IN-CLASS QUESTIONS FOR 14 DEC 2020

MATH1014 (CALCULUS), SPRING SEMESTER, 2020

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(1) Suppose $(1,1)$ is a critical point of a function f with continuous second derivatives. In each case, what can you say about f?
   (a) $f_{xx}(1,1) = 4$, $f_{xy}(1,1) = 1$, $f_{yy}(1,1) = 2$.
   (b) $f_{xx}(1,1) = 4$, $f_{xy}(1,1) = 3$, $f_{yy}(1,1) = 2$.

(2) Find and classify the critical points of the following functions.
   (a) $f(x,y) = xy + \frac{1}{x} + \frac{1}{y}$.
   (b) $f(x,y) = \sin x \sin y, \quad -\pi < x < \pi, \quad -\pi < y < \pi$.

(3) Find the extreme vales of f subject to the given constraints:
   (a) $f(x,y) = xyz, \quad x^2 + 2y^2 + 3z^2 = 6$.
   (b) $f(x,y,z) = x^2 + y^2 + z^2, \quad x - y = 1, \quad y^2 - z^2 = 1$.

(4) Find the maximum and minimum volumes of a rectangular box whose surface area is 1500 square cm and whose total edge length is 200cm.

(5) Calculate the following double integrals.
   (a) $\displaystyle\iint_R \frac{xy^2}{x^2+1}\, dA$, where $R = [0,1] \times [-3,-3]$.
   (b) $\displaystyle\iint_R \frac{\ln y}{xy}\, dA$, where $R = [1,3] \times [1,5]$.

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