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SAMPLE PAPER – 2009
Class – XII
Subject - Mathematics

Time 3 Hours   Max Marks 100

General Instructions

1.   All questions are compulsory
2.   Q 1 – 10 carries 1 marks, Q 11 – 22 carries 4 marks Q-23to 29 carries 6 marks

1. If A = $\begin{pmatrix} 1 & 0 \\ -1 & 7 \end{pmatrix}$ Find k such that $A^2 - 8A + kI = 0$

2. If A is a square matrix of order 3x3 and k is a scalar, then find the value of $|kA|$

3. If f: R → R such that f(x) = [x] . Prove that f is neither 1-1 nor onto by taking examples.

4. Find x if $\sin(\sin^{-1}(1/5) + \cos^{-1}x) = 1$

5. Find $\int \dfrac{1 + \cot x}{x + \log \sin x} dx$

6. Find the minor and cofactors of the elements of the second row of the following determinant   1
    $\begin{vmatrix} 2 & -3 \\ -4 & 3 & 6 \\ 2 & -7 & 9 \end{vmatrix}$

7.   If $|a| = 5$, $|b| = 13$ $|a \times b| = 25$. Find a.b

8. Show that a = 3i-2j+k, b = i-3j+5k and c = 2i+j-4k form a right angled triangle.

9. A line makes its 60º, 45º with x and y axis respectively. Find the angle which its makes with the z axis.

10. Evaluate $\int_0^1 x(1-x)^n dx$

11. Prove that $2\tan^{-1}[1/5] + \tan^{-1}[1/7] + 2\tan^{-1}[1/8] = \pi/4$ (or)

Given A = {3,4,7} B = {3,5,6,8}. Construct an example for each of the following.
    i)   An injective function from A to B
    ii)   A many one into function from A to B.
    iii)   A many one onto function from B to A.

12. Using properties prove that $\begin{vmatrix} a^2 & bc & c^2+ac \\ a^2+ab & b^2 & ca \\ ab & b^2+bc & c^2 \end{vmatrix}$

13. Find dy/dx If $y = \tan^{-1}\left(\dfrac{\sqrt{1+x^2} - \sqrt{1-x^2}}{\sqrt{1+x^2} + \sqrt{1-x^2}} \right)$

14. Find the points on the curve $y= x^3-2x^2-2x$ at which the tangent lines are parallel to the line y=2x-3. Also find their equations.

15. Show that the function $f(x) = |x – 3|$ is continuous at x=3 , but not differentiable at x = 3

16. Evaluate $\int\sqrt{\tan x}\, dx$ or $\int e^{2x} \dfrac{[\sin 4x – 2]}{[1 –\cos 4x]}\, dx$

17. Evaluate $\int_1^3 (x^2+3e^x)\, dx$ (or)

18. Solve the following Differential equation
    $dy/dx + y\cot x = x^2 \cot x + 2x$ (or) Solve $(y^2-x^2)dy = 3xy dx$

19. Evaluate $\int_0^{\pi/4}\log(1+\tan x)\, dx$ (or) $\int_0^5 |x-1| + |x-2| + |x-3|\, dx$

20. If a,b,c are the vectors such that a+b+c = 0 $|a| = 3$, $|b| = 4$ and $|c| = 5$, find a.b+b.c +c.a

21. Find the point on the line $\dfrac{x+2}{3} = \dfrac{y+1}{2} = \dfrac{z-3}{2}$ at a distance $3\sqrt{2}$ from the point (1,2,3)

    (or) Find the shortest between the lines $r = i+j +\lambda(2i-j+k)$; $r = 2i+j-k+\mu(3i-5j+2k)$

22. A random variable X has the following probability distribution :-

X	-2	-1	0	1	2	3
P(X)	0.1	k	0.2	2k	0.3	k

 Find i) the value of k ii) P(X≤1) iii) P(X) ≥0 iv) find E(X)

23. Let X be a non empty set with its power set as P(X). Let * be a binary operation defined on it such that A * B = A∩B where A, B ε P(X). Then prove that

    i)   * is a binary operation in P(X)
    ii)   Is * commutative?
    iii)   Is * associative ?
    iv)   Find the identity element in P(X) with respect to *
    v)   Find all the invertible elements in P(X) with respect to *
    vi)   Is " o " is a binary operation defined on P(X) as AoB = AUB, then verify o distributes itself over *. (or)
    Show that the function f : N → N given by f(x) = x+1 if x is odd
                                        = x-1 if x is even is bijective and hence find f^{-1}

24. If the length of three sides of a trapezium other then base are equal to 10cm, then find the area of the trapezium when it is maximum. (or)
Show that the semi vertical angle of a right circular cone of given surface area and maximum volume is $\sin^{-1}[1/3]$

25. Using integration find the area of the triangle whose vertices are (2,0), (4,5) and (6,3)
(or) Using the integration Find the area of the region in the first quadrant enclosed by
The x axis, the line $y = x$ and the circle $x^2+y^2 = 32$

26. Using the product of the matrices, solve the following system of equations.

$A = \begin{pmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{pmatrix}$ $B = \begin{pmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{pmatrix}$ $x-y+2z = 1 ; 2y - 3z = 1; 3x-2y+4z = 2$

(OR) Find A^{-1} using elementary transformations if $A = \begin{pmatrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{pmatrix}$

27. Find the equation of the plane through the point (3,2,1) and parallel to the plane $x+y-2z = 2$. Find the foot of the perpendicular and the image from point (2,3,3) to the plane. (or) Find the foot of the perpendicular and image from (1,2,-3) to the line
$\dfrac{x+1}{2} = \dfrac{y-3}{-2} = \dfrac{z}{-1}$

28. A student is given a test with 8 questions of true – false type. If he gets 6 or more answers correct he is declared pass. Given that he guesses the answer to each question, Compute the probability that i) he will pass in the test. ii) he has answered all the questions correctly. Iii) Answered at most two questions correctly

(or) For A,B and C the chances of being selected as the manager of a firm are in the ratio 4:1:2 respectively. The respective probabilities for them to introduce a radical change in marketing strategy are 0.3, 0.8 and 0.5. If the change does take place, find the probability that it is due to the appointment of B or C.

29. A firm deals with two kinds of fruit juices pineapple and orange juice. These two mixtures are sold as soft drinks A and B. One tin of A requires 4 liters of pineapple juice and 1 liter of orange juice. One tin of B requires 2 liters of pineapple and 3liters of orange juice. The firm has only 46 liters of pineapple juice and 24 liters of orange juice. Each tin of A and B are sold at a profit of Rs 4 and Rs 3 respectively. How many tins of each type should the company manufacture in a day to maximize the profit.