3t^2\,\mathbf{j} + 3\,\mathbf{k}$ is the position of a particle at time t.

(a) Find the particle's velocity and acceleration vectors.

$\vec{r}'(t) = \vec{v}(t) = 3t^2\vec{i} + 6t\vec{j}$ //

$\vec{r}''(t) = \vec{a}(t) = 6t\vec{i} + 6\vec{j}$ //

(b) Write the particle's velocity as the product of its speed and direction.

$\text{speed} = |\vec{r}'(t)| = (9t^4 + 36t^2)^{1/2} = 3t(t^2+1)^{1/2}$

$\vec{v}(t) = \vec{r}'(t) = 3t(t^2+1)^{1/2}\left(\frac{t}{(t^2+1)^{1/2}}\vec{i} + \frac{2}{(t^2+1)^{1/2}}\vec{j}\right)$ //

3. (2 pts.) Find parametric equations for the line tangent to the curve traced out by $\mathbf{r}(t) = 3t^4\,\mathbf{i} + t^3\,\mathbf{j} + 2t^2\,\mathbf{k}$ when $t = 1$.

$\text{direction} = \vec{r}'(1) = 12\vec{i} + 3\vec{j} + 4\vec{k}$ //

$\vec{r}'(t) = 12t^3\vec{i} + 3t^2\vec{j} + 4t\vec{k}$

$\vec{r}'(1) = 12\vec{i} + 3\vec{j} + 4\vec{k}$

$\text{point} \Rightarrow \vec{r}(1) = 3\vec{i} + \vec{j} + 2\vec{k}$

$P = (3,1,2)$ //

$x = 3 + 12t$

$y = 1 + 3t$

$z = 2 + 4t$