



K15U 0584

Reg. No. :

Name :

I Semester B.Sc. Degree (CCSS – Reg./Supple./Improv.)
Examination, November 2015
Core Course in Mathematics
1B01 MAT : DIFFERENTIAL CALCULUS
(2014 Admn. Onwards)

Time : 3 Hours

Max. Marks : 48

SECTION – A

All the **first four** questions are **compulsory**. They carry **1 mark each**.

1. Find $\lim_{x \rightarrow -5} \frac{x^2}{5-x}$.

2. Find the inverse of the function $y = x^2, x \geq 0$ expressed as a function of x .

3. Define curvature of an arc.

4. State Euler's theorem on homogeneous functions. (4×1=4)

SECTION – B

Answer **any 8** questions from among the questions **5 to 14**. These questions carry **two marks each**.

5. Given that $1 - \frac{x^2}{4} \leq u(x) \leq 1 + \frac{x^2}{2}$ for all $x \neq 0$, find $\lim_{x \rightarrow 0} u(x)$.

6. Find the n^{th} derivative of $\sin(ax + b)$.

7. Let $f(x) = x^3 - 2$. Find the value of $\frac{df^{-1}}{dx}$ at $x = 6 = f(2)$ without finding a formula for $f^{-1}(x)$.

P.T.O.



8. Find a polar equation for the circle $x^2 + (y - 3)^2 = 9$.
9. Graph the set of points whose polar coordinates satisfy $\theta = \frac{\pi}{2}$, $r \geq 0$.
10. Verify Rolle's theorem for $\frac{\sin x}{e^x}$ in $(0, \pi)$.
11. Find the asymptotes of the curve $x^2y^2 - x^2y - xy^2 + x + y + 1 = 0$.
12. Find $\lim_{x \rightarrow 0} \frac{\left(\sqrt{1+x} - 1 - \frac{x}{2}\right)}{x^2}$.
13. Find the domain and range of the function $w = \sin xy$.
14. Find the values of $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ if $f(x, y) = x^2 + 3xy + y - 1$. (8x2=16)

SECTION - C

Answer **any 4** questions from among the questions **15 to 20**. These questions carry **4 marks each**.

15. Find the derivative of y with respect to the appropriate variable.
- a) $y = \sec^{-1}(2s + 1)$
- b) $y = \csc^{-1}(x^2 + 1)$, $x > 0$.
16. If $x = a(\cos t + t \sin t)$, $y = a(\sin t - t \cos t)$, find $\frac{d^2y}{dx^2}$.
17. Show that $\sin x (1 + \cos x)$ is maximum when $x = \frac{\pi}{3}$.
18. Show that the radius of curvature at any point of the cardioid $r = a(1 - \cos \theta)$ varies as \sqrt{r} .



19. Find the derivative of $w = xy$ with respect to t along the path $x = \cos t$, $y = \sin t$.

What is the derivatives value at $t = \frac{\pi}{2}$?

20. Find the value of $\frac{dy}{dx}$ at the given point if $x^2 + xy + y^2 - 7 = 0$, $(1, 2)$. (4x4=16)

SECTION - D

Answer **any 2** questions. **Each** question carries **6** marks.

21. State formal definition of limit and prove that $\lim_{x \rightarrow 1} f(x) = 1$ if $f(x) = \begin{cases} x^2, & x \neq 1 \\ 2, & x = 1 \end{cases}$.

22. Sketch the lines and find Cartesian equations for them

a) $r \cos\left(\theta - \frac{\pi}{4}\right) = \sqrt{2}$,

b) $r \cos\left(\theta - \frac{2\pi}{3}\right) = 3$.

23. Graph the function $y = x^4 - 4x^3 + 10$.

24. Find the linearization $L(x, y)$ of the functions at the given point.

a) $f(x, y) = x^2 + y^2 + 1$ at $(1, 1)$

b) $f(x, y) = 3x - 4y + 5$ at $(1, 1)$.

(2x6=12)