

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. (a) Sketch the graph of the surface $y = x^2$. Include some sense of size/position. Name the shape. [5 pts]
 - (b) Write down the equation for the cylinder of radius 6 centered around the x -axis. [5 pts]
 - (c) All together on one xy -plane sketch the level curves for $f(x, y) = x - y^2$ for $c = 0, 2, 4$. Label each with its value of c . [10 pts]
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Please put problem 2 on answer sheet 2

2. (a) Given $f(x, y) = x^2y + 3xy$, find the directional derivative of f in the direction of $2\mathbf{i} - 3\mathbf{j}$ at the point $(1, 2)$. [12 pts]
 - (b) Given $z = x^2y$ and $x = st^2$ and $y = t^3$ use the Chain Rule to calculate $\frac{\partial z}{\partial t}$. [8 pts]
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Please put problem 3 on answer sheet 3

3. Find all points where the level surface $x - y^3 + z^2 = 0$ is parallel to the plane $3x - 9y + 24z = 10$. [20 pts]
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Please put problem 4 on answer sheet 4

4. Find all three of the critical points for the function $f(x, y) = x^2y - 2x^2 - y^2$. For each critical point calculate if it is a relative maximum, relative minimum or saddle point. [20 pts]
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Please put problem 5 on answer sheet 5

5. Use Lagrange Multipliers to find the maximum and minimum of $f(x, y) = 2x + xy$ with the constraint $x^2 + y^2 = 4$. Your system should have three solutions. [20 pts]
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The End and the TA Section List

Avi	0311 ↔ 10:00	0321 ↔ 11:00
Zeynep	0312 ↔ 10:00	0322 ↔ 11:00
Jialin	0331 ↔ 12:00	0341 ↔ 1:00
Zack	0332 ↔ 12:00	0342 ↔ 1:00