REV-01
BSM/16/25

2022/12

**SET A**

# B.Sc. MATHEMATICS
## FIRST SEMESTER
## CALCULUS
## BSM – 101 IDMj

[USE OMR SHEET FOR OBJECTIVE PART]

**Duration: 3 hrs.** **Full Marks: 70**

**( Objective )**

**Time: 30 min.** **Marks: 20**

***Choose the correct answer from the following:*** ***1X20=20***

1. Given $S=(0,1)$ and $a=2$ .Which of the following option is correct
   a. $S$ is a nbd of $2$ b. $S$ is not a nbd of $2$
   c. $S$ may or may not be a nbd of $2$ d. None of the above

2. Given $S=(0,1)$ .Is $0$ is a limit point of $S$?
   a. YES b. NO
   c. YES if $0\varepsilon(1,0)$ d. No if $0\varepsilon(0,1)$

3. Domain of $f(x)=\frac{1}{x}$ is what?
   a. $R-\{1\}$ b. $R-\{-1\}$
   c. $R$ d. $R-\{0\}$

4. $\lim_{x\to 2}\frac{x^2-4}{x-2}=?$
   a. $-4$ b. $0$
   c. $4$ d. $2$

5. The C.F of the equation $\frac{d^2y}{dx^2}+9y=\cos 4x$ is
   a. $C_1\cos 3x-C_2\sin 3x$ b. $C_1\cos 3x+C_2\sin 3x$
   c. $-C_1\cos 3x+C_2\sin 3x$ d. $C_1\cos 9x+C_2\sin 9x$

6. Stationary point of $2x^3-3x^2-12x+6$ are
   a. $x=-1,2$ b. $x=1,2$
   c. $x=-1,-2$ d. $x=1,-2$

If $y = \log x$, which of the following is fifth derivative $y_5 = ?$

a. $y_5 = \dfrac{(-1)^4.4}{x^4}$

b. $y_5 = \dfrac{(-1)^4.4}{x^5}$

c. $y_5 = \dfrac{24}{x^4}$

d. $y_5 = \dfrac{24}{x^5}$

If $f(x) = x + |x|, f(-3) = ?$

a. $-6$

b. $6$

c. $0$

d. $3$

Given $N = \{1,2,3,.....\}$

a. $N$ is a closed set

b. $N$ is an open set

c. $N$ is not a closed set

d. $N$ is not open set

). Statement of Lagrange's mean value theorem is

a. If a function $f$ defined on $[a,b]$ is

(i)continuous on $[a,b]$

(ii)Derivable on $]a,b[$,

(iii) $f(a) = f(b)$

then there exist at least one real number $c$ between $a$ and $b$ such that

$f'(c) = \dfrac{f(b) - f(a)}{b - a}$

b. If a function $f$ defined on $[a,b]$ is

(i)continuous on $[a,b]$

(ii)Derivable on $]a,b[$,then there exist at least one real number $c$ between $a$ and $b$ such that $f'(c) = \dfrac{f(b) - f(a)}{b - a}$

c. If a function $f$ defined on $[a,b]$ is

(i)continuous on $[a,b]$

(ii)Derivable on $]a,b[$,

(iii) $f(a) = f(b)$

then there exist at least one real number $c$ between $a$ and $b$ such that $f'(c) = 0$

**d.** If a function $f$ defined on $[a,b]$ is

(i)continuous on $[a,b]$

(ii)Derivable on $]a,b[$,then there exist at least one real number $c$ between $a$ and $b$ such that $f'(c) = 0$

**11.** $\int dx = ?$

a. $dx$ b. $x$

c. Both a and b d. $x + c$, where $c$ is arbitrary constant

**12.** Given $S = \{x : 0 \le x \le 1, x \in Q\}$,Then

a. $S$ is a bounded above b. $S$ is not a bounded set

c. $S$ is a bounded set d. None of the above

**13.** Equation of tangent is

a. $y - y' = \frac{dy}{dx}(x - x')$ b. $y - y' = \frac{dx}{dy}(x - x')$

c. $x - x' = \frac{dy}{dx}(y - y')$ d. All of the above

**14.** Equation of normal is

a. $y - y' = \frac{dy}{dx}(x - x')$ b. $x - x' = \frac{dy}{dx}(y - y')$

c. $x - x' = \frac{dx}{dy}(y - y')$ d. None of the above

15. $\int \log x = ?$

a. $\frac{1}{x}$ b. $x$

c. $x \log x + c$ d. None of the above

16. $\int \frac{\cos x - \sin x}{\sin x + \cos x} dx =$

a. $\log(\sin x + \cos x)$ b. $\log(\sin x - \cos x)$

c. Both a and b d. None of the above

17. A straight line that constantly approaches a given curve but does not meet at any infinite distance is called

a. Tangent b. Normal

c. Asymptote d. None of the above

18. Asymptotes may be

a. Vertical b. Horizontal

c. Oblique d. All of the above

19. How many tangents a parabola have

a. One b. Two

c. Four d. None of the above

20. $\int a^x dx =$

a. $a^x \log_e a$ b. $\log_e a$

c. Both a and b d. None of the above

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## Descriptive

**Time : 2 hrs. 30 min.** **Marks : 50**

***[ Answer question no.1 & any four (4) from the rest ]***

1. Define Asymptote. Also find all the asymptotes to the curve $f(x) = \frac{3x-2}{x+1}$ **10**

2. Find the derivative of the following **5+5=10**

   a. $y = e^{2x}\sin x + x^3 \log x$

   b. $y = \frac{1-\cos x}{1+\cos x}$

3. State and Prove Rolle's Theorem **2+8=10**

4. Find the maximum or minimum value of $3x^4 + 8x^3 - 6x^2 + 24x + 1$ **10**

5. If $y = A\cos nx + B\sin nx$, show that $y_2 + n^2 y = 0$ **10**

6. **5+5=10**

   a. Evaluate $\lim_{\substack{x \to 0 \\ y \to 0}} \frac{x^2 y}{x^4 + y^2}$

   b.Discuss the continuity of

$$f(x,y) = \begin{cases} \frac{x}{\sqrt{x^2+y^2}}, x \neq 0, y \neq 0 \\ 2, x = 0, y = 0 \end{cases}$$ at the origin.

7. a. Find the equation of tangent to the curve $xy^2 = 4(4-x)$ at the point where it cuts the line $x = y$ **10**

8. Find the equation of normal to the curve $x = a(t - \sin t), y = a(1 - \cos t)$ at the point t **10**

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