

- j) The series $x + \frac{x^3}{3!} + \frac{x^5}{5!} + \dots$ represent expansion of
 (a) $\sin x$ (b) $\cos x$ (c) $\sinh x$ (d) $\cosh x$
- k) If $u = ax^2 + 2hxy + by^2$ then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is equal to
 (a) $2u$ (b) u (c) 0 (d) none of these
- l) What is the value of $\frac{\partial}{\partial x}(x^y) = \underline{\hspace{2cm}}$.
 (a) x^y (b) $x^y \log x$ (c) yx^{y-1} (d) none of these
- m) $\lim_{(x,y) \rightarrow (1,-2)} \frac{3x-4y}{x-y} = \underline{\hspace{2cm}}$.
 (a) $\frac{3}{11}$ (b) -5 (c) 5 (d) none of these
- n) If $x = r \cos \theta$, $y = r \sin \theta$ then $\frac{\partial x}{\partial r}$ is equal to
 (a) $\sec \theta$ (b) $\operatorname{cosec} \theta$ (c) $\cos \theta$ (d) $\sin \theta$

Attempt any four questions from Q-2 to Q-8

Q-2 Attempt all questions (14)

- a) Find all n^{th} roots of unity. (05)
- b) Using De Moivre's theorem prove that $\cos^4 \theta = \frac{1}{8}(\cos 4\theta + 4 \cos 2\theta + 3)$. (05)
- c) Simplify:
$$\frac{(\cos 5\theta - i \sin 5\theta)^{\frac{2}{5}} \left(\cos \frac{2\theta}{5} + i \sin \frac{2\theta}{5} \right)^5}{(\cos 3\theta + i \sin 3\theta)^{\frac{1}{3}} \left(\cos \frac{2\theta}{3} - i \sin \frac{2\theta}{3} \right)^{18}}$$
 (04)

Q-3 Attempt all questions (14)

- a) Trace the Cissoids $y^2(2a-x) = x^3$. (05)
- b) Expand $f(x) = \sin x$ in powers of x up to x^5 by Maclaurin's series. (05)
- c) Find the modulus, principal argument, complex conjugate and polar form of $z = -1 + i$. (04)

Q-4 Attempt all questions (14)

- a) Discuss whether the function $f(x) = \begin{cases} |x| & x \neq 0 \\ 0 & x = 0 \end{cases}$ is continuous at $x = 0$. (05)
- b) Evaluate: $\lim_{x \rightarrow 0} \left(\frac{\tan x - \sin x}{x^3} \right)$ (05)
- c) If $f(x) = \begin{cases} 1+x, & \text{if } x \leq 2 \\ 5-x, & \text{if } x > 2 \end{cases}$ then show that $f'(2)$ does not exist. (04)



- Q-5 Attempt all questions (14)**
- a) Test for convergence the series (05)
- i) $\sum_{n=1}^{\infty} \frac{n^2}{2^n}$ ii) $\sum_{n=1}^{\infty} \frac{1}{2^n}$
- b) Find radius of convergence and interval of convergence of the power series $\sum_{n=1}^{\infty} \frac{(-1)^n x^{2n-1}}{2n-1}$. (05)
- c) Define: $\frac{\partial(u, v)}{\partial(x, y)}$. If $x = r \cos \theta$ and $y = r \sin \theta$ then find $\frac{\partial(x, y)}{\partial(r, \theta)}$. (04)
- Q-6 Attempt all questions (14)**
- a) If $z = yf(x^2 - y^2)$ then show that $y \frac{\partial z}{\partial x} + x \frac{\partial z}{\partial y} = \frac{xz}{y}$. (05)
- b) If $f(x, y) = \log(y \sin x + x \sin y)$ then find $\frac{\partial^2 f}{\partial x \partial y}, \frac{\partial^2 f}{\partial y \partial x}$. (05)
- c) Find the equation of tangent plane and normal line to the surface $x^2 + 2y^2 + 3z^2 = 12$ at the point $(1, 2, -1)$. (04)
- Q-7 Attempt all questions (14)**
- a) Find the maximum and minimum values of $f(x, y) = 2 + 2x + 2y - x^2 - y^2$. (05)
- b) Discuss the continuity of $f(x, y) = \begin{cases} \frac{x^3 - y^3}{x^2 + y^2}, & (x, y) \neq (0, 0) \\ 0 & , (x, y) = (0, 0) \end{cases}$ at $(0, 0)$. (05)
- c) Expand e^x in powers of $(x+3)$. (04)
- Q-8 Attempt all questions (14)**
- a) Define Homogeneous function and State Euler's theorem and using it find (07)
- i) $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ and ii) $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$ if $u = \log\left(\frac{x^4 + y^4}{x + y}\right)$.
- b) Trace the curve $r = a(1 - \cos \theta)$. (07)

