

MATH 201. Final Exam Material.

I-On limits:

1) Do all the homework problems in 14.2.

2)

Find the following limits:

(a) $\lim_{(x,y) \rightarrow (0,0)} \frac{x^3 + y^6}{x^3}$

(b) $\lim_{(x,y) \rightarrow (0,0)} \frac{x + y}{x^2 + y + y^2}$

12. Show that the following limits exist:

a. $\lim_{(x,y) \rightarrow (1,2)} \frac{xy - y}{x^2 - x + 2xy - 2y}$

b. $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 + y^2}{\ln(x^2 + y^2)}$

13. Show that $\lim_{(x,y) \rightarrow (-1,1)} \frac{x^2 - 1}{y - 1}$ does not exist by using the following two paths:

$y = x^2$ and $y = -x$.

Use polar coordinates to show that $\lim_{(x,y) \rightarrow (0,0)} \frac{3y}{(x^2 + y^2)^2 + xy + y}$ exists.

Evaluate the following limit, or show that it does not exist: $\lim_{(x,y) \rightarrow (0,0)} \frac{2xy}{x^2 + 2y^2}$.

II- On partial derivatives:

1) Do all the homework problems in 14.3.

2) Let $f(x, y) = \tan^{-1}(xy^2)$. Find ALL its second partial derivatives.

3) Let $f(x, y) = \cos(x - 2y) + \ln(x - 2y)$. Find $\frac{\partial f}{\partial x}$, $\frac{\partial^2 f}{\partial x^2}$ and $\frac{\partial^2 f}{\partial y \partial x}$

III- On functions of several variables in general

1) Do all homework problems in 14.1:

2)

- a. Find the domain of the function $f(x, y) = \sqrt{16 - x^2 - y^2}$
- b. Identify the level curves of this function.