

1. The domain of the function

$$f(x, y) = e^x \sqrt{x-1} + \log y - 2 + \sqrt{3-x} + \sqrt{4-y}$$

is:

- A. A square in the xy plane.
 - B. The region between two vertical lines
 - C. The region between two horizontal lines
 - D. The first quadrant
 - E. None of the above
2. The equation of the tangent line to the curve $\mathbf{r}(t) = \langle 3 \cos(t), 2 \sin(2t), -e^{4t} \rangle$ at $t = 0$ is:
- A. $\mathbf{r}(t) = \langle 2, 6t, 4t + 1 \rangle$
 - B. $\mathbf{r}(t) = \langle 2, 6t, -4t + 1 \rangle$
 - C. $\mathbf{r}(t) = \langle 3, 4t, 4t - 1 \rangle$
 - D. $\mathbf{r}(t) = \langle 3, 4t, -4t - 1 \rangle$
 - E. $\mathbf{r}(t) = \langle 4, 3t, 4t + 1 \rangle$
3. If $f(x, y) = 2x^2 - y^2$, $x = u - v$ and $y = u + v$ then $\partial f(x, y) / \partial u$ is equal to:
- A. $-2(u^2 + 6uv + v^2)$
 - B. $2u - 6v$
 - C. $6u + 2v$.
 - D. $-(2u + 6v)$
 - E. $2(u^2 - v^2)$

4. Suppose that z satisfies the equation $2z^3 - xy + y^2 = 56$. Assuming that this defines z as an implicit function of x, y , determine $\partial z / \partial x + \partial z / \partial y$ at the point $(x, y, z) = (1, 2, 3)$.
- A. $-25/12$
 - B. -2
 - C. -54
 - D. 0
 - E. $-1/54$
5. The Laplacian of a function $f = f(x, y)$ is defined to be $f_{xx} + f_{yy}$. Which of the following functions has Laplacian equal to zero?
- A. $f = 3x^3y + 3y^3x + 12xy$
 - B. $f = x^3y - 3y^3x - 12xy$
 - C. $f = x^3y + 3y^3x + x + y$
 - D. $f = x^2y - 3y^2x + 12xy$
 - E. $f = 3x^3y - 3y^3x + 12xy$
6. A curve C is the intersection of the surfaces $F = 3x^2 + y^2 - 28 = 0$ and $G = z - 3x^2 - 4y^2$. The tangent line to C at the point $P = (3, 1, 31)$ has a direction vector equal to
- A. $\langle 6, -6, -108 \rangle$
 - B. $\langle 2, -18, -108 \rangle$
 - C. $\langle 3, 1, 0 \rangle$
 - D. $\langle -3, -4, 1 \rangle$
 - E. $\langle 6, -6, 31 \rangle$

7. Let $f(x, y, z) = xy^2 + yz^2 + zx^2$. The directional derivative of $f(x, y, z)$ at the point $P = (-1, -1, 2)$ in the direction $v = \langle 1, 2, 3 \rangle$ is:
- A. $-2\sqrt{6}$
 - B. 0
 - C. $2\sqrt{6}$
 - D. 1
 - E. 3
8. Let $f(x, y) = 2xe^y - 3ye^x + x - y$. The directional derivative of $f(x, y)$ at the point $(0, 0)$ is equal to zero for which of the following directions?
- A. $\langle 2, -1 \rangle$
 - B. $\langle 4, 1 \rangle$
 - C. $\langle 1, 2 \rangle$
 - D. $\langle 3, 4 \rangle$
 - E. $\langle 4, 3 \rangle$
9. Let $I = \int \int_R f(x)g(y) dA$ where $R = [0, 3] \times [1, 5]$. If $\int_0^3 f(x) dx = 15$ and $\int_1^5 g(y) dy = 9$, which of the following is the correct value of I ?
- A. 15
 - B. 9
 - C. 135
 - D. 12
 - E. Not enough information to decide
10. Let $I = \int \int_R (x^2 + xy) dA$ where R is the region defined by $0 \leq x \leq 2$ and $0 \leq y \leq x$. Which of the following is the correct value of I ?
- A. 16
 - B. 6
 - C. $16/3$
 - D. $28/3$
 - E. 4