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

A

MASTER VERSION

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

$$4x - y + 3z = 6 \ ?$$

(a) It is parallel to the plane $8x - 2y - 6z = 10$ _____(correct)

(b) It has a normal vector $\vec{n} =< 4, -1, 3 >$

(c) It passes through the point $(1, 1, 1)$

(d) It intersects the x-axis at $(\frac{3}{2}, 0, 0)$

(e) The point $(0, -6, 0)$ lies in the plane

2. If $w = x^2 - 3y^2, \quad x = s\cos t, \quad y = s\sin t,$ then $\dfrac{\partial w}{\partial t} =$

(a) $-4s^2\sin(2t)$ _____(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 $\dfrac{\partial z}{\partial y}$ at the point $(4, 1, 2)$ is equal to

(a) $-\dfrac{8}{5}$ _____(correct)

(b) $\dfrac{9}{4}$

(c) $\dfrac{23}{19}$

(d) $-\dfrac{2}{3}$

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

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

(a) lying on or inside the ellipse $\frac{x^2}{4} + \frac{y^2}{16} = 1$ _____(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) $y - z = 0$
(c) $18x + y - z = 0$
(d) $32x + y - z = 0$
(e) $x + y - z = 0$

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

$$f_{xyzz}(1, 1, 1) + f_{xzyz}(1, 1, 1) =$$

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

7. Let $z = x^2 + y^2$. If (x, y) changes from $(1, 1)$ to $(1.2, 0.9)$, then using **differentials**, the change in z is approximately equal to

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

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

   (a) 0 (correct)
   (b) $\dfrac{3}{4}$
   (c) $\dfrac{3}{2}$
   (d) DNE
   (e) 3

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

(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 $(0, 1)$ is equal to

(a) $\sqrt{5}$ _____ (correct)
(b) $\sqrt{3}$
(c) 2
(d) 3
(e) 5

11. An equation for the **level surface** of $f(x, y, z) = 4x^2 + 4y^2 - z^2$ that passes through the point $(1, 1, 3)$ is given by

(a) $z^2 = 4x^2 + 4y^2 + 1$ (correct)

(b) $z^2 = 4x^2 + 4y^2$

(c) $z^2 = 4x^2 + 4y^2 + 3$

(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

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

$$L_2 : x = 8 - 3s,\ y = -8 + 4s,\ z = -14 + 7s$$

then $a\ b\ c\ =$

(a) -28 (correct)

(b) 27

(c) -17

(d) 38

(e) 25

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

(a) 6 (correct)

(b) 8

(c) 3

(d) 4

(e) 2

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

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

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

Which of the following is **FALSE ?**

(a) g is differentiable at $(0, 0)$ (correct)

(b) f is not differentiable at $(0, 0)$

(c) $D_u\ g(0, 0) = 0$

(d) $D_u\ f(0, 0)$ does not exist

(e) $f_x(0, 0) = 0$

15. Which 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