

Linear Algebra and Calculus

Course Code 25APS0101

Question Bank

Partial Derivatives (CAT-1)

Ques1. If $z = x^3y^2 + 4xy$, then $\frac{\partial z}{\partial x}$ is

- (a) $3x^2y^2 + 4y$
- (b) $3xy^2 + 4x$
- (c) $x^2y^2 + 4y$
- (d) $3x^2y + 4$

Ques2. If $z = x^2 + y^2 + xy$, then $\partial z / \partial y$ equals

- (a) $2y + x$
- (b) $2x + y$
- (c) $2y - x$
- (d) $x + y$

Ques3. If $u = e^{xy}$, then $\partial u / \partial x$ is

- (a) $xy e^{xy}$
- (b) $x e^{xy}$
- (c) $y e^{xy}$
- (d) e^{xy}

Ques4. If $u = \ln(x^2 + y^2)$, then $\partial u / \partial x$ equals

- (a) $2x/(x^2 + y^2)$
- (b) $x/(x^2 + y^2)$
- (c) $2y/(x^2 + y^2)$
- (d) $1/(x^2 + y^2)$

Ques5. If $z = x \sin y + y \cos x$, then $\partial z / \partial x$ equals

- (a) $\sin y - y \sin x$
- (b) $\sin y + y \cos x$
- (c) $\cos y - y \sin x$
- (d) $\sin x + y \cos x$

Ques6. If $u = \tan^{-1}(xy)$, then $\partial u / \partial x$ is

- (a) $y/(1 + x^2y^2)$
- (b) $x/(1 + x^2y^2)$
- (c) $xy/(1 + x^2y^2)$
- (d) $1/(1 + x^2y^2)$

Ques7. If $u = x^2y + 3y^2$, then u_{yy} equals

- (a) 6
- (b) 3
- (c) $2x$
- (d) 0

Ques8. If $z = x^2y + xy^2$, then $\partial z/\partial x$ at $(1, 2)$ is

- (a) 8
- (b) 6
- (c) 10
- (d) 12

Ques9. If $z = x^3 + y^3 - 3xy$, then $\partial z/\partial y$ at $(1, 2)$ equals

- (a) 9
- (b) 10
- (c) 8
- (d) 6

Ques10. If $u = e^{xy}$, find $\partial u/\partial y$ at $(1, 0)$.

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

Ques11. If $z = x^2y^2$, then z_{xy} at $(2, 3)$ equals

- (a) 24
- (b) 12
- (c) 36
- (d) 18

Ques12. If $u = \ln(x + y)$, then $\partial u/\partial y$ at $(1, 1)$ equals

- (a) $1/2$
- (b) 1
- (c) $1/4$

(d) 2

Ques13. If $z = v(x^2 + y^2)$, then $\partial z / \partial x$ at (3, 4) equals

(a) $3/5$

(b) $4/5$

(c) $1/5$

(d) 1

Ques14. If $u = x^3 + 3x^2y + 3xy^2 + y^3$, then $xu_x + yu_y$ equals

(a) $2u$

(b) $3u$

(c) $4u$

(d) u

Ques15. If $u = \frac{x^2 + y^2}{\sqrt{(x + y)}}$, the degree of the homogeneous function is

(a) $1/2$

(b) $3/2$

(c) $5/2$ (d) 3

Ques16. If u is homogeneous of degree 6 and $u = 64$ at a point, then $xu_x + yu_y =$

(a) 64

(b) 128

(c) 256

(d) 384

Ques17. If $u = x^3y^2/(x + y)$, then the degree of u is

(a) 2

(b) 3

(c) 4

(d) 5

Ques18. If $u = \sqrt{(x^2 + xy + y^2)}$, then u is homogeneous of degree

(a) 0

(b) $1/2$

(c) 1

(d) 2

Ques19. If $u = x^3 \sin(y/x)$, then $x \cdot \partial u / \partial x + y \cdot \partial u / \partial y$ equals

(a) u

(b) $2u$

(c) $3u$

(d) $4u$

Ques20. If u is homogeneous of degree 6, then $x^2u_{xx} + 2xyu_{xy} + y^2u_{yy}$ is

(a) $24u$

(b) $30u$

(c) $36u$

(d) $42u$

Ques21. If $u = (x^4 + 2x^2y^2 + y^4)/(x^2 + y^2)$, then the value of $x \cdot \partial u / \partial x + y \cdot \partial u / \partial y$ is

(a) u

(b) $2u$

(c) $3u$

(d) $4u$

Ques22. If $u = x^5 \cos(y/x)$, then $x \cdot \partial u / \partial x + y \cdot \partial u / \partial y$ is equal to

(a) $3u$

(b) $4u$

(c) $5u$

(d) $6u$

Ques23. If u is a homogeneous function of degree 4 and $u(2, 1) = 8$, then the value of $2 \cdot \partial u / \partial x + \partial u / \partial y$ at $(2, 1)$ is

(a) 8

(b) 16

(c) 24

(d) 32

Ques24. If $u = (x + y)^4 / (x^2 + y^2)$, then the degree of homogeneity of u is

(a) 0

(b) 1

(c) 2

(d) 4

Ques25. If $u = (x^2 + y^2)^{\frac{3}{2}}$, then $x^2u_{xx} + 2xyu_{xy} + y^2u_{yy}$ is equal to

(a) $3u$

(b) $6u$

(c) $(15/4)u$

(d) $(3/4)u$

Ques26. If $u = x^4 f(y/x)$, where f is a differentiable function, then $x \cdot \partial u / \partial x + y \cdot \partial u / \partial y$ is

(a) $2u$

(b) $3u$

(c) $4u$

(d) $5u$

Ques27. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, then $xu_x + yu_y + zu_z$ is equal to

(a) $3u$

(b) $2u$

(c) 0

(d) 3

Ques28. If $u = \sin^{-1}[(x + y)/(\sqrt{x} + \sqrt{y})]$, then $x \cdot \partial u / \partial x + y \cdot \partial u / \partial y$ is

(a) $(1/2) \tan u$

(b) $-(1/2) \tan u$

(c) $(1/4) \tan u$

(d) $-(1/4) \tan u$

Ques29. The normal line to $z = x^2 + y^2$ at $(1, 2, 5)$ is

(a) $(x - 1)/2 = (y - 2)/4 = (z - 5)/(-1)$

(b) $(x - 1)/1 = (y - 2)/2 = (z - 5)/1$

(c) $(x - 1)/4 = (y - 2)/2 = (z - 5)/1$

(d) $(x - 1)/2 = (y - 2)/2 = (z - 5)/2$

Ques30. The equation of the normal line to the surface $xyz = a^3$ at the point (x_1, y_1, z_1) is

(a) $(x - x_1)/(y_1 z_1) = (y - y_1)/(z_1 x_1) = (z - z_1)/(x_1 y_1)$

(b) $-(x - x_1)/(y_1 z_1) = (y - y_1)/(z_1 x_1) = -(z - z_1)/(x_1 y_1)$

(c) $(x - x_1)/(y_1 z_1) = -(y - y_1)/(z_1 x_1) = -(z - z_1)/(x_1 y_1)$

(d) $-(x - x_1)/(y_1 z_1) = -(y - y_1)/(z_1 x_1) = (z - z_1)/(x_1 y_1)$

Ques31. The equation of the tangent plane to the surface $x^2 + y^2 + z^2 = 14$ at the point $(1, 2, 3)$ is

(a) $x + 2y + 3z = 14$

(b) $2x + 4y + 6z = 14$

(c) $x + 2y + 3z = 7$

(d) $2x + 2y + 2z = 14$

Ques32. The equation of the normal line to the surface $x^2 + y^2 + z^2 = 9$ at the point $(2, 1, 2)$ is

(a) $(x - 2)/2 = (y - 1)/1 = (z - 2)/2$

(b) $(x - 2)/1 = (y - 1)/2 = (z - 2)/2$

(c) $(x - 2)/4 = (y - 1)/2 = (z - 2)/4$

(d) $(x - 2)/2 = (y - 1)/2 = (z - 2)/1$

Ques33. The normal line to the surface $x^2 + 2y^2 + 3z^2 = 18$ at $(2, 1, 2)$ is

(a) $(x - 2)/4 = (y - 1)/4 = (z - 2)/12$

(b) $(x - 2)/2 = (y - 1)/2 = (z - 2)/6$

(c) $(x - 2)/4 = (y - 1)/2 = (z - 2)/6$

(d) $(x - 2)/1 = (y - 1)/2 = (z - 2)/3$

Ques34. The tangent plane to the surface $e^x + y + z = 5$ at the point $(0, 2, 2)$ is

(a) $x + y + z = 4$

(b) $x + y - z = 0$

(c) $x - y + z = 0$

(d) $2x + y + z = 5$

Ques35. The tangent plane to the surface $\ln x + \ln y + \ln z = 0$ at $(1, 1, 1)$ is

(a) $x + y - z = 1$

(b) $x + y + z = 3$

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

(d) $x + 2y + z = 3$

Ques36. The normal line to the surface $xy = z$ at $(1, 2, 2)$ is

(a) $(x - 1)/2 = (y - 2)/1 = (z - 2)/(-1)$

(b) $(x - 1)/1 = (y - 2)/2 = (z - 2)/1$

(c) $(x - 1)/2 = (y - 2)/2 = (z - 2)/1$

(d) $(x - 1)/1 = (y - 2)/1 = (z - 2)/2$

Ques37. The tangent plane to the surface $xz + y = 5$ at $(1, 2, 3)$ is

(a) $3x + y + z = 8$

(b) $x + 3y + z = 8$

(c) $3x - y + z = 8$

(d) $x + y + 3z = 8$

Ques38. If $z = f(x, y)$, where $x = r \cos\theta$, $y = r \sin\theta$, then $\partial z/\partial r$ is (a)

$f_x \cos\theta + f_y \sin\theta$

(b) $f_x \sin\theta + f_y \cos\theta$

(c) $f_x \cos\theta - f_y \sin\theta$

(d) $f_x + f_y$

Ques39. If $z = x^2 + y^2$, where $x = t^2$, $y = e^t$, then dz/dt equals

(a) $4t^3 + 2e^{2t}$

(b) $2t^2 + 2e^t$

(c) $4t + 2e^t$

(d) $2t^3 + e^{2t}$

Ques40. Let $u = f(x, y)$, where $x = rs$, $y = r/s$. Then $\partial u/\partial r$ is

(a) $s \cdot f_x + (1/s) \cdot f_y$

(b) $r \cdot f_x + s \cdot f_y$

(c) $s \cdot f_x - (1/s) \cdot f_y$

(d) $f_x + f_y$

Ques41. If $z = f(x, y)$, where $x = x(t)$ and $y = y(t)$, then dz/dt is given by:

(a) $\partial z/\partial x + \partial z/\partial y$

(b) $(\partial z/\partial x)(dx/dt) + (\partial z/\partial y)(dy/dt)$

(c) $(\partial z/\partial x)(dy/dt) + (\partial z/\partial y)(dx/dt)$

(d) $(\partial z/\partial x) \cdot (\partial z/\partial y)$

Ques42. If $z = x + y$, where $x = t^2$, $y = t^3$, then dz/dt at $t = 1$ is:

(a) 5

(b) 6

(c) 4

(d) 3

Ques43. If $u = f(x, y)$ and x, y are both functions of two variables r and s , then $\partial u/\partial r$ equals:

(a) $(\partial u/\partial x)(\partial x/\partial r) + (\partial u/\partial y)(\partial y/\partial r)$

(b) $(\partial u/\partial x)(\partial x/\partial s) + (\partial u/\partial y)(\partial y/\partial s)$

(c) $\partial u/\partial x + \partial u/\partial y$

(d) $(\partial u/\partial r)(\partial x/\partial u)$

Ques44. If $z = x^2 + y^2$ where $x = t$, $y = t^2$, then dz/dt at $t = 1$ is:

(a) 2

- (b) 6
- (c) 4
- (d) 10

Ques45. For $z = f(x, y)$, $x = r \cos \theta$, $y = r \sin \theta$, the expression $\partial z / \partial \theta$ involves:

- (a) only $\partial z / \partial x$
- (b) only $\partial z / \partial y$
- (c) both $\partial z / \partial x$ and $\partial z / \partial y$
- (d) neither

Ques46. A function $z = f(x, y)$ is called a composite function when:

- (a) x and y are independent variables
- (b) x and y are themselves functions of other variables
- (c) z is constant
- (d) f is linear

Ques47. If $w = f(x, y, z)$ and x, y, z are functions of t , then dw/dt has how many terms (by chain rule)?

- (a) 1
- (b) 2
- (c) 3
- (d) 4

Ques48. If $z = f(x, y)$ and $x = e^t$, $y = e^{-t}$, the chain rule requires:-

- (a) dx/dt and dy/dt
- (b) only dx/dt
- (c) only $\partial z / \partial x$
- (d) second derivatives

Ques49. If $z = f(x, y)$, where $x = 2r + s$, $y = r - 2s$, then $\partial z / \partial r$ equals

- (a) $2\partial z / \partial x + \partial z / \partial y$
- (b) $2\partial z / \partial x - \partial z / \partial y$
- (c) $\partial z / \partial x + 2\partial z / \partial y$
- (d) $\partial z / \partial x - \partial z / \partial y$

Ques50. The chain rule for composite functions extends the concept of:

- (a) Implicit differentiation
- (b) Ordinary derivative chain rule to multivariable functions
- (c) Integration by parts

(d) Partial integration

Ques51. If $z = x^2y$, $x = t^2$, $y = t^3$, then dz/dt is:

- (a) $2t^5 + 3t^5$
- (b) $4t^6 + 3t^6$
- (c) $7t^6$
- (d) $5t^5$

Ques52. If $u = x^2 + y^2$, $x = r \cos\theta$, $y = r \sin\theta$, then $\partial u/\partial r$ equals:

- (a) $2r$
- (b) r
- (c) $2r^2$
- (d) r^2

Ques53. If $z = f(x, y)$, $x = uv$, $y = u/v$, then $\partial z/\partial u$ is:

- (a) $v \cdot \partial z/\partial x + (1/v) \cdot \partial z/\partial y$
- (b) $v \cdot \partial z/\partial x - (1/v) \cdot \partial z/\partial y$
- (c) $u \cdot \partial z/\partial x + (1/u) \cdot \partial z/\partial y$
- (d) $v \cdot \partial z/\partial x + v \cdot \partial z/\partial y$

Ques54. If $w = x^2 + y^2 + z^2$, where $x = t$, $y = t^2$, $z = t^3$, then dw/dt at $t = 1$ is:

- (a) 14
- (b) 12
- (c) 16
- (d) 18

Ques55. If $z = xy$, $x = e^t \cos t$, $y = e^t \sin t$, then dz/dt equals:

- (a) $2e^{2t} \sin t \cos t$
- (b) $e^{2t}(\cos 2t + \sin 2t)$
- (c) e^{2t}
- (d) e^t

Ques56. If $z = f(x, y)$ is homogeneous of degree n , and $x = r \cos\theta$, $y = r \sin\theta$, then by Euler's theorem, $x(\partial z/\partial x) + y(\partial z/\partial y)$ equals:

- (a) nz
- (b) z/n
- (c) n^2z
- (d) z

Ques57. If $u = f(x - y, y - x)$, then $\partial u/\partial x + \partial u/\partial y$ is:

- (a) 0
- (b) 1
- (c) $2u$
- (d) u

Ques58. If $z = f(x, y)$ with $x = a + h$, $y = b + k$ (a small change), the total differential dz used in composite differentiation is:

- (a) $\partial z / \partial x \, dx + \partial z / \partial y \, dy$
- (b) $\partial z / \partial x \, dx - \partial z / \partial y \, dy$
- (c) $(\partial z / \partial x)(\partial z / \partial y)$
- (d) $dx + dy$

Ques59. If $z = x^2 - y^2$, $x = r \cos \theta$, $y = r \sin \theta$, then $\partial z / \partial \theta$ equals:

- (a) $-2r^2 \sin \theta \cos \theta - 2r^2 \sin \theta \cos \theta$
- (b) $-4r^2 \sin \theta \cos \theta$
- (c) $2r^2 \cos 2\theta$
- (d) $-2r^2 \sin 2\theta$

Ques60. If $u = x^2y + y^2z + z^2x$, and $x = t$, $y = t^2$, $z = t^3$, the number of chain-rule terms needed to compute du/dt is:

- (a) 2
- (b) 3
- (c) 4
- (d) 6

Ques61. If $F(x, y) = 0$ defines y implicitly as a function of x , then dy/dx is given by:

- (a) $-(\partial F / \partial x) / (\partial F / \partial y)$
- (b) $-(\partial F / \partial y) / (\partial F / \partial x)$
- (c) $(\partial F / \partial x) / (\partial F / \partial y)$
- (d) $(\partial F / \partial x) \times (\partial F / \partial y)$

Ques62. If $x^2 + y^2 = 25$, then dy/dx at the point $(3, 4)$ is:

- (a) $-3/4$
- (b) $3/4$
- (c) $-4/3$
- (d) $4/3$

Ques63. If $z = f(x, y)$ and y is itself a function of x , the total derivative dz/dx is given by:

- (a) $\partial z/\partial x$
- (b) $\partial z/\partial x + (\partial z/\partial y)(dy/dx)$
- (c) $\partial z/\partial x - (\partial z/\partial y)(dy/dx)$
- (d) $(\partial z/\partial y)(dy/dx)$

Ques64. If $xy = c$ (a constant), then dy/dx by implicit differentiation is:

- (a) $-y/x$
- (b) y/x
- (c) $-x/y$
- (d) x/y

Ques65. The total differential of $z = f(x, y)$ is defined as:

- (a) $\partial z/\partial x dx + \partial z/\partial y dy$
- (b) $\partial z/\partial x dy + \partial z/\partial y dx$
- (c) $\partial z/\partial x + \partial z/\partial y$
- (d) $dx + dy$

Ques66. For $z = f(x, y)$ with $y = y(x)$, the total derivative dz/dx (by chain rule) has how many terms?

- (a) 1
- (b) 2
- (c) 3
- (d) 4

Ques67. If $F(x, y) = 0$ and $\partial F/\partial y = 0$ at a point, then dy/dx at that point is:

- (a) 0
- (b) 1
- (c) undefined
- (d) equal to $\partial F/\partial x$

Ques68. If $x^3 + y^3 = 3axy$ then dy/dx equals:

- (a) $(ay - x^2)/(y^2 - ax)$
- (b) $(x^2 - ay)/(y^2 - ax)$
- (c) $(ay - x^2)/(ax - y^2)$
- (d) $(x^2 + ay)/(y^2 + ax)$

Ques69. If $x^2 + xy + y^2 = 7$, then dy/dx equals:

- (a) $-(2x + y)/(x + 2y)$
- (b) $(2x + y)/(x + 2y)$

(c) $-(x + 2y)/(2x + y)$

(d) $(2x - y)/(x - 2y)$

Ques70. If $z = x^2 + y^2$ and $y = x^2$ (so y depends directly on x), the total derivative dz/dx at $x = 1$ is:

(a) 2

(b) 4

(c) 6

(d) 8

Ques71. If $e^x + e^y = e^{x+y}$, then dy/dx equals:

(a) $-(e^x - e^{x+y})/(e^y - e^{x+y})$

(b) $(e^x - e^y)/e^{x+y}$

(c) e^{x-y}

(d) $-e^{y-x}$

Ques72. If $z = x^2y^3$, the total differential dz equals:

(a) $2xy^3 dx + 3x^2y^2 dy$

(b) $2xy^3 dx - 3x^2y^2 dy$

(c) $x^2y^3(dx + dy)$

(d) $2x dx + 3y dy$

Ques73. If $u = f(x, y)$, the total differential du representing the absolute error in u is given by:

(a) $\partial u/\partial x + \partial u/\partial y$

(b) $\partial u/\partial x dx + \partial u/\partial y dy$

(c) $\partial u/\partial x dx - \partial u/\partial y dy$

(d) $\partial^2 u/\partial x \partial y dx dy$

Ques74. If x is measured with an absolute error δx , then the percentage error in x is defined as:

(a) $\delta x/x$

(b) $(x/\delta x) \times 100$

(c) $(\delta x/x) \times 100$

(d) $\delta x \times 100$

Ques75. If $u = x^n$, the relative error $\delta u/u$ in terms of the relative error in x is:

(a) $n(\delta x/x)$

(b) $(1/n)(\delta x/x)$

(c) $n^2(\delta x/x)$

(d) $(\delta x/x)^n$

Ques76. If $u = xy$, and the percentage errors in x and y are 1% and 2% respectively, the percentage error in u is approximately:

(a) 2%

(b) 1%

(c) 3%

(d) 0.5%

Ques77. If $u = x/y$, the percentage error in u when x and y have percentage errors e_1 and e_2 respectively is:

(a) $e_1 - e_2$

(b) $e_1 + e_2$

(c) e_1/e_2

(d) $e_1 \cdot e_2$

Ques78. The period of a simple pendulum is $T = 2\pi\sqrt{l/g}$. If the error in length l is 2%, the percentage error in T is:

(a) 2%

(b) 1%

(c) 4%

(d) 0.5%

Ques79. The area of a circle of radius r is $A = \pi r^2$. If the radius is measured with an error of 1.5%, the percentage error in the calculated area is:

(a) 1.5%

(b) 3.0%

(c) 2.25%

(d) 0.75%

Ques80. In calculating the volume of a sphere $V = (4/3)\pi r^3$, if r increases by 1%, the percentage increase in V is:

(a) 1%

(b) 3%

(c) $4/3$ %

(d) $1/3$ %

Ques81. If the kinetic energy of a body is given by $K = (1/2)mv^2$, and the errors in measuring mass m and velocity v are 1% and 2% respectively, the maximum error in K is:

- (a) 3%
- (b) 5%
- (c) 4%
- (d) 2%

Ques82. If $g = 2s/t^2$, and the relative errors in s and t are 1% and 2% respectively, then the relative error in g is:

- (a) 3%
- (b) 5%
- (c) 1%
- (d) 4%

Ques83. The percentage error in the area of a rectangle when an error of +1% is made in its length and breadth is:

- (a) 2%
- (b) 1%
- (c) 3%
- (d) 4%

Ques84. According to the Reciprocal Property of Jacobians, if $J = \partial(u,v)/\partial(x,y)$ and $J' = \partial(x,y)/\partial(u,v)$, then:

- (a) $J \cdot J' = 0$
- (b) $J \cdot J' = 1$
- (c) $J + J' = 1$ (d) $J = J'$

Ques85. If two functions $u(x, y)$ and $v(x, y)$ are functionally dependent then their Jacobian $J = \partial(u,v)/\partial(x,y)$ is:

- (a) 1
- (b) ∞
- (c) 0
- (d) -1

Ques86. If $x = r \cos\theta$ and $y = r \sin\theta$, then the Jacobian $\partial(x,y)/\partial(r,\theta)$ is:

- (a) r
- (b) $1/r$

(c) r^2

(d) 1

Ques87. Using the Chain Rule for Jacobians, if u, v are functions of r, s and r, s are functions of x, y , then $\partial(u,v)/\partial(x,y)$ equals:

(a) $\partial(u,v)/\partial(r,s) + \partial(r,s)/\partial(x,y)$

(b) $\partial(u,v)/\partial(r,s) \cdot \partial(r,s)/\partial(x,y)$

(c) $[\partial(u,v)/\partial(r,s)] / [\partial(r,s)/\partial(x,y)]$

(d) $\partial(r,s)/\partial(u,v) \cdot \partial(x,y)/\partial(r,s)$

Ques88. If $u = x + y$ and $v = x - y$, then the value of $\partial(u,v)/\partial(x,y)$ is:

(a) 0

(b) 2

(c) -2

(d) 1

Ques89. For spherical polar coordinates $x = r \sin\theta \cos\phi$, $y = r \sin\theta \sin\phi$, $z = r \cos\theta$, the Jacobian $\partial(x,y,z)/\partial(r,\theta,\phi)$ is:

(a) $r \sin\theta$

(b) $r^2 \sin\theta$

(c) $r \cos\theta$

(d) $r \sin^2\theta$

Ques90. If $u = x^2$ and $v = y^2$, then $\partial(u,v)/\partial(x,y)$ is:

(a) $4xy$

(b) $2xy$

(c) $x + y$

(d) 0

Ques91. If $\partial(u,v)/\partial(x,y) = 4$, then the value of $\partial(x,y)/\partial(u,v)$ is:

(a) -4

(b) 4

(c) $1/4$ (d) 0

Ques92. For cylindrical coordinates $x = \rho \cos\phi$, $y = \rho \sin\phi$, $z = z$, the Jacobian $\partial(x,y,z)/\partial(\rho,\phi,z)$ is:

(a) ρ

(b) ρ^2

(c) 1

(d) pz

Ques93. If $u = x(1 - y)$ and $v = xy$, then the Jacobian $\partial(u,v)/\partial(x,y)$ is:

(a) x

(b) y

(c) $-x$

(d) 1

Ques94. If $u = x + y + z$, $v = y + z$, $w = z$, then the $\partial(u,v,w)/\partial(x,y,z)$ is:

(a) 0

(b) 1

(c) 2

(d) $x + y + z$

Ques95. If $u = x^2 - y^2$ and $v = 2xy$, where $x = r \cos\theta$ and $y = r \sin\theta$, then $\partial(u,v)/\partial(r,\theta)$ is:

(a) $4r^3$

(b) $2r^2$

(c) r^3

(d) $4r$

Ques96. What is the constant term (first term) in the Maclaurin series expansion of $f(x) = e^x$?

(a) 0

(b) 1

(c) e

(d) x

Ques97. The Maclaurin series expansion of $\sin x$ contains only:

(a) Even powers of x

(b) Odd powers of x

(c) Positive integers only (d) Negative powers of x

Ques98. In the Taylor series expansion of $f(x)$ about $x = a$, the coefficient of $(x - a)$ is given by:

(a) $f(a)$

(b) $f'(a)$

(c) $f''(a)/2!$

(d) $f'''(a)$

Ques99. The Maclaurin series expansion of $\cos x$ begins as:

- (a) $x - x^3/6$
- (b) $1 - x^2/2$
- (c) $1 + x + x^2/2$
- (d) $x + x^2/2$

Ques100. For a two-variable function $f(x, y)$, the first term in its Maclaurin series expansion is: (a) $f(1,1)$

- (b) $f(x,y)$
- (c) $f(0,0)$
- (d) 0

Ques101. The value of $f_x(0,0)$ for $f(x,y) = x^2 + 3xy + 2y$ is:

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

Ques102. The coefficient of x^2 in the Maclaurin series of $(1 + x)^{-1}$ is:

- (a) 1
- (b) -1
- (c) 2
- (d) -2

Ques103. The first-order linear terms in the Taylor expansion of $f(x, y)$ about (a, b) are:

- (a) $(x - a)f_x(a, b) + (y - b)f_y(a, b)$
- (b) $(x - a)^2f_x(a, b) + (y - b)^2f_y(a, b)$
- (c) $f_x(a, b) + f_y(a, b)$
- (d) $(x - a)(y - b)f_{xy}(a, b)$

Ques104. What is the second derivative $f''(0)$ for $f(x) = e^{2x}$ at $x = 0$?

- (a) 1
- (b) 2
- (c) 4
- (d) 8

Ques105. In the Maclaurin series of $f(x,y) = e^xe^y$, the constant term is:

- (a) 0

- (b) 1
- (c) e
- (d) 2

Ques106. The expansion of $f(x) = x^2 + 2x + 1$ in powers of $(x - 1)$ is:

- (a) $4 + 4(x - 1) + (x - 1)^2$
- (b) $1 + 2(x - 1) + (x - 1)^2$
- (c) $4 + 2(x - 1) + (x - 1)^2$
- (d) $(x - 1)^2$

Ques107. The coefficient of x^3 in the Maclaurin expansion of $f(x) = e^{3x}$ is:

- (a) 3
- (b) $9/2$
- (c) 27 (d) 1

Ques108. Expand $f(x, y) = xy$ about the point $(1, 2)$ up to first-degree terms.

- (a) $2 + 2(x - 1) + (y - 2)$
- (b) $2 + (x - 1) + 2(y - 2)$
- (c) $2 + (x - 1) + (y - 2)$
- (d) $2(x - 1) + 2(y - 2)$

Ques109. The first two non-zero terms in the Maclaurin series of $f(x) = \tan x$ are:

- (a) $x + x^2/2$
- (b) $x + x^3/3$
- (c) $x - x^3/3$ (d) $1 + x$

Ques110. What is the coefficient of xy in the Maclaurin expansion of $f(x, y) = \sin x \cdot \sin y$? (a) 0

- (b) 1
- (c) -1
- (d) $1/2$

Ques111. The Taylor series expansion of $f(x) = 1/x$ about $a = 1$ up to the term $(x - 1)^2$ is:

- (a) $1 - (x - 1) + (x - 1)^2$
- (b) $1 + (x - 1) + (x - 1)^2$
- (c) $1 - (x - 1) - (x - 1)^2$
- (d) $1 - 2(x - 1) + (x - 1)^2$

Ques112. For $f(x, y) = x^2 + y^2$, the second-order terms in the Maclaurin expansion are: (a) $x + y$

(b) $x^2 + y^2$

(c) $2x + 2y$

(d) $2xy$

Ques113. The Maclaurin expansion of $f(x) = \log(1 - x)$ up to the x^2 term is:

(a) $-x - x^2/2$

(b) $x - x^2/2$

(c) $-x + x^2/2$

(d) $x + x^2/2$