

Bago University

Department of Mathematics

First Semester Examination, March 2019

Second Year (B.Sc)

Math 2102

(Mathematics Specialization)

Calculus of Several Variables

Time Allowed: (3) Hours

Answer ALL Questions.

- 1.(a) Find $\frac{\partial f}{\partial x}$, $\frac{\partial f}{\partial y}$ and $\frac{\partial f}{\partial z}$ if $f(x, y, z) = \sin^{-1}(xyz)$.
- (b) Find the derivative of $f(x, y) = xe^y + \cos(xy)$ at the point $(2, 0)$ in the direction of $\underline{v} = 3\hat{i} - 4\hat{j}$.
- 2.(a) Find the equation for the tangent plane and normal line of the surface
 $f(x, y, z) = x^2 + y^2 + z^2 = 3$ at the point $P_0(1, 1, 1)$.
- (b) Use Taylor's Formula, find a quadratic approximation to $f(x, y) = \sin x \sin y$ near the origin.
- 3.(a) Find the linearization of $f(x, y) = e^x \cos y$ at the point $\left(0, \frac{\pi}{2}\right)$.
- (b) Find the local extrema values of $f(x, y) = 3y^2 - 2y^3 - 3x^2 + 6xy$.
- 4.(a) Find the volume of the region bounded above by the surface $z = 4 - y^2$ and below by the rectangle $R : 0 \leq x \leq 1, 0 \leq y \leq 2$.
- (b) Sketch the region bounded by the given lines $y = 0, x = 0$ and $x = \ln 2$ and the curve $y = e^x$. Then express the regions area as iterated double integral and evaluate the integral.
- 5.(a) Change the Cartesian integral into an equivalent polar integral. Evaluate the polar integral
$$\int_{-1}^1 \int_0^{\sqrt{1-x^2}} dy dx.$$
- (b) Evaluate the integral $\int_0^3 \int_0^{\sqrt{9-x^2}} \int_0^{\sqrt{9-x^2}} dz dy dx.$
- 6.(a) Convert the integral $\int_{-1}^1 \int_0^{\sqrt{1-y^2}} \int_0^x (x^2 + y^2) dz dx dy$ to an equivalent integral in Cylindrical coordinates and evaluate the result.

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(b) Evaluate the integral $\int_0^4 \int_{x=\frac{y}{2}}^{x=(\frac{y}{2})+1} \frac{2x-y}{2} dx dy$. By applying the transformation

$u = \frac{2x-y}{2}, v = \frac{y}{2}$ and integrating over an appropriate region in the uv-plane.
