

408L CLASS PROBLEMS

MARCH 9TH, 2020

Problem 1. For each of the following functions $f(x, y)$, find $\frac{\partial}{\partial x}f(x, y)$ and $\frac{\partial}{\partial y}f(x, y)$.

(1) $f(x, y) = x^2 + 2xy + y^2$.

(2) $f(x, y) = \sin(xy)$.

(3) $f(x, y) = ye^{x^2+y^2}$.

(4) $f(x, y) = \frac{x}{y}$.

(5) $f(x, y) = x^y$.

Problem 2. The Laplace equation $(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2})f(x, y) = 0$ tells when a function $f(x, y)$ returns the temperature of a 2-dimensional room *at thermal equilibrium*.

Which of the following functions satisfy the heat equation?

(1) $f(x, y) = xy$.

(2) $f(x, y) = x^2 - y^2$.

(3) $f(x, y) = x^2 + y^2$.

(4) $f(x, y) = \log(x^2 + y^2)$.

(5) $f(x, y) = \frac{x}{x^2+y^2}$.

(6) $f(x, y) = \sin(y)e^x$.