

Math 241 Exam 2 Sample 1

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. Let $f(x, y) = 3x^2 + 6xy - 2y^3$.
 - (a) Find the directional derivative of $f(x)$ in the direction of $3\hat{i} + \hat{j}$. [5 pts]
 - (b) Find the two critical points for f . [6 pts]
 - (c) For each critical point, determine if that critical point is a relative minimum, relative maximum, or saddle point. [9 pts]
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Please put problem 2 on answer sheet 2

2. (a) Let $f(x, y) = |x| + y$. On a single plane draw the level curves for $c = 0, 1$ and 2 and label each with its value of c . [10 pts]
 - (b) Find the parametric equations of the line which is perpendicular to the surface $f(x, y) = x^2y + y^3$ at the point $(1, 2)$. [10 pts]
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Please put problem 3 on answer sheet 3

3. (a) Sketch the surface $z = 1 + \sqrt{x^2 + y^2}$. Be sure to include some points or tick marks to give a sense of scale/position. [5 pts]
 - (b) Sketch the surface $z = 2$. Be sure to include some points or tick marks to give a sense of scale/position. [5 pts]
 - (c) Write down the equation for the cylinder of radius 3 which runs along the x -axis. [5 pts]
 - (d) Write down the equation for the paraboloid opening down with vertex at $(0, 0, 7)$. [5 pts]
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Please put problem 4 on answer sheet 4

4. Find the maximum and minimum values of the function $f(x, y) = 3x^2 + y^2$ on the region $x^2 + y^2 \leq 2, y \geq 0$. [20 pts]
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Please put problem 5 on answer sheet 5

5. Use Lagrange multipliers to find the maximum and minimum values of the function $f(x, y) = xy + 2x$ on the curve $x^2 + y^2 = 4$. [20 pts]
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The End