MATHS MATHS MATHS MATHS MATHS MATHS CODE - 041 (S) B Bhathergar Int. Schol Time: 3hrs General Instructions: i) All questions are compulsory The question paper consist of 26 questions divided into three sections: A, B and C. ii) Section A comprises of 6 questions of one mark each. Section B comprises of 13 questions of four marks each and Section C comprises of 7 questions of six marks each. All questions in section A are to be answered in one word, one sentence or as per the exact iii) requirement of the questions. There is no overall choice. However internal choice has been provided in 4 questions of four iv) marks each and 2 questions of six marks each. You have to attempt only one of the alternative in all such questions. Use of calculator is not permitted. You may ask for logarithmic tables and graph paper if v) required. SECTION A (Question 1 to 6 carry 1 mark each) 1. If  $f: R \to R$  and  $g: R \to R$  and  $f(x) = x^2 + 1$  and  $g(x) = \sin x$  then find gof. Construct a 2 x 2 matrix A = [aij] whose elements aij are given by  $aij = \frac{(i-j)^2}{2}$ MAPHS d) None of these 4. Show that all elements of main diagonal of skew – symmetric matrix are zeros? 5. Find an angle  $\theta$ , which increases twice as fast as its Sine. &  $B = \begin{bmatrix} 1 & 0 & 4 \end{bmatrix}$ . Find (AB) (Question 11 to 22 carry '4' marks each) is continuous, then find value of 'p'

M.M.: 100 MATHS MATHS Show that the curves  $4x = y^2$  and 4xy = k cut a right angles, if  $k^2 = 512$ 

Prove that the function  $f(x) = x^2 - x + 1$  is neither increasing nor decreasing on (-1,

9. If 
$$x = sin\left(\frac{1}{a}\log y\right)$$
 then show that  $(1-x^2)y_2 - xy_1 - a^2y = 0$ 

10. Solve the differential equation:

$$(1+x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}$$
, given that

y = 0 when x=1

OR

Integrate

$$\int \frac{x^2}{\left(x \sin x + \cos x\right)^2} \, dx$$

- 11. Prove that  $2 \tan^{-1} \left( \sqrt{\frac{a-b}{a+b}} \tan \frac{\theta}{2} \right) = \cos^{-1} \left( \frac{a \cos \theta + b}{a + b \cos \theta} \right)$
- 13. Show that

$$\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ bc & ca & ab \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix}$$
$$= (a - b) (b - c) (c - a) (ab + bc + ca)$$

14. If 
$$A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$$
 then prove that  $(aI + bA)'' = a''I + na''^{-1}bA$  where  $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ 

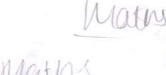
and n is a positive integer n.

Solve initial value problem

$$(x + y + 1)^2 dy = dx$$
;  $y(-1) = 0$ 

MATHS MATHS

- - $\tan(x-\theta)\tan(x+\theta)\tan 2x dx$
  - (ii)  $\left[\sqrt{1+2\tan x(\tan x+\sec x)}\right] dx$



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16. Integrate  $\int e^x dx$  limits as a sum

OR
Integrate 
$$\int \frac{dx}{\sqrt{\sin^3 x} \sin(x+\alpha)}$$

- 17. The total cost of providing x radio sets per day is Rs.  $\left(\frac{x^2}{4} + 35x + 25\right)$  and the price per set at which they may be sold is Rs  $\left(50 - \frac{x}{2}\right)$ . Find the daily output to maximize the total profit.
- 18. If  $x\sqrt{1+y} + y\sqrt{1+x} = 0$  then prove that

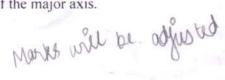
$$\frac{dy}{dx} = -\frac{1}{(1+x)^2}$$

19. Show that  $f(x) = x^2$  is differentiable at x = 1 and find f'(1)

## SECTION C

(Question 20 to 26 carry '6' marks each)

- 20. Find the area of the greatest isosceles triangle that can be inscribed in a given ellipse having its vertex coincident with one end of the major axis.
- Find the area of the region  $\{(x, y): y^2 \le 4x; 4x^2 + 4y^2 \le 9\}$



and -1 < t < 1 then show that  $\frac{dy}{dx} = -\frac{y}{x}$ 

-1 Find A<sup>-1</sup> through elementary row transformation method.

OR

Solve the initial value problem

$$(1 + y^2) dx = (\tan^{-1} y - x) dy; y (0) = 0$$

3

MATHS MATHS

**24.** Show that the function f in A = R -  $\left\{\frac{2}{3}\right\}$  defined as  $f(x) = \frac{4x+3}{6x-4}$  is one – one and onto. Hence find f1.

25. Integrate 
$$\int \frac{x^2 + 1}{(x - 1)^2 (x + 3)} dx$$

OR

Determine the product

$$\begin{bmatrix} 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix} \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 0 \end{bmatrix} a$$

and use it to solve the system of equation

$$x-y+z=4$$
;  $x-2y-2z=0$ ;  $2x+y+3z=1$ 

26. From differential equation representing the family of ellipses having centre at the origin and foci on x -axis.

OR

$$A = \begin{bmatrix} 3 & 2 & 0 \\ 1 & 4 & 0 \\ 0 & 0 & 5 \end{bmatrix}$$

then show that  $A^2 - 7A + 10 I_3 = 0$  and hence find  $A^{-1}$ .