



A Charutar Vidya Mandal's Institution
V. P. & R. P. T. P. SCIENCE COLLEGE

(AUTONOMUS) (Grant-in-Aid)

Affiliated to Sardar Patel University

VALLABH VIDYANAGAR-388120

Bachelor of Science (Semester 1) External Examination-2024

US01IDMTH01: Successive Differentiation and Partial Derivatives



Date: 21-11-2024, (Thursday)

Time: 11:00 am to 12:30 pm

Total marks: 25

NOTE: The symbols used in this paper have usual meaning unless specified.

Q. 1 Write the most appropriate answer from the following multiple-choice questions. [05]

(1) The function $y = (x + \sqrt{x^2 + 1})^k$ satisfies:

(a) $(x^2 + 1)y' = k^2y$

(b) $(1 + x^2)y'' + ky' - xy = 0$

(c) $\sqrt{x^2 + 1}y' = ky$

(d) $(x^2 + 1)y'' + xy' - k^2y = 0$

(2) If $y = (2x + 3)^{10}$, then y_7 is

(a) $\frac{2^7(10!)(2x+3)^3}{3!}$

(b) $\frac{2^7(10!)(2x+3)^3}{7!}$

(c) $\frac{2^3(7!)(2x+3)^3}{10!}$

(d) none of these

(3) The n th non zero term in Maclaurin's series expansion of $\sin x$ is

(a) $\frac{(-1)^n x^n}{n!}$

(b) $\frac{x^n}{n!}$

(c) $\frac{(-1)^n x^{2n-1}}{(2n-1)!}$

(d) $\frac{(-1)^n x^{2n+1}}{(2n+1)!}$

(4) If $x^2y + xy^2 + \frac{x^3}{3} + \frac{y^3}{3} = 0$ then $\frac{dy}{dx}$ is

(a) 0

(b) 1

(c) -1

(d) 2

(5) The function $\sin^{-1} \left(\frac{\sqrt{x}-\sqrt{y}}{\sqrt{x}+\sqrt{y}} \right)$ is

(a) a homogeneous function of degree 0

(b) a homogeneous function of degree $\frac{1}{2}$

(c) a homogeneous function of degree 1

(d) not a homogeneous function

Q. 2 (A) Derive n th order derivative of $\cos(ax + b)$. [05]

(B) If $\cos^{-1} \left(\frac{y}{b} \right) = \log \left(\frac{x}{n} \right)^n$, then prove that $x^2y_{n+2} + (2n+1)xy_{n+1} + 2n^2y_n = 0$. [05]

OR

Q. 2 (P) Expand $(1+x)^n$ in powers of x . [04]

(Q) State and prove Leibnitz's theorem. [06]



P.T.O.

Q. 3 (A) If $u = \cot^{-1} \left(\frac{x+y}{\sqrt{x}+\sqrt{y}} \right)$, then show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + \frac{1}{4} \sin(2u) = 0$. [05]

(B) If $H = f(u, v, w)$, where $u = y - z$, $v = z - x$, and $w = x - y$, then find $\frac{\partial H}{\partial x} + \frac{\partial H}{\partial y} + \frac{\partial H}{\partial z}$. [05]

OR

Q. 3 (P) State and prove Euler's theorem for homogeneous functions of two variables. [05]

(Q) Discuss the maximum or minimum values of $u = x^3 + y^3 - 3xy$. [05]

ALL THE BEST

