KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Marks Obtained:	

Level : B.Arch. | Course : MATH 105
Year : I | Semester : I
Exam Roll No.: | Time: 30 mins. | F.M. : 20
30 MAY 2019
Registration No.: | Date :

SECTION "A"
[10 Q. × 1 = 10 marks]

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

1. A function $y = f(x)$ is an ..... function if $f(-x) = f(x)$
2. If f : $\mathbb{R} \to \mathbb{R}$. The domain of the function f(x) = $\sqrt{x-4}$ is .....
3. The value of $\frac{d}{dx} log(\sin x)$ is .....
4. The inclination with the x-axis of the tangent to the curve $x2 + y2 = 36$ at $(2,6)$ is given by .....
5. If $\lim_{x\to a^+} f(x) \neq \lim_{x\to a^-} f(x)$. Then function $y = f(x)$ has a ..... discontinuity at $x = a$.
6. If $F(x) = \int_0^x \sqrt[3]{t+5}\, dt$, the value of $F'(x)$ at x = 22 is .....
7. $\lim_{x\to 3^-} \frac{\lceil x \rceil}{\lfloor x \rfloor}$ = ..., where symbols have their usual meaning.
8. The value of $7\Gamma\left(\frac{3}{2}\right)$ ..... where symbols have their usual meaning.
9. The first order differential equation of $x^2 + y^2 = 25$ is .....
10. The perpendicular distance from origin to plane $3x - y + \sqrt{6}z = 5$ is .....

SECTION "B"
[10 Q. × 1 = 10 marks]

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

11. Two planes $a_1x + b_1y + c_1z = d_1$ and $a_2x + b_2y + c_2z = d_2$ will be parallel if .....

[$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$; $a_1a_2 + b_1b_2 + c_1c_2 = 0$;

$\frac{a_1}{a_2} = \frac{b_1}{b_2}$; $b_1b_2 + c_1c_2 = 0$]

12. If A, B, C be the angles which a line makes with the co-ordinate axes, then $\sin^2 A + \sin^2 B + \sin^2 C =$ .....
[2; 3 ; 4; 5]

13. The average value of $f(x) = 5 - x^2$ on the closed interval [0, 2] is .....
[11/5; 11/3; 5; 1]

14. The value of $f(x) = x^3 - 12x + 5$ is maximum at $x =$.....
[-2; 2; 1; -1]

15. The gamma value of $\Gamma(n+1)$ is ..... if n is a positive integer
[n + 1; n; (n+1)!; n!]

16. The graph of the function $y^2 = 4x$ is symmetric about .....
[y-axis; x-axis; line y = x; origin]

17. The oblique asymptote to the curve $y = \frac{x^2-3}{2x-4}$ is .....
[$y = \frac{x}{2} + 1$; $y = \frac{x}{2} - 1$; $x = 3$; $y = 3$]

18. The value of $\frac{d^n}{dx^n}(e^x)$ is .....
[$n^n e^{nx}$; $n!\, e^{nx}$; ne^{nx} ; e^x]

19. If $f'(x) = \frac{1}{\sqrt{1-x^2}}, f(0) = 0$. Then $f(1) =$ .....
[$\frac{\pi}{2}$; $\sqrt{\frac{\pi}{2}}$; 1 ; 0]

20. The value of $\int \tan x \, dx$ is .....
[$\log sin + c$ $\log x + c$; $x \log x + c$; $-\log \cos x$]

KATHMANDU UNIVERSITY
End Semester Examination [C]
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30 MAY 2019

Level : B. Arch.
Year : I
Time : 2 hrs. 30 mins.

Course : MATH 105
Semester : I
F.M. : 55

SECTION "C"
[3Q. × 7 = 21 marks]

1. Define the co-planar lines. Prove that the lines $\frac{x+5}{3} = \frac{y+4}{1} = \frac{z-7}{-2}$ and $3x + 2y + z - 2 = 0 = x - 3y + 2z - 13$ are coplanar. Find the equation of the plane in which they lie. [1 + 3+ 3]

2. Define limit and continuity of a function $y = f(x)$ at a point $x = a$. Prove that differentiability of a function at a point implies continuity at that point but converse may not be true. [2 + 3 + 2]

3. Define critical point and point of inflection of a function. What are the critical points and point of inflections of the function, $f(x) = x^4 - 4x^3 + 4x^2$ where $0 \leq x \leq 5$? Also find absolute maxima and minima value of this function. [2 + 2 + 3]

OR

What is right hand derivative and left hand derivative of a function at a point? For what value of a and b will $f(x) = \begin{cases} ax, & \text{if } x < 2 \\ ax^2 - ax + 3, & \text{if } x \geq 2 \end{cases}$ be differentiable for all values of x. Write down the necessary condition for local extreme value. [2 + 3 + 2]

SECTION "C"
[6Q × 4 = 24 marks]

4. Find $\frac{dy}{dx}$ (*ANY TWO*):
(a) $y_x = x_y$ (b) $x^2(x - y) = x^2 - y^2$ (c) $x = e^{\cos 2t}$, $y = e^{\sin 2t}$

5. Evaluate the following integrals (*ANY TWO*):
(a) $\int \frac{5x - 13}{(x-3)(x-2)} dx$ (b) $\int_0^2 \frac{dx}{\sqrt[3]{(x-1)}}$ (c) $\int (1 + e^{\tan\theta}) sec^2\theta \, d\theta$

6. Find the average value of $f(x) = 4 - x^2$ on [0, 3] and verify the mean value theorem of average value.

7. Find the area of the region between the curve $y = 2x^2 + x$ and the x- axis on the interval [0, 5].

OR

Find the area bounded between the curves $\boldsymbol{y = x^4}$ and $\boldsymbol{y = 8x}$.

8. Define Beta and gamma function. Evaluate: $\Gamma\left(\frac{3}{2}\right)\ \Gamma\left(\frac{5}{2}\right)$.

9. What is a differential equation and solve: $(2x\ -\ y)dx + (y - x)dy = 0$.

SECTION "E"

[5Q. × 2 = 10 marks]

10. Suppose $f: \mathbb{R}^2 \to \mathbb{R}^2$ defined by $f(x, y) = x^2 + 2xy + y^2 + 5$, then find f_x and f_y, where symbols have their usual meaning.

11. Find the points on the curve $x^2 + y^2 = 9$, where the tangent is parallel to y- axis.

12. Evaluate limit: $\lim_{x \to 0} \frac{\sin x - x}{x^3}$

13. Find the equation of a tangent plane to the sphere $x^2 + y^2 + z^2 = 9$ at the point (2, 2, -1).

14. Find all asymptotes of the curve $f(x) = \frac{x^2 + 1}{x^2 - 1}$.