

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks Scored:

Level : B.Sc.\B. Pharm.\B. Tech.

Course : MATH 111

Year : I

Semester: I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 06 MAR 2019

SECTION "A"

[10 Q. \times 1 = 10 marks]

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

1. A finite interval is said to be _____ if it contains one endpoint but not the other endpoint.
2. If $f(x) = x + 5$, and $g(x) = x^2 - 3$, then $f(g(2)) =$ _____
3. The domain of the function $y = \sqrt{x - 5}$ is _____
4. Sometimes a _____ uses different formulas on different parts of its domain.
5. The average rate of change of the function $y = f(x)$ with respect to x over the interval $[x_1, x_2]$ is _____
6. $\lim_{x \rightarrow 5} \frac{x-5}{x^2-25} =$ _____
7. If the function with domain D is continuous at every point of a closed interval I , then the function has a/n _____ value on D at a point c if $f(x) \leq f(c)$ for all x in D .
8. The limit of Riemann sums $\lim_{\|P\| \rightarrow 0} \sum_{k=1}^n 2c_k^3 \Delta x_k$, where P is a partition of the interval $[-1, 0]$ can be expressed in terms of definite integral as _____
9. The derivative of the function $\int_0^x \sqrt{1+t^2} dt$ is _____
10. $\int \frac{dx}{x\sqrt{x^2-1}} =$ _____

SECTION "B"

[10 Q. \times 1 = 10 marks]

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

11. The slope of the function $y = \frac{1}{x-1}$ at $x=3$ _____
 [0; 1/4; -1/4; 1]
12. The absolute value expression of an inequality $0 \leq x + 2 \leq 4$
 [$|x| < 2$; $|x| \leq 2$; $|x| > 2$; $|x| \geq 2$]
13. Suppose that f is a function that $\sqrt{4 - 2x^2} \leq f(x) \leq \sqrt{4 + 2x}$ for that are near 0 but not equal to 0 then $\lim_{x \rightarrow 0} f(x) =$ _____
 [4; -4; 2; -2]
14. The point of discontinuity of the function $f(x) = \frac{x^2-1}{3x}$ at _____
 [1; -1; 0; ∞]
15. The Domain of function $f(x) = \ln^{-1}x$ is _____
 [$(-1, 1)$; $(-\infty, 0)$; $(0, \infty)$; $(-\infty, \infty)$]
16. A point at which the second derivative becomes zero is called _____
 [Critical point; point of inflection; Local Maximum; Local Minimum]
17. If $f(x) = \frac{x}{|x|-4}$ then $f(-2) =$ _____
 [1; 2; -1; -2]
18. Suppose that f and g are continuous and that $\int_1^2 f(x)dx = -7$ $\int_1^5 f(x)dx = 5$ and $\int_5^1 g(x)dx = -12$ then $\int_5^1 [g(x) - f(x)]dx =$ _____
 [$\int_1^5 f(x)dx$; $\int_1^5 g(x)dx$; $\int_5^1 g(x)dx$; $\int_1^2 f(x)dx$]
19. The horizontal asymptote to the curve $y = \frac{x+3}{x+2}$ is _____
 [$y = 0$; $y = 1$; $y = -\infty$; $y = \infty$]
20. The y-intercept of the line $8x + 5y = 20$ is _____
 [-4; 4; 8; 20]

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Year : I
Time : 2 hrs. 30 mins.

Course : MATH 111
Semester: I
F. M. : 55

SECTION "C"

[3Q × 7 = 21 marks]

1. How does it mean for a function to be continuous at a point? How can looking at the graph of a function help you tell where the function is continuous? [2+2+3]
Discuss the continuity at $x=3$ of the function given by

$$f(x) = \begin{cases} x^2 - 1 & x < 3 \\ 2ax & x \geq 3 \end{cases}$$

OR

What is the average rate of function $g(t)$ over the interval from $t = a$ to $t = b$? How is it related to a secant line?

Suppose that functions f and g and their derivatives have the following values at $x = 0$ and $x = 1$.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
0	1	1	5	$\frac{1}{3}$
1	3	-4	$-\frac{1}{3}$	$-\frac{8}{3}$

Find the derivatives of the following combinations at the given value of x

- i) $5f(x) + g(x)$, $x=1$
 - ii) $\frac{f(x)}{g(x)+1}$, $x=1$
 - iii) $f(g(x))$, $x=0$
 - iv) $f(x+g(x))$, $x=0$
2. State the first and second fundamental theorems on integral calculus.
Find the average value of $f(x) = -3x^2 - 1$ on $[0, 3]$. Does the function f actually take on this value at some point in the given domain? [3+4]
3. When is a matrix said to be echelon form? Use Gaussian elimination and back addition method to solve the given systems of equations simultaneously. [2+5]

$$\begin{array}{l} 4x - 11y + 13z = 3 \\ 4x - 12y + 10z = 0 \\ x - 3y + 2z = -1 \end{array} \quad \text{and} \quad \begin{array}{l} 4x - 11y + 13z = 14 \\ 4x - 12y + 10z = 10 \\ x - 3y + 2z = 2 \end{array}$$

SECTION "D"
[6Q × 4 = 24 marks]

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

a) $2xy + y^2 = x + y$

b) $y = (\sin x)^x$

c) $y = \frac{x^2 + 5x - 1}{x^2}$

5. Evaluate the following integrals (ANY TWO).

a) $\int_0^1 (4y - y^2 + 4y^3 + 1)^{-2/3} (12y^2 - 2y + 4) dy$

b) $\int x^3 \cos x dx$

c) $\int \frac{1}{1 + \sin x} dx$

6. Solve the initial value problem

$$\frac{ds}{dt} = 4x(x^2 + 8)^{-1/3}, \quad y(0) = 0$$

7. Find all the points of local maxima and minima and the corresponding maximum and minimum values of the function given $y = 1 - 9x - 6x^2 - x^3$.

8. Evaluate the following limits.

a) $\lim_{t \rightarrow 0} \frac{5t^2 - 3t}{7t^2 + 1}$

b) $\lim_{t \rightarrow 0^+} \left(\frac{1}{x} - \frac{1}{\sin x} \right)$

9. Use Gaussian elimination to find a solution to the given system or show that it is inconsistent

$$-2x + 4y + 2z = 6$$

$$4x - 9y - 8z = -5$$

$$8x - 19y - 20z = 7$$

SECTION "E"
[5Q × 2 = 10 marks]

10. Write an equation for the line through the point (-1, 1) with slope -1.

11. Say whether the function $f(x) = x^2 + 1$ is even, odd or neither

12. Determine the row rank of the matrix

$$A = \begin{bmatrix} 1 & 2 & -3 \\ -2 & -5 & 4 \\ -5 & -13 & 9 \end{bmatrix}$$

13. Sketch a graph of the equation $x^2 + y^2 = 64$.

14. If y varies as x, and y=5 when x=15, find the equation between x and y.