

Math 173 - Quiz 4

February 9, 2012

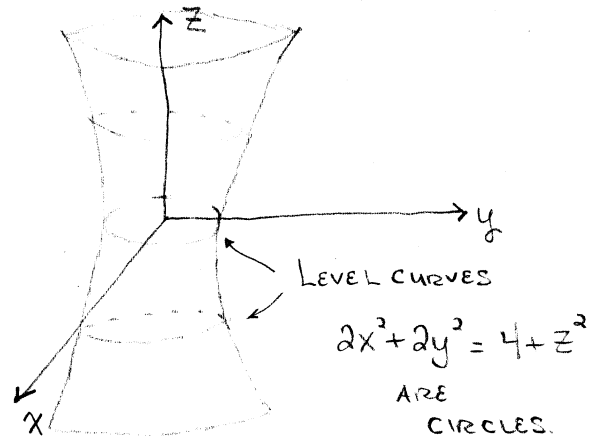
Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (3 points) Describe and draw a rough sketch of the surface defined by $2x^2 + 2y^2 - z^2 = 4$.

HYPERBOLOID OF 1 SHEET



2. (3 points) Find $\vec{r}(t)$ if $\frac{d\vec{r}}{dt} = (t^2 + t)\hat{i} + \frac{1}{t+1}\hat{j} + \sqrt{t}\hat{k}$ and $\vec{r}(0) = \hat{i} + 2\hat{j} + 3\hat{k}$.

$$\vec{r}(t) = \left[\frac{1}{3}t^3 + \frac{1}{2}t^2 + c_1 \right] \hat{i} + \left[\ln|t+1| + c_2 \right] \hat{j} + \left[\frac{2}{3}t^{3/2} + c_3 \right] \hat{k}$$

$$\vec{r}(0) = \hat{i} + 2\hat{j} + 3\hat{k} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k} \Rightarrow c_1 = 1, c_2 = 2, c_3 = 3$$

$$\vec{r}(t) = \left[\frac{1}{3}t^3 + \frac{1}{2}t^2 + 1 \right] \hat{i} + \left[\ln|t+1| + 2 \right] \hat{j} + \left[\frac{2}{3}t^{3/2} + 3 \right] \hat{k}$$

3. (4 points) A rock is thrown from 3 ft above the ground with an initial speed of 65 ft/s and a launch angle of 60° . Find the rock's maximum height and the location where it hits the ground.

$$\vec{r}(t) = \frac{65}{2}t \hat{i} + \left(-16t^2 + \frac{65\sqrt{3}}{2}t + 3 \right) \hat{j}$$

HITS GROUND WHEN

$$-16t^2 + \frac{65\sqrt{3}}{2}t + 3 = 0$$

$$\Rightarrow t = 3.570738\dots$$

MAX HEIGHT WHEN

$$-32t + \frac{65\sqrt{3}}{2} = 0$$

$$t = \frac{65\sqrt{3}}{64} \approx 1.759 \text{ sec}$$

LOCATION IS

$$\approx \frac{65}{2}(3.57) = \boxed{116.025 \text{ FT}}$$

MAX HEIGHT IS

$$-16 \left(\frac{65\sqrt{3}}{64} \right)^2 + \frac{65\sqrt{3}}{2} \left(\frac{65\sqrt{3}}{64} \right) + 3 = \frac{13443}{256} \approx 52.51 \text{ FT}$$