San José State University

Math 32, Fall 2008

Practice Final Exam

December 12, 2008

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Total

Explain your work
1. (20 points) Find the set of all points at which the function

\[ f(x, y) = \begin{cases} 
\frac{xy}{x^2 + xy + y^2} & \text{if } (x, y) \neq (0, 0) \\
0 & \text{if } (x, y) = (0, 0).
\end{cases} \]

is continuous.

Solution:
2. (20 points) If $u = f(x, y)$, where $x = e^s \cos t$ and $y = e^s \sin t$, show that

$$u_{xx} + u_{yy} = e^{-2s}(u_{ss} + u_{tt}).$$

Solution:
3. (20 points) Are there any points on the hyperboloid \( x^2 - y^2 - z^2 = 1 \) where the tangent plane is parallel to the plane \( z = x + y \)? Justify your answer.

Solution:
4. **(20 points)** Find the extreme values of the function

\[ f(x, y) = 2x^2 + 3y^2 - 4x - 5 \]

on the region \( D = \{(x, y) : x^2 + y^2 \leq 16\} \).

Solution:
5. (20 points) Compute the double integral
\[ \int \int_D (x + y) \, dA, \]
where \( D \) is the disk of radius 2 centered at the origin.

Solution:
6. **(20 points)** Find the volume of the solid bounded by the cylinder \( y = x^2 \) and the planes \( z = 0, \ z = 4 \) and \( y = 9 \).

Solution: