

Chapter 10 Checkpoint part a

Directions:

- You will have 1.5 hours to complete as many of the following questions as you can. When you begin the checkpoint, please write down the current time at the top of your cover page, and leave a space to write the time you finish. When you finish please immediately write the time.
- You may use your notes, the book, and any materials posted on the course website. Also, feel free to ask me clarifying questions or about typos. You may not use any other resource. In particular, you may not use any other resource on the internet, you may not use a computer to assist you with graphing or computations (unless the problem explicitly states otherwise) and you may not discuss the problems with anyone else.
- Each problem corresponds to a standard and specifically asks about that standard. You may complete as many or as few of the problems as you wish.
- If you have a question about any of the problems, or think there is an error please email me immediately. Also, if something occurs during your allotted time or some other special circumstance arises, please email me immediately.
- This last direction might feel strange or contrived but it has actually been shown to help you do better on assessments like these. Before you start please write out the following statement or rephrase it in your own words:

I am a problem solver and my mind grows everyday. I improve with lots of practice. I learn from my mistakes. Learning is my superpower.

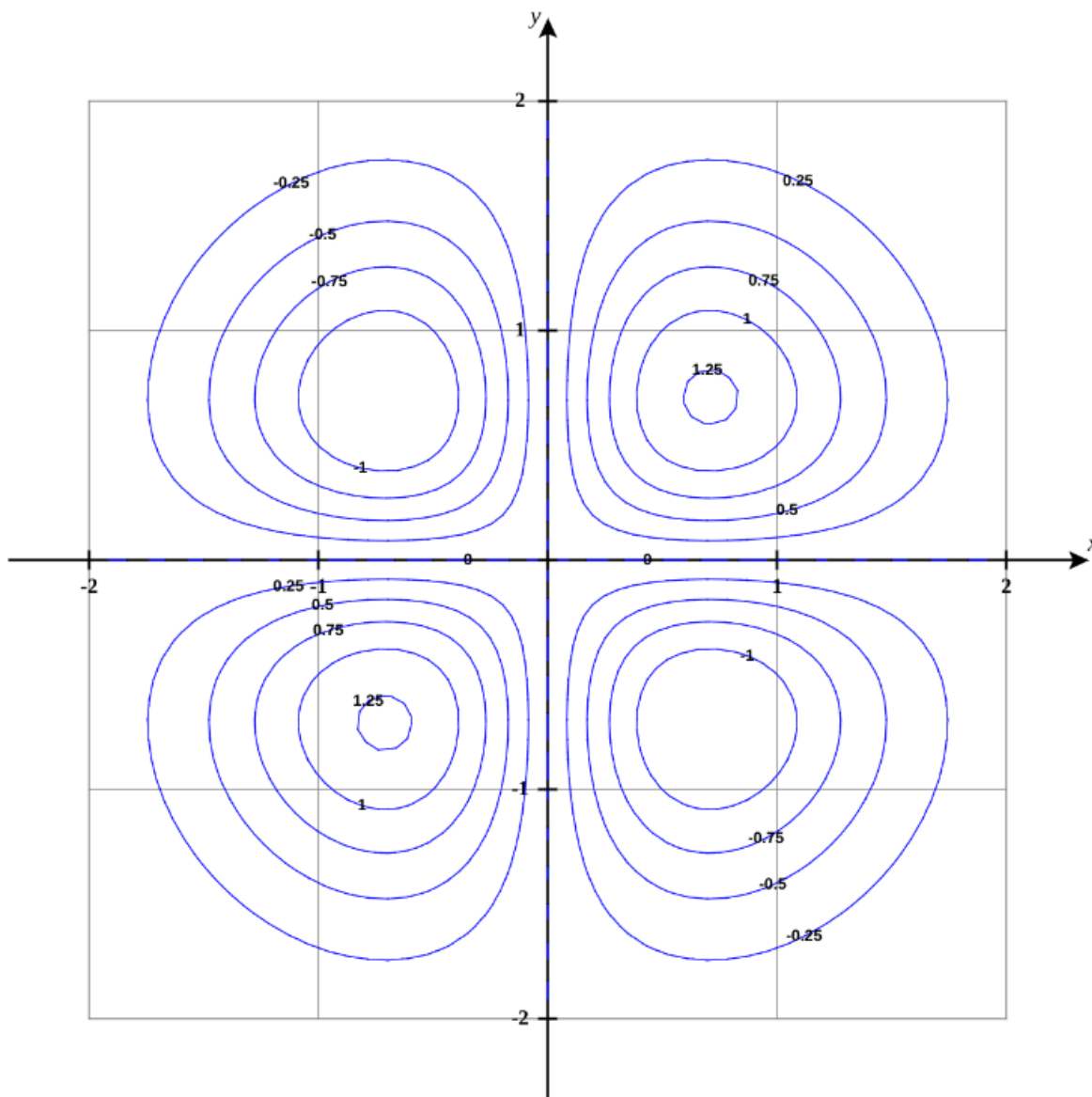
Chapter 10: I can calculate, use, and interpret partial derivatives.

- ☐ D.1 ** I can evaluate limits of functions of two variables.
- ☐ D.2 I can evaluate and interpret first-order partial derivatives of functions of two variables using formulas, tables, graphs, and contour maps.
- ☐ D.3 I can evaluate and interpret second-order partial derivatives of functions of two variables using formulas, tables, graphs, and contour maps.
- ☐ D.4 I can find equations of tangent planes for functions of two variables and use them to approximate function values.
- ☐ D.5 ** I can compute and interpret derivatives using various chain rules.
- ☐ D.6 I can evaluate and interpret directional derivatives and gradients of functions of multiple variables.
- ☐ D.7 I can find and classify critical points of functions of two variables.

D.1 Consider the function $f(x, y) = \frac{xy}{\sqrt{x^4 + y^4}}$. Does the limit $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$ exist? Regardless of your answer make sure to justify it by showing your work and writing a few sentences of explanation.

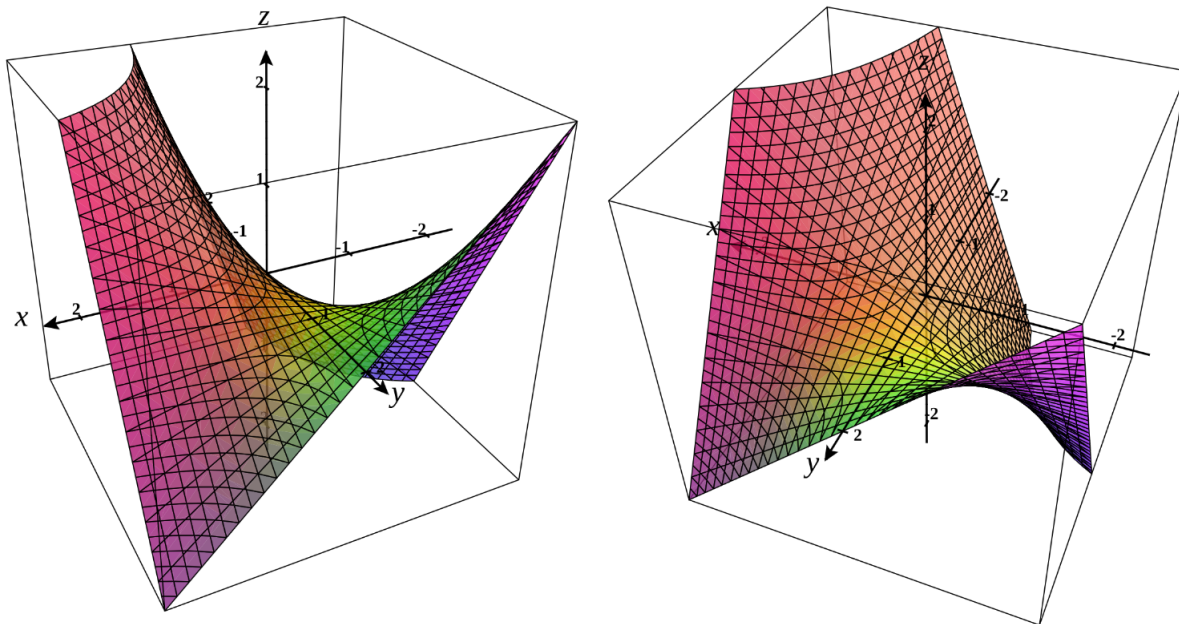
D.2 (a) Consider $f(x, y) = e^y + \sin(yx)$. Compute $f_x(x, y)$ and $f_y(x, y)$

(b) Consider the contour plot of $g(x, y)$ below.



- i. Estimate a point at which $g_x(x, y)$ is positive. Write a sentence explaining your answer.
- ii. Estimate a point at which $g_y(x, y)$ is positive. Write a sentence explaining your answer.
- iii. Estimate a point at which $g_x(x, y)$ is zero. Write a sentence explaining your answer.

D.3 Below are two images (to help give perspective) of the graph of a function $f(x, y)$.



- (a) Is $f_{xx}(0, 1)$ positive? Negative? Zero? Justify your answer with a written explanation and possibly a picture.
- (b) Is $f_{yx}(0, 1)$ positive? Negative? Zero? Justify your answer with a written explanation and possibly a picture.

D.4 Use the tangent plane of $z = \sin(x)e^y$ at $(\pi/2, 0, 1)$ to estimate $\sin(\pi/2 + 0.1)e^{-0.1}$ by hand.