Mathematics Mock Test XII for March 2012 Exams

Series PRACTICE

Code No. **65/I**

Roll No. | | | | | | | |

Candidates must write the set code on the title page of the answer book

MATHEMATICS

TIME:3HR. **M.MARKS: 100**

General Instructions

1. All questions are compulsory.
2. The question paper consists of 29 questions divided into three sections A, B and C. Section A comprises of 10 questions of one mark each, section B comprises of 12 questions of four marks each and section C comprises of 07 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.
4. There is no overall choice. However, internal choice has been provided in 04 questions of four marks each and 02 questions of six marks each. You have to attempt only one of the alternatives in all such questions.
5. Use of calculators in not permitted. You may ask for logarithmic tables, if required.

Mathematics Mock Test XII for March 2012 Exams

Section A

Questions 1 to 10 carry 1 mark each.

1. If R and S are reflexive relations, defined on set A, prove that $R \cap S$ is also a reflexive relation.

2. Find the principal value of $\cos^{-1}\left(-\frac{1}{2}\right)$.

3. If $A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 \\ 0 & 2 \\ 5 & 0 \end{bmatrix}$, verify $(AB)^T = B^T A^T$

4. If ω be the cube root of unity, show that $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} = 0$

5. If $A = \begin{vmatrix} 1 & -2 & 4 \\ 0 & 2 & 1 \\ -4 & 5 & 3 \end{vmatrix}$, find adj A.

6. Evaluate $\int \frac{1}{\sqrt{(2-x)^2 - 1}} dx$

Mathematics Mock Test XII for March 2012 Exams

7. Find $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \left(\sin^{101} x + x^{205}\right) dx$

8. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, show that $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}$.

9. If $\vec{a}$ is a unit vector and $\left(\vec{x}-\vec{a}\right)\cdot\left(\vec{x}+\vec{a}\right)=8$, then find $\left|\vec{x}\right|$.

10. Find the point of intersection of the line $\frac{2-x}{5}=\frac{y-3}{5}=\frac{z-2}{2}$ and the plane $x-y+z=2$

Section B

Questions 11 to 22 carry 4 mark each.

11. Show that the function $f:R\to R$, defined by $f(x)=\frac{2x-1}{3}, x\in R$ is one one onto. Also find the inverse of f.

12. Prove that $\tan\left[\frac{1}{2}\sin^{-1}\frac{2x}{1+x^2}+\frac{1}{2}\cos^{-1}\frac{1-y^2}{1+y^2}\right]=\frac{x+y}{1-xy}, xy<1$.

OR

Prove that $2\tan^{-1}\frac{1}{5}+\sec^{-1}\frac{5\sqrt{2}}{7}+2\tan^{-1}\frac{1}{8}=\frac{\pi}{4}$.

13. Using properties of determinants, prove that $\begin{vmatrix}1 & 1 & 1\\ x & y & z\\ x^2 & y^2 & z^2\end{vmatrix}=(x-y)(y-z)(z-x)$

Mathematics Mock Test XII for March 2012 Exams

14. Differentiate $\tan(3x-2)$ with respect to x, ab initio.

OR

If $x = a(\cos\theta + \theta\sin\theta)$; $y = a(\sin\theta - \theta\cos\theta)$, find $\frac{d^2y}{dx^2}$

15. Discuss the continuity of the function : $f(x) = \begin{cases} \frac{e^{\frac{1}{x-1}} - 2}{e^{\frac{1}{x-1}} + 2}, & x \neq 1 \\ 1, & x = 1 \end{cases}$ at $x = 1$

16. For the function $f(x) = x^3 - 6x^2 - 1$, find the intervals in which $f(x)$ (i) increases and (ii) decreases. OR

From a cylindrical drum containing oil and kept vertical, the oil is leaking at the rate of $10cm^3/sec$ .If the radius of the drum is 10 cm and height 50 cm. find the rate at which level of oil is changing when oil level is 20 cm.

17. Evaluate $\int \frac{x^2+1}{x^4+1}dx$

OR

Evaluate $\int\left(\sqrt{\tan x}+\sqrt{\cot x}\right)dx$

18. Find the point at which the function f(x) = $|x|+|x-1|$ is continuous.

19. Solve the differential equation $\left(x^2-y^2\right)dx+2xydy=0$, given that y = 1 when x = 1.

OR

Solve the differential equation $\frac{dy}{dx}+y=\cos x$.

20. The position vectors of the points A, B, C and D are $3\hat{i}-2\hat{j}-\hat{k}$, $2\hat{i}+3\hat{j}-4\hat{k}$, $-\hat{i}+\hat{j}+2\hat{k}$, $4\hat{i}+5\hat{j}+\lambda\hat{k}$ respectively. If the points A, B, C and D are coplanar, find the value of λ.

21. A variable plane which remains at a constant distance 3p from the origin, cut co-ordinate axes at A, B, C. Show that the locus of the centroid of triangle ABC is $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}$

22. The probabilities of A,B,C solving a problem are $\frac{1}{3},\frac{2}{7}$ and $\frac{3}{8}$ respectively. If all the three try to solve the problem simultaneously, find the probability that
(i) the problem is solved. (ii) exactly one of them solves the problem.

Section C

Questions 23 to 29 carry 6 mark each.

23. Solve the equations by finding A^{-1}, $x+2y-3z=6$, $3x+y-2z=3$, $2x-y+z=2$.

24. Show that the cone of greatest volume which can be inscribed in a given sphere is such that three times, its altitude is twice the diameter of the sphere. Find the volume of the largest cone inscribed in a sphere of radius R.

Mathematics Mock Test XII for March 2012 Exams

25. Evaluate $\int_0^{\frac{\pi}{4}} \log(1+\tan x)\,dx$

OR

Evaluate $\int_1^3 x^2 dx$ as a limit of sum.

26. Find the area of the smaller part of the circle $x^2+y^2=a^2$ cut off by the line $x=\frac{a}{\sqrt{2}}$

27. Find the distance of the point $(1,-2,3)$ from the plane $x-y+z=5$, measured parallel to $\frac{x+1}{2}=\frac{y+3}{3}=\frac{z+1}{-6}$

28. A and B throw alternately a pair of dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. Find their respective chance of winning, if A begins.

29. If a young man rides his motorcycle at 25 kmph, he has to spend `2 per km on petrol, if he rides at a faster speed of 40 kmph, the petrol cost increases to `5 per km. He has `100 to spend on petrol and wishes to find what is the maximum distance he can travel within one hour, Express as L.P.P and solve it.

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