

MATHEMATICS

Time allowed 1.5 hours

Maximum Marks: 50

General Instructions:

1. *All questions are compulsory.*
 2. *The question paper consists of 16 questions divided into three sections A, B and C. Section A comprises of 6 questions of one marks each, Section B comprises of 8 questions of four marks each and Section C comprises of 2 questions of six marks each.*
 3. *All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.*
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SECTION 'A'

Question numbers 1 to 6 carry 1 marks each.

1. For what value of x , the matrix $\begin{bmatrix} 5-x & x+1 \\ 2 & 4 \end{bmatrix}$ is singular.
2. If $\sin(\sin^{-1}\frac{1}{5} + \cos^{-1}x) = 1$, then find the value of x .
3. If $A = \begin{bmatrix} 3 & 1 \\ 2 & -3 \end{bmatrix}$, then find $|\text{adj } A|$.
4. If $\begin{pmatrix} a+b & 2 \\ 5 & b \end{pmatrix} = \begin{pmatrix} 6 & 5 \\ 2 & 2 \end{pmatrix}'$, then find a .
5. Find the value of: $\int 6^x dx$.
6. Evaluate: $\frac{d}{dx}|x|$

SECTION 'B'

Question numbers 7 to 14 carry 4 marks each.

7. Evaluate:

$$\int \frac{x+3}{\sqrt{5-4x+x^2}} dx$$

OR

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

8. Show that $y = \log(1+x) - \frac{2x}{2+x}$, $x > -1$, is an increasing function of x throughout its domain.
9. For the curve $y = 4x^3 - 2x^5$, find all, the points at which the tangent passes through the origin.
10. Show that: $\cos^{-1}\frac{12}{13} + \sin^{-1}\frac{3}{5} = \sin^{-1}\frac{56}{65}$

OR

Solve for x : $\tan^{-1}\frac{x-1}{x-2} + \tan^{-1}\frac{x+1}{x+2} = \frac{\pi}{4}$

11. Using properties of determinants prove that:

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

12. Differentiate $(x \cos x)^x + (x \sin x)^{\frac{1}{x}}$ with respect to x .

13. If $x = a(\cos t + t \sin t)$ and $y = a(\sin t - t \cos t)$, find $\frac{d^2y}{dx^2}$

14. Find the value of 'a' for which the function f is defined as

$$f(x) = \begin{cases} a \sin \frac{\pi}{2}(x+1), & x \leq 0 \\ \frac{\tan x - \sin x}{x^3}, & x > 0 \end{cases}$$

is continuous at $x=0$.

SECTION 'C'

Question numbers 15 to 16 carry 6 marks each.

15. Gaurav purchases 3 pens, 2 bags and 1 instrument box and pays ₹ 41. From the same shop, Dheeraj purchases 2 pens, 1 bag and 2 instrument boxes and pay ₹ 29, while Ankur purchases 2 pens, 2 bags and 2 instrument boxes and pay ₹ 44. Translate the problem into a system of equations. Solve the system of equations by matrix method and hence find the cost of 1 pen, 1 bag and 1 instrument box. Write two uses of instrument box.

16. Evaluate:

$$\int \frac{1}{\sin^4 x + \sin^2 x \cos^2 x + \cos^4 x} dx$$

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