

Math 241 Exam 2 Sample 4

Directions: Do not simplify unless indicated. No calculators are permitted. Show all work as appropriate for the methods taught in this course. Partial credit will be given for any work, words or ideas which are relevant to the problem.

Please put problem 1 on answer sheet 1

1. Define $f(x, y) = x^2 + 6xy - 2y^3$.
 - (a) Find the directional derivative of $f(x, y)$ in the direction of $\hat{i} - \hat{j}$ at $(2, 2)$. [7 pts]
 - (b) Find the two critical points for $f(x, y)$. [5 pts]
 - (c) For each critical point determine if it is a relative maximum, minimum or saddle point. [8 pts]
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Please put problem 2 on answer sheet 2

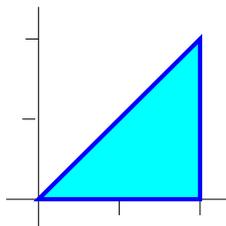
2.
 - (a) If $z = x^2y + x$ and $x = 2s + t$ and $y = t \sin s$ use the chain rule to find $\frac{\partial z}{\partial t}$ in terms of s and t . [10 pts]
 - (b) Find the equation of the plane tangent to $f(x, y) = x^2y + y^2$ at the point $(1, 2, 6)$. [10 pts]
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Please put problem 3 on answer sheet 3

3.
 - (a) Sketch the surface $z = \sqrt{4 - x^2 - y^2}$. Be sure to include some tick marks or coordinates to give a sense of scale/position. Write the name of the surface. [5 pts]
 - (b) Sketch the surface $y = x^2$. Write the name of the surface. [5 pts]
 - (c) Write down the equation of the sphere of radius 2 with center at $(2, 0, 0)$. [5 pts]
 - (d) Write down the equation of the paraboloid opening down with vertex at $(0, 0, 4)$. [5 pts]
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Please put problem 4 on answer sheet 4

4. Find the maximum and minimum values of $f(x, y) = xy + x^2$ on the triangle shown: [20 pts]



Please put problem 5 on answer sheet 5

5. Use Lagrange multipliers to find the maximum and minimum values of the function $f(x, y) = xy + 2y$ on the circle $x^2 + y^2 = 4$. [20 pts]
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Extra Credit. Put your answer to this in a box on page 3:

What is Justin's favorite sport?

[2 pts]