
Attention!  Please, note that this is the closed book test.  You are not allowed to use graphing calculator.  Simple calculators are allowed.  Please, show all important steps in you solution but do not make your solution excessively long.

1. (15pt) The equation of the surface in cylindrical coordinates is

\[ r^2 - 4r \cos \theta + z^2 = 5. \]

Write the corresponding equation in Cartesian coordinates.
2. (20pt) Check if the following function is continuous at \((0, 0)\):

\[
  f(x, y) = \frac{x^2 y^2}{x^4 + y^4}, \quad f(0, 0) = 0.
\]
3. (15pt) Find the directional derivative of the function

\[ f(x, y) = x^3 y - xy - 2 \]

at (1, 2) in the direction of the vector (3, 4).
4. (20pt) Let

\[ f(x, y) = xy, \quad x(s, t, r) = s^2 - t + r/2, \quad y(s, t, r) = \sqrt{sr} + t. \]

Find

\[ \frac{\partial}{\partial s} f(x(s, t, r), y(s, t, r)) \]
5. (15pt) Sketch the graph of the function of two variables

\[ f(x, y) = y - x^2 \]
6. (15pt) Write the equation of the tangent plane to the surface
\[ \sin^2(x) + y^2 - \tan(z) = 0 \]
at \((\pi/2, 1, \pi/4)\). 

1. Blah
2. Blah
3. Blah
4. Blah