KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2024

Marks Scored:

Level : BHI
Year : I

Course : HIMS 103
Semester : I

Exam Roll No. : Time: 30 mins. F. M. : 10

Registration No.: Date : 0 2 APR 2025

SECTION "A"

[10 Q. × 0.5 = 5 marks]

Fill in the blank space(s) by writing the most appropriate word(s) or symbol(s).

1. A function y = f(x) is an odd function of x if ________________.

2. The solution set on the real line $|x-1| \leq 1$ ________________.

3. A finite interval is said to be ____________ if it contains only the right endpoint.

4. The set of all possible output values is called the ______________ of the function.

5. If f(x) = x + 5, and g(x) = x^2, then g(f(1)) = ________________.

6. If f is the ______________ then $\lim_{x \to x_0} f(x) = \lim_{x \to x_0} k$ for any value of x_0

7. Suppose that $g(x) \leq f(x) \leq h(x)$ for all x in some open interval containing c except possibly $x = c$ itself. Suppose also that $\lim_{x \to c} g(x) = \lim_{x \to -c} h(x) = L$ then______________.

8. The derivative of the function $y = 3x^3$ with respect to x is ______________.

9. $\lim_{x \to 0}(x^2 + 5x + 9) =$ ________________.

10. The derivative of the function $\int_0^x (1-t)\, dt$ is ________________.

SECTION "B"

[10 Q.× 0.5 = 5 marks]

Fill in the blank space(s), **DO NOT TICK**, by selecting the most appropriate answers from among the given ones.

11. $\int \frac{dx}{x} =$ ________________

[x; $x+c$; lnx; $lnx+c$]

12. The derivative of the function $y = x^2$ at x=2________________

[0; 4; -4; ¼]

13. Suppose that f is a function that $\sqrt{1+2x^2} \leq f(x) \leq \sqrt{1-2x}$ for that are near 0 but not equal to 0 then $\lim_{x\to 0} f(x) =$ ________________

[1; −1; 2; −2]

14. The point of discontinuity of the function $f(x) = \frac{1}{x} - 3$ at ______________

[$x = 0$; $x \neq 0$; $x \leq 0$; $x \geq 0$]

15. A point at which the first derivative becomes zero is called ________________

[Critical point, point of inflection, Local Maximum, Local Minimum]

16. The derivative of $f(x) = sinx$ is ____________________

[$-cosx$; $cosx$ $sinx$; ; $-sinx$]

17. Suppose that f and g are continuous and that $\int_1^2 f(x)dx = 4$ $\int_1^3 f(x)dx = -5$ and $\int_3^1 g(x)dx = -7$ then $\int_3^1 [f(x) - g(x)]dx =$ ______________

[$\int_2^1 f(x)dx$, $\int_1^3 g(x)dx$, $\int_3^1 g(x)dx$, $\int_1^2 f(x)dx$]

18. The y-intercept of the line $4x + y = 20$ is ________________

[-5; 5; -20; 20]

19. Two linear systems of equations are said to be __________ if they have the same solution

[Equal; Equivalent; No solution; Many solution]

20. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$, be a 2×2 matrix then A^2 is equal to ____________

[$\begin{bmatrix} 7 & 6 \\ 12 & 4 \end{bmatrix}$, $\begin{bmatrix} -5 & -2 \\ -6 & 0 \end{bmatrix}$, $\begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$, $\begin{bmatrix} 7 & 8 \\ 9 & 4 \end{bmatrix}$]

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Time : 2 hrs. 30 mins.		F. M. : 40

SECTION "C"
[2 Q. × 8 = 16 marks]

1. What conditions must be satisfied by a function if it is to be continuous at an interior point of its domain? What are the basic types of discontinuity?

[2+2+4]

Discuss the continuity at x=0 of the function given by

$$f(x) = \begin{cases} 3x - 2 & x \leq 0 \\ x + 1 & x > 0 \end{cases}$$

2.

a. Determine whether $\vec{z}$ can be generated (or written) as a linear combination of $\vec{x}$ and $\vec{y}$.

$\vec{x} = \begin{bmatrix} 1 \\ -2 \\ -5 \end{bmatrix}$, $\vec{y} = \begin{bmatrix} 2 \\ 5 \\ 6 \end{bmatrix}$ and $\vec{z} = \begin{bmatrix} 7 \\ 4 \\ -3 \end{bmatrix}$ [4]

b. Given $\vec{x} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$,and $\vec{y} = \begin{bmatrix} 2 \\ -5 \end{bmatrix}$, then find $4\vec{x}$, $-3\vec{y}$ and $4\vec{x} + (-3)\vec{y}$ [4]

OR

a. Find the sums of the following series $\sum_{n=1}^{\infty} \frac{3^{n-1}-1}{6^{n-1}}$ [4]

b. Write out the first ten terms of the sequence: $a_1 = 1,\ a_{n+1} = \frac{a_n}{n+1}$ [2]

c. Find a formula for the nth term of the sequence 12, 14, 16, 18, 20, 22… [2]

SECTION "D"
[6 Q. × 4 = 24 marks]

3. Find $\frac{dy}{dx}$ (***ANY TWO***)

a. $y = 4x - 2x^3 - 9$ b. $y = -10x + 3cosx$ c. $y = x^2e^x$

4. Evaluate the following integrals (***ANY TWO***).

a. $\int_0^2 x(x-3)\,dx$ b. $\int x^2e^x\,dx$ c. $\int 3x^2\sqrt{x^3+1}\,dx$

P.T.O.

5. Solve the initial value problem

$$\frac{dy}{dx} = 5 - x, \qquad y(0) = -3$$

6. Find all the points of local maxima and minima and the corresponding maximum and minimum values of the derivative function given

$$f(x) = x^2 - 4x + 3.$$

7. Evaluate the following limits.

a. $\lim\limits_{x \to -5} \frac{x^2+3x-10}{x+5}$

b. $\lim\limits_{x \to 0} \frac{\frac{1}{x-1}+\frac{1}{x+1}}{x}$

8. Find a solution to the given system of equations by using row operation method

$$x + 5y = 7$$

$$-2x - 7y = -5$$