

KATHMANDU UNIVERSITY  
End Semester Examination  
March/April, 2025

Marks Scored:

Level : B.Arch  
Year : I

Course : MATH 105  
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 02 APR 2025

SECTION "A"  
[10 Q. × 1 = 10 marks]

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

1. A function  $f(x) = -x^2$  is increasing on \_\_\_\_\_.
2. The range of the real function  $f(x, y) = \sin(xy)$  is \_\_\_\_\_.
3. A \_\_\_\_\_ that meet a sphere in two coincident points is tangent to the sphere.
4. The inclination of the tangent to the curve  $x^2 + y^2 = 4$  at  $(2, 2)$  with the  $x$ -axis is given by \_\_\_\_\_.
5. The function  $f(x) = \frac{x^2-4}{x-2}$  has \_\_\_\_\_ type discontinuity at  $x = 2$ .
6. The set of all points  $(x, y, g(x, y))$  in space for  $(x, y)$  in the domain of  $g$  is \_\_\_\_\_ of the function.
7. The necessary condition for the differential equation of the form  $P(x, y)dx + Q(x, y)dy = 0$  to be exact is \_\_\_\_\_.
8. The value of  $\Gamma\left(\frac{7}{2}\right)$  \_\_\_\_\_.
9. The first order differential equation of  $x^2 + y^2 = 9$  is \_\_\_\_\_.
10. The \_\_\_\_\_ of the squares of the direction cosines is unity.

## 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. The z-intercept of the plane  $2x + 3y - 4z = 12$  is \_\_\_\_\_.  
[ - 4;                      - 3 ;                      3                      4 ]
12.  $\lim_{x \rightarrow 3^-} \frac{|x|}{x} =$  \_\_\_\_\_.  
[ - 1;                      0 ;                      1;                      2 ]
13. The average value of  $f(x) = 4 - x^2$  on the closed interval  $[0, 3]$  is \_\_\_\_\_.  
[ - 1 ;                      0;                      1/2;                      1].
14. The distance of the origin from the plane  $6x - 2y + 2z = 14$  is \_\_\_\_\_ unit.  
[ 1;                      2;                      3;                      4 ]
15. The order and degree {order, degree} of the differential equation whose solution being  $y = \text{Cos } x + \text{Sin } x$  is \_\_\_\_\_.  
[ {1, 1};                      {1, 2};                      {2, 1};                      {2, 2} ]
16. The graph of the function  $y^2 = x$  is symmetric about \_\_\_\_\_.  
[ y-axis;                      x-axis;                      line  $y = x$ ;                      origin ]
17. The oblique asymptote to the curve  $y = \frac{x^2+1}{x-1}$  is \_\_\_\_\_.  
[  $y = x + 1$ ;                       $y = x - 1$ ;                       $x = 1$ ;                       $y = 1$  ]
18. The value of  $\frac{d^4}{dx^4}(\text{Sin } x)$  at  $x = \pi/2$  is \_\_\_\_\_.  
[ - 1 ;                      0;                      1 ;                       $\pi$  ]
19. If  $F(x) = \int_0^x \frac{1}{1+t^2} dt$ , the value of  $F'(x)$  at  $x = 1$  is \_\_\_\_\_.  
[ 1/2;                      1;                      2 ;                      3 ]
20. The radius of the sphere  $x^2 + y^2 + z^2 - 6x - 8y + 10z + 1 = 0$  is \_\_\_\_\_ units.  
[ 3 ;                      4;                      5;                      7 ]

KATHMANDU UNIVERSITY  
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Time : 2 hrs. 30 mins.

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

SECTION "C"  
[3 Q. × 7 = 21 marks]

1. Define the continuity of a function  $y = f(x)$  at a point  $x = a$ . Write the continuity test for the function at a point. Also, find the continuous extension of the function  
 $f(x) = \frac{x^2-9}{x-3}$  at  $x = 3$ . [1 + 2 + 4]
2. Define the co-planar lines. Prove that the lines given by  $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$  and line  $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$  are coplanar. Also, find the equation of the plane in which they lie. [2 + 3 + 2]
3. Write the first derivative test for the extreme values of the function. Also, find the extreme values of the function  $f(x) = -x^3 + 3x + 3$  defined on  $[-2, 2]$ . [2 + 5]

OR

Define the first order partial derivatives of  $f(x, y)$  relative to its variables. Also, use proper symbol to find the mixed-order partial derivatives of the function  $f(x) = \tan^{-1}(y/x)$ . [2 + 5]

SECTION "D"  
[6 Q. × 4 = 24 marks]

4. Find  $\frac{dy}{dx}$  (ANY TWO):  
a.  $y^{\cos x} = x^{\sin y}$       b.  $f(x) = \ln(\cos(e^{\sqrt{\sinh x}}))$       c.  $x = \cos^3 t, y = \sin^3 t$
5. Evaluate the following integrals (ANY TWO):  
a.  $\int e^x \sin x \, dx$       b.  $\int_1^2 \frac{dx}{\sqrt{2x-x^2}}$       c.  $\int_0^{\infty} \frac{1}{x^2+1} \, dx$
6. Define the gamma function and use it to evaluate:  $\int_0^{\pi/2} \sin^4 \theta \cos^6 \theta \, d\theta$ .
7. Find the equation of the plane passing through the points  $(0, 1, 1)$ ,  $(1, 1, 2)$  and  $(-1, 2, -2)$ .

OR

Find the equation of the line through  $(-1, 3, 2)$  that is perpendicular to the plane  $x + 2y + 2z = 3$ . Also, find the coordinate of its foot.

8. Sketch the graph and find the area bounded between the curves  $y = x^2$  and  $x = y^2$ .

P.T.O.

9. Solve the IVP:  $(x^2y + y) dy + (xy^2 + x) dx = 0$  with  $y(0) = 1$ .

SECTION "E"

[5 Q.  $\times$  2 = 10 marks]

10. Find the equation of the sphere described on the line joining the points  $(1, -1, 3)$  and  $(-2, 2, -2)$ .
11. Find the angle between the planes  $2x - y + z = 6$  and  $x + y + 2z = 3$ .
12. Evaluate the limit:  $\lim_{x \rightarrow 0} x^x$
13. Find the third order derivative of  $y = x + \tan x$  at  $x = 0$ .
14. Find all asymptotes of the curve  $f(x) = \frac{x^2 - 3}{x - 1}$ .