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 $\overrightarrow{\boldsymbol{r}}(t)=2t\,\overrightarrow{\boldsymbol{i}}+3t^2\,\overrightarrow{\boldsymbol{j}}+4t^3\,\overrightarrow{\boldsymbol{k}}$ 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 $\overrightarrow{\boldsymbol{r}}(t)=\sqrt{6}t^2\,\overrightarrow{\boldsymbol{i}}+\frac{2}{3}t^3\,\overrightarrow{\boldsymbol{j}}+6t\,\overrightarrow{\boldsymbol{k}}$ 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 $\overrightarrow{\boldsymbol{a}}=1\,\overrightarrow{\boldsymbol{i}}+2\,\overrightarrow{\boldsymbol{j}}-3\,\overrightarrow{\boldsymbol{k}}$ and $\overrightarrow{\boldsymbol{b}}=2\,\overrightarrow{\boldsymbol{i}}-2\,\overrightarrow{\boldsymbol{j}}+3\,\overrightarrow{\boldsymbol{k}}$. Find vectors $\overrightarrow{\boldsymbol{u}}$ and $\overrightarrow{\boldsymbol{v}}$ with $\overrightarrow{\boldsymbol{b}}=\overrightarrow{\boldsymbol{u}}+\overrightarrow{\boldsymbol{v}}$, $\overrightarrow{\boldsymbol{u}}$ parallel to $\overrightarrow{\boldsymbol{a}}$, and $\overrightarrow{\boldsymbol{v}}$ perpendicular to $\overrightarrow{\boldsymbol{a}}$.

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