Homework 3

Math 3302, Fall 2018

Due September 19

For each problem, you must show your work (as applicable) to receive credit - if we cannot determine how you performed any step then it will be marked incorrect. While you may use electronic devices to check your work, you should be able to do all of these problems without electronic assistance, since all exams will not allow electronic devices.

1. Use traces to sketch and identify surfaces in space defined by the following equations:

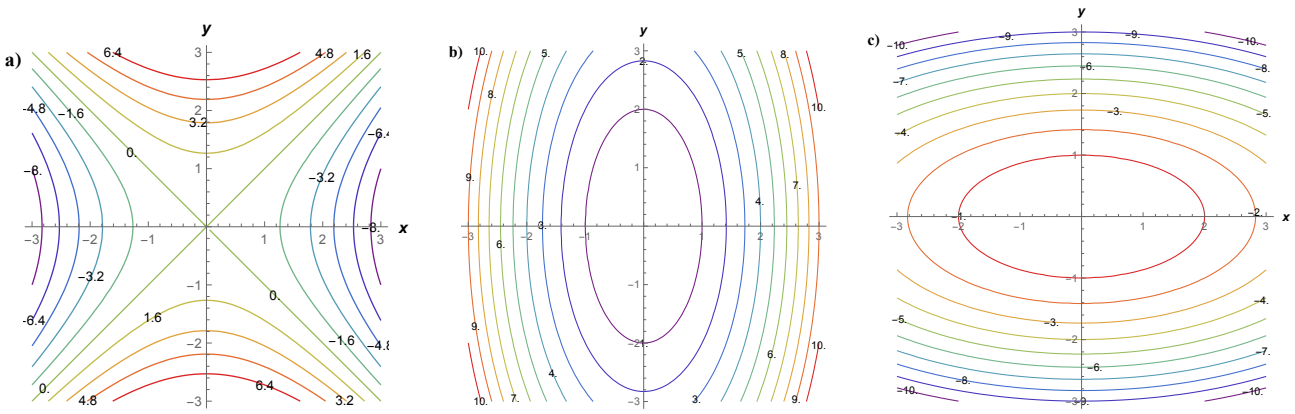
(a) $y = -z + 1$

(b) $x^2 + y^2 = 3$

(c) $x + 4y^2 + 9z^2 = 0$

(d) $x = y^2 - z^2$

2. To each of the three contour plots in the figure bellow, assign one of the following six equations. Look carefully at the labels of each level curve, and think very carefully about the relationship between the shape of the contours and the form of the equations.



$i)\ z = x^2 + \left(\frac{y}{2}\right)^2$ $\quad$ $iv)\ z = -x^2 + y^2$

$ii)\ z = x^2 - y^2$ $\quad$ $v)\ z = \left(\frac{x}{2}\right)^2 + y^2$

$iii)\ z = -x^2 - \left(\frac{y}{2}\right)^2$ $\quad$ $vi)\ z = -\left(\frac{x}{2}\right)^2 - y^2$

3.(a) Consider the two surfaces $\rho = 3\csc\phi$ (given in spherical coordinates) and $r = 3$ (given in cylindrical coordinates). Are they the same surface, or are they different surfaces? Explain your answer.

3.(b) Consider the two surfaces $\sin\{\phi\} = \cos\{\phi\}$ (given in spherical coordinates) and $z = \sqrt{r^2}$ (given in cylindrical coordinates). Are they the same surface, or are they different surfaces? Explain your answer.

4. At what point(s) does the curve $\vec{r}(t) =< t, 2t - t^2, 0 >$ intersect the paraboloid $y = x^2 + z^2$?

5. Consider the curve $\mathbf{r}(t) = \left\langle e^{-t}\cos t, e^{-t}\sin t, te^{-t^2} \right\rangle$

(a) Find $\mathbf{r}'(t)$, $\mathbf{T}'(1)$, $\mathbf{r}''(t)$, and $\mathbf{r}'(t) \times \mathbf{r}''(t)$

(b) Find the vector equation for the tangent line to the point where $t = 0$.

6. Let $y = x^2$ be the parabolla in the $xy-$plane parametrized by $\vec{r}(t) = \langle t, t^2, 0\rangle$. What are the vectors $\vec{T}$, $\vec{N}$, and $\vec{B}$ at the origin?

7. Evaluate the integral

$$\int_1^2 \left(t^2\vec{i} + t\sqrt{t-1}\vec{j} + t\sin(\pi t)\,\vec{k}\right) dt$$