Math 241, Spring 1998, exam 2

There are 10 problems on 5 pages. Each problem is worth 10 points. SHOW your work. $\boxed{CIRCLE}$ your answer. **NO CALCULATORS!** CHECK your answer, whenever possible.

1. Graph and label the level sets of $f(x, y) = y^2 - x^2$ which correspond to $c = 1$, $c = 0$, and $c = -1$.

2. Graph $z = y^2 - x^2$ in $3-$space.

3. Graph $x^2 + y^2 - z^2 = 0$ in $3-$space.

4. **(There is no partial credit for this problem. Make sure your answer is correct.)** Find the equation of the plane through $(0, 1, 1)$, $(1, 3, -2)$, and $(3, 1, 4)$.

5. Find the equations of the line tangent to $\overrightarrow{r}(t) = 2t \overrightarrow{i} + 3t^2 \overrightarrow{j} + 4t^3 \overrightarrow{k}$ at $t = 1$.

6. Find the intersection of $\dfrac{x - 3}{1} = \dfrac{y + 1}{-2} = \dfrac{z - 10}{3}$ and $2x + 3y = z$.

7. Find the length of the curve $\overrightarrow{r}(t) = \sqrt{6}t^2 \overrightarrow{i} + \frac{2}{3}t^3 \overrightarrow{j} + 6t \overrightarrow{k}$ for $3 \le t \le 6$.

8. Find the point on $2x + y + 2z = 4$ which is closest to $(1, 2, 3)$.

9. **(There is no partial credit for this problem. Make sure your answer is correct.)** Let $\overrightarrow{a} = 1 \overrightarrow{i} + 2 \overrightarrow{j} - 3 \overrightarrow{k}$ and $\overrightarrow{b} = 2 \overrightarrow{i} - 2 \overrightarrow{j} + 3 \overrightarrow{k}$. Find vectors $\overrightarrow{u}$ and $\overrightarrow{v}$ with $\overrightarrow{b} = \overrightarrow{u} + \overrightarrow{v}$, $\overrightarrow{u}$ parallel to $\overrightarrow{a}$, and $\overrightarrow{v}$ perpendicular to $\overrightarrow{a}$.

10. Let $f(x, y) = x \cos y + (\ln x) \sin(xy)$. Find f_x.