The Islamia University of Bahawalpur

Department of Mathematics

Objective

Time Allowed: 10 Minutes **Total Marks: 10**

Question No 1:

Choose the most appropriate option. Overwriting and cutting is not allowed.

1. $\lim_{(x,y)\to(1,1)} \frac{xy-y-2x+2}{x-1} = ?$:
   a. 1
   b. – 1
   c. 10
   d. None of these

2. **The function f(x, y, z) = $x^2 + y^2 - 2z^2$ is continuous at P(x , y, z):**
   a. P(1, 0, 1)
   b. P(1, 0, O)
   c. Every point in space
   d. None of these

3. **The partial derivative of f(x, y) w.r.t. y at point (x_0, y_0) is**:
   a. $\lim_{h\to 0} \frac{f(x_0, y_0+h)-f(x_0,y_0)}{h}$
   b. $\lim_{h\to 0} \frac{f(x_0, y_0-h)-f(x_0,y_0)}{h}$
   c. $\lim_{h\to 0} \frac{f(x_0+h, y_0)-f(x_0,y_0)}{h}$
   d. None of these

4. **The 3-dimensional Laplace equation is:**
   a. $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 y}{\partial y^2} = 0$
   b. $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + \frac{\partial^2 z}{\partial z^2} = 0$
   c. $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + \frac{\partial^2 f}{\partial z^2} = 0$
   d. None of these

5. **If *f*(x, y) = xe^y + cos(xy), then $f_x(2, 0)$ is:**
   a. 2
   b. 0
   c. 7
   d. None of these

6. **A bounded above and monotonic increasing sequence is**

a. Convergent
b. Divergent
c. Not a sequence
d. None of these

7. The equation of tangent to the ellipse $\frac{x^2}{4} + y^2 = 2$ at point P(- 2, 1) is:

a. x – 2y = 4
b. x – y = - 4
c. x + 2y = 4
d. x – 2y = - 4

8. If $\vec{A} = x^2 z\hat{i} - 2y^3 z^2 \hat{j} + xy^2 z\hat{k}$, then $\nabla \cdot \vec{A}$ at point (1, -1, 1) is:

a. 2
b. – 3
c. 4
d. None of these

9. An interior point of the domain of a function f(x,y) where both f_x and f_y are zero or not exit is a:

a. Critical point
b. Saddle point
c. Both (a) & (b)
d. None of these

10. The function *f*(x, y) has a local minimum at (a, b):

a. If $f_{xx} > 0$ and $f_{xx} f_{yy} - f_{xy}^2 > 0$
b. If $f_{xx} > 0$ and $f_{xx} f_{yy} - f_{xy}^2 < 0$
c. If $f_{xx} < 0$ and $f_{xx} f_{yy} - f_{xy}^2 > 0$
d. None of these

Subjective

Time Allowed: 80 Minutes **Total Marks: 15**

Note: Attempt any two (2) questions.

Question No 2: **(04+3.5)**

(a) If **A** and **B** are differentiable vector point functions, and ϕ is a differentiable scalar point function, the prove that $\nabla\cdot(\phi\vec{A}) = \phi(\nabla\cdot\vec{A}) + \vec{A}\cdot(\nabla\phi)$.

(b) Derive the vector equation of a straight line passing through two points in space.

Question No 3: **(4+3.5)**

(a) Evaluate f_x, f_y and f_{xy}, if $f(x, y) = x^2 + y^2 - 2xy - x + 3y - z - 4$.

(b) Find the distance of the point Q(1, 1, 5) to the line passing through P(1, 3, 0) and parallel to the vector $\vec{B} = \hat{i} - \hat{j} + 2\hat{k}$.

Question No 4: **(2.5+2.5+2.5)**

(a) Find the local maxima, local minima and saddle points of the function $f(x, y) = x^2 + 3xy + 3y^2 + 4x + 4y - 4$.

(b) Evaluate: $\int_0^1 \int_{2y}^{2} 4\cos(x^2)\,dxdy$.

(c) Evaluate: $\int_0^{\pi} \int_0^{\pi} \int_0^{\pi} \cos(x + y + z)\,dxdydz$