King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

MATH 201 - Exam II - Term 131

Duration: 120 minutes

Name:______________________________ ID Number:______________________________

Section Number:____________________ Serial Number:___________________________

Class Time: _________________________ Instructor's Name:_______________________

Instructions:

1. Write your name, ID number and Section number on the examination paper on the given answer sheet for the MCQS.
2. Write neatly and eligibly. You may lose points for messy work.
3. Show all your work. No points for answers without justification.
4. Make sure that you have 10 pages of problems
5. The maximum point for each page is 10
6. All types of calculators, pagers or mobile phones are NOT allowed during the examination.
7. Use a good eraser. DO NOT use the erasers attached to the pencil.
8. Calculators and Mobiles are not allowed.

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1. Find an equation for the plane passing through the point $Q(-1, -4, 5)$ and containing the line with parametric equations

$$x = 1 - t,\ y = 2t - 3,\ z = t.$$

2. A) Find $\dfrac{\partial z}{\partial y}$ if z is defined implicitly as a function of x and y by the equation

$$\sin(xyz) = x + 2y + 3z$$

B) Give an equation for the tangent plane to the surface $x^2 + y^3 + z^2 = 0$ at the point $(2, -2, 2)$.

3. A) Sketch the surface given by $z = x^2 - 4$

B) Find and sketch the domain of

$$f(x,y) = \sqrt{x} + \sqrt{y-x}$$

4. Let $f = f(x, y)$ such that

$$(D_{\vec{j}}f)|_{(1,1)} = -\sqrt{2} \text{ and } (D_{\vec{u}}f)|_{(1,1)} = 3, \text{ where } \vec{u} = \left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle.$$

Find $(D_{\vec{v}}f)|_{(1,1)}$ if $\vec{v} = \frac{1}{\sqrt{3}}\langle 1, \sqrt{2}\rangle$.

5. Consider the function

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

A) In what direction (unit vector) does f decrease most rapidly at $(-1, 1)$?

B) In what direction is the rate of change of f at $(-1, 1)$ equal to zero. (Find all directions).

6. The quadratic surface given by $4x^2 - 2y^2 - z^2 + 1 = 0$ is

   a) A hyperboloid of one sheet
   b) A cone
   c) An ellipsoid
   d) A hyperboloid to two sheets
   e) A paraboloid

7. Let $z = x^3y^2 + y^3x$, where $x = u^2 + v^2$, $y = u - v^2$.
   $\frac{\partial z}{\partial v}$ when $u = 1$ and $v = 1$ is equal to

   a) 0
   b) 3
   c) 2
   d) 1
   e) -1

8. If $L = \lim_{(x,y)\to(0,0)} \dfrac{3xy^2}{x^2+y^4}$ then

a) L does not exist
b) $L = 0$
c) $L = \dfrac{3}{2}$
d) $L = 3$
e) $L = \dfrac{3}{4}$

9. The line

$$x = 2 + 3t,\ y = 1 + 2t,\ z = -1 - t$$

intersects the plane $2x - 3y + 4z = 13$ at the point

a) $(-10, -7, 3)$
b) $(2, 1, -1)$
c) $(1, -1, 0)$
d) $(0, 2, 7)$
e) $(0, 0, 3)$

10. If $f(x, y, z) = e^x + \cos(y + z)$, then the linearization $L(x, y, z)$ of f at the point $\left(0, \frac{\pi}{4}, \frac{\pi}{4}\right)$ is given by

a) $L(x, y, z) = x - y - z + 1 + \frac{\pi}{2}$

b) $L(x, y, z) = \frac{\pi}{2}x + 3y - z + 1$

c) $L(x, y, z) = x - y + z - \frac{\pi}{4}$

d) $L(x, y, z) = \frac{\pi}{4}x + \frac{\pi}{2}y - z + 1$

e) $L(x, y, z) = 2x - y + \pi z + 1$

11. A vector $\vec{u}$ that is normal to the surface $x^2 + y^2 - 2z^2 = 0$ at $(1, 1, 1)$ is given by

a) $\vec{u} = < 2, 2, -4 >$

b) $\vec{u} = < 1, -3, 0 >$

c) $\vec{u} = < -1, -1, 4 >$

d) $\vec{u} = < -1, 1, 4 >$

e) $\vec{u} = < 1, 1, 0 >$

12. A direction vector $\vec{u}$ of the line of intersection of the planes $x + y + 3z = 1$ and $x - y + 2z = 0$ is given by

a) $\vec{u} = < 5, 1, -2 >$

b) $\vec{u} = < 1, -1, 0 >$

c) $\vec{u} = < 1, 1, 3 >$

d) $\vec{u} = < 1, -1, 2 >$

e) $\vec{u} = < 3, 1, 0 >$

13. The distance from the point $(1, 6, -1)$ to the plane $2x + y - 2z = 19$ is equal to

a) 3

b) 2

c) 19

d) 4

e) 1

14. If $w = \ln(2x + 3y)$, then $w_{xy}(0, 1)$ is equal to

a) $\frac{-2}{3}$
b) -2
c) $\frac{3}{4}$
d) -4
e) $\frac{3}{2}$

15. Let $f(x, y) = 3xy + 6$ then $df(x, y)$ is equal to

a) $3ydx + 3xdy$
b) $(3x + 3y)dx\,dy$
c) $3dx + 3dy$
d) $3y + 3x + 6dx + dy$
e) $3xydxdy + 6$