

King Fahd University of Petroleum and Minerals
Department of Mathematics
Math 201
Major Exam II
251
12 Novmber 2025
Net Time Allowed: 90 Minutes

B

MASTER VERSION

1. Which one of the following statements is **FALSE** about the plane

$$3x - 2y + z = 6?$$

- (a) It is parallel to the plane $6x - 4y - 2z = 10$ _____(correct)
- (b) It has a normal vector $\vec{n} = \langle 3, -2, 1 \rangle$
- (c) It passes through the point $(1, 1, 5)$
- (d) It intersects the x -axis at $(2, 0, 0)$
- (e) The point $(0, -3, 0)$ lies in the plane

2. If $w = 2x^2 - y^2$, $x = s \cos t$, $y = s \sin t$, then $\frac{\partial w}{\partial t} =$

- (a) $-3s^2 \sin(2t)$ _____(correct)
- (b) $-2s^2 \sin(2t)$
- (c) $-3s^2 \cos(2t)$
- (d) $-6s^2 \sin(2t)$
- (e) $-4t^2 \cos(2t)$

3. If z is defined **implicitly** as a differentiable function of x and y by the equation

$$x \ln y + y^2 z + z^2 = 6,$$

then $\frac{\partial z}{\partial y}$ at the point $(6, 1, 2)$ is equal to

(a) -2 _____(correct)

(b) $\frac{9}{5}$

(c) $\frac{27}{19}$

(d) $-\frac{5}{3}$

(e) $-\frac{9}{4}$

4. The **domain** of the function $f(x, y) = \sqrt{16 - x^2 - 4y^2}$ is the set of all points

(a) lying on or inside the ellipse $\frac{x^2}{16} + \frac{y^2}{4} = 1$ _____(correct)

(b) lying outside the ellipse $\frac{x^2}{4} + \frac{y^2}{16} = 1$

(c) lying on or inside the circle $x^2 + y^2 = 16$

(d) lying on or outside the circle $x^2 + y^2 = 16$

(e) lying on or inside the ellipse $\frac{x^2}{16} + \frac{y^2}{2} = 1$

5. An equation of the **tangent plane** to the surface

$$z = y e^{2xy}$$

at the point $(0, 2, 2)$, is

- (a) $8x + y - z = 0$ _____(correct)
- (b) $y - 8z = 0$
- (c) $8x + y + z = 0$
- (d) $32x + y - z = 0$
- (e) $x + y - 8z = 0$

6. If $f(x, y, z) = x^3 - 4xy + 3y^3 + xy^2z^2$, then

$$f_{xyz}(2, 2, 2) + f_{yzxz}(2, 2, 2) =$$

- (a) 16 _____(correct)
- (b) 8
- (c) 14
- (d) 10
- (e) 2

7. Let $z = x^2 + y^2$. If (x, y) changes from $(1, 1)$ to $(1.3, 0.9)$, then using **differentials**, the change in z is approximately equal to

- (a) 0.4 _____(correct)
- (b) 0.02
- (c) -0.1
- (d) 0.05
- (e) 0.2

8. $\lim_{(x,y) \rightarrow (0,0)} \frac{4x^3}{2x^2 + 2y^2} =$

- (a) 0 _____(correct)
- (b) 1
- (c) $\frac{3}{2}$
- (d) DNE
- (e) 2

9. If $z = \ln(4x^2 + y^2)$, then $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} =$

- (a) 2 _____(correct)
- (b) z
- (c) 0
- (d) $-z$
- (e) z^2

10. The **maximum value** of the directional derivative of $f(x, y) = y^2 - x \sqrt{y}$ at the point $(4, 4)$ is equal to

- (a) $\sqrt{53}$ _____(correct)
- (b) $\sqrt{33}$
- (c) 7
- (d) 3
- (e) 4

11. An equation for the **level surface** of $f(x, y, z) = 4x^2 + 4y^2 - z^2$ that passes through the point $(0, 0, 3)$ is given by

- (a) $z^2 = 4x^2 + 4y^2 + 9$ _____(correct)
(b) $z^2 = 4x^2 + 4y^2$
(c) $z^2 = 4x^2 + 4y^2 + 81$
(d) $z^2 = x^2 + y^2 + 3$
(e) $z^2 = x^2 + y^2 + 9$

12. If (a, b, c) is the **point of intersection** between the lines

$$L_1 : x = 1 + 2t, \ y = 1 - 3t, \ z = 2 - 5t$$

$$L_2 : x = 9 - 3s, \ y = -10 + 4s, \ z = -17 + 7s$$

then $a \ b \ c =$

- (a) 18 _____(correct)
(b) 9
(c) 12
(d) -16
(e) -15

13. If $ax + by + cz = 8$ is an **equation for the plane** passing through the points $P(2, 1, 0)$ and $Q(3, 0, 4)$ and is perpendicular to the yz -plane, then $a + b + c =$

- (a) 10 _____(correct)
- (b) 8
- (c) 3
- (d) 4
- (e) 6

14. Consider the unit vector $u = \frac{1}{\sqrt{2}}(i + j)$ and the two functions

$$f(x, y) = \begin{cases} \frac{4xy}{x^2 + y^2} & \text{if } (x, y) \neq (0, 0) \\ 2 & \text{if } (x, y) = (0, 0) \end{cases}$$

$$g(x, y) = \begin{cases} \frac{4xy}{x^2 + y^2} & \text{if } (x, y) \neq (0, 0) \\ 0 & \text{if } (x, y) = (0, 0) \end{cases}$$

Which of the following is **FALSE** ?

- (a) f is differentiable at $(0, 0)$ _____(correct)
- (b) g is not differentiable at $(0, 0)$
- (c) $D_u f(0, 0) = 0$
- (d) $D_u g(0, 0)$ does not exist
- (e) $g_x(0, 0) = 0$

15. Which one of the following statements is **FALSE** ?

- (a) The graph of $16x^2 + y^2 + 16z^2 = 4$ is a cylinder _____(correct)
- (b) The graph of $16x^2 - y^2 + 16z^2 = 0$ is an elliptic cone
- (c) The graph of $16x^2 - y + 16z^2 = 4$ is an elliptic paraboloid
- (d) The graph of $16x^2 - y^2 + 16z^2 = 4$ is a hyperboloid of one sheet
- (e) The graph of $16x^2 - y^2 - 16z^2 = 4$ is a hyperboloid of two sheets