PRINCE ACADEMY
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BOARD SAMPLE PAPER- I (2025-26)

Time : 03 : 00 Hours | **CLASS – XII MATHS (041)** | **M.M. : 80**

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQs and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4marks each) with sub parts

SECTION -A (1 x 20 =20)

1. $\int \frac{e^x(1+x)}{\cos^2(xe^x)}dx$ is equal to

(a) $\tan(xe^x) + C$ (b) $\cot(xe^x) + C$ (c) $\cot(e^x) + C$ (d) $\tan(1+x) + C$

2. The value of $\int_2^3 \frac{x}{x^2+1}dx$ is

(a) log 4 (b) $\log\frac{3}{2}$ (c) $\frac{1}{2}\log 2$ (d) $\log\frac{9}{4}$

3. The order and degree of the differential equation :

$\left(\frac{d^4y}{dx^4}\right)^2 = \left[x+\left(\frac{dy}{dx}\right)^2\right]^3$ are :

(a) order 4, degree 2 (b) order 1, degree 6 (c) order 2, degree 3 (d) order 3, degree 2

4. Integrating factor of the differential equation $\text{Cosx}\frac{dy}{dx} + y\text{Sinx} = 1$ is :

(a) tanx (b) secx (c) sinx (d) cosx

5. If projection of $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ on $\vec{b} = 2\hat{i} + \lambda\hat{k}$ is zero, then the value of λ is :

(a) 0 (b) 1 (c) $\frac{-2}{3}$ (d) $\frac{-3}{2}$

6. If a line makes angles α, β, γ with positive direction of Co-ordianate axes, then the value of $\text{Cos}2\alpha + \text{Cos}2\beta + \text{Cos}2\gamma$ is :

(a) 0 (b) 2 (c) -1 (d) None of these

7. The function $f: R \to R$ defined by f(x) = 4+3cosx is

(a) bijective (b) one-one but not onto

(c) onto but not one-one (d) neither one-one nor onto

8. $\sin\left[\frac{\pi}{3}+\sin^{-1}\left(\frac{1}{2}\right)\right]$ is equal to

(a) -1 (b) 1 (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

9. The domain of the function $\cos^{-1}(2x-3)$ is :

(a) (-1, 2) (b) (1, 2) (c) [-1, 1] (d) [1, 2]

10. The number of the all possible matrices of order 3x3 with each entry 0 or 1 is

(a) 18 (b)27 (c) 81 (d) 512

11. If $A=\begin{bmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & -5 \end{bmatrix}$ is a singular matrix, then the value of x is

(a) $\frac{13}{25}$ (b) $\frac{-25}{13}$ (c) $\frac{5}{13}$ (d) $\frac{25}{13}$

12. If A is a square matrix of order 3 such that $|A|=-5$, then $|\text{adj.A}|$ is equal to

(a) 125 (b) -25 (c) 25 (d) ± 25

13. The value of λ for which $f(x)=\begin{cases}\lambda x^2+8x, x\le 2 \\ 2x+6, x>2\end{cases}$ is continuous at X = 2 is

(a) 0 (b) 2 (c) $\frac{1}{2}$ (d) $-\frac{3}{2}$

14. If the set A contains 5 element and the set B contains 6 elements, then the number of both one-one and onto mapping from A to B is

(a) 720 (b) 120 (c) 30 (d) 0

15. The two vectors $\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+4\hat{k}$ represents the two sides AB and AC, respectively of ΔABC. The length of the median through A is

(a) $\frac{\sqrt{34}}{2}$ (b) $\frac{\sqrt{48}}{2}$ (c) $\frac{2}{\sqrt{18}}$ (d) $\frac{2}{\sqrt{52}}$

16. The value of $\int_{-\pi/2}^{\pi/2} x^3 \sin^4 x\, dx$ is

(a) 0 (b) $\frac{\pi}{2}$ (c) π (d) $\frac{\pi^2}{4}$

17. If $A=\begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that $A^{-1} = kA$, then k is equal to

(a) 19 (b) 1/19 (c) -1/19 (d) -19

18. The corner points of the feasible region fo the Linear Programming Problem are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). Let the objective function is Z = 4x + 6y then the minimum value of the objective function occurs at

(a) (0, 2) Only

(b) (3, 0) only

(c) The mid-point on the line segment joining the points (0, 2) and (3, 0)

(d) Any point on the line segment joining the points (0, 2) and (3, 0)

For questions 19-20

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).

(c) (A) is true and (R) is false.

(d) (A) is false, but (R) is true.

19. Assetion (A) : The vector equation of the line passing through the point (6, -4, 5) and (3, 4, 1) is $\vec{r} = \left(6\hat{i} - 4\hat{j} + 5\hat{k}\right) + \lambda(-3\hat{i} + 8\hat{j} + 4\hat{k})$.

Reason (R) : The vector equation of the line passing through the points $\vec{a}$ and $\vec{b}$ is $\vec{r} = \vec{a} + \lambda(\vec{b} - \vec{a})$

20. Assertion (A) : If n (A) = p and n (B) = q then the number of relations from A to B is 2^{pq}

Reason (R) : A relation from A to B is not a subset of A x B

SECTION - B (2 x 5 =10)

21. Write the pincipal value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right)$.

OR

Write the value of $\tan^{-1}\left[2\sin\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$.

22. Find all the points of local maxima and minima of the function.

$f(x) = x^3 - 6x^2 + 9x - 8$.

23. If the line $\frac{1-x}{3} = \frac{y-2}{2k} = \frac{3-z}{-2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$ are perpendicular, find the value of k.

OR

Find the angle between the lines $\frac{x-4}{3} = \frac{y+1}{1} = \frac{z-6}{4}$ and $\frac{x-1}{1} = \frac{y+4}{1} = \frac{z-5}{2}$.

24. The integral $\int \frac{x^9}{(4x^2+1)^6}dx$ is euqal to

25. If $\vec{a}, \vec{b}, \vec{c}$ be three vectros such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ and $|\vec{a}| = 3, |\vec{b}| = 4, |\vec{c}| = 5,$ then find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$.

SECTION - C(3 x 6=18)

26. Solve the following linear programming problem (LPP) graphically.

Maximize Z = 2x - y.

Subject to constraints,

$x + 2y \geq 100$,

$2x - y \leq 0$,

$2x + y \leq 200$ and $x, y \geq 0$.

27. Find the shortest distance between the lines given below :

$\vec{r} = (1+2\lambda)\hat{i} + (2+3\lambda)\hat{j} + (3+4\lambda)\hat{k}$

$\vec{r} = (2+3\mu)\hat{i} + 4(1+\mu)\hat{j} + 5(1+\mu)\hat{k}$

OR

Find equation of a line passing through the point (1, 2, -4) and perpendicular to the lines

$\vec{r} = (\hat{i} + 19\hat{j} + 10\hat{k}) + \lambda(3\hat{i} - 16\hat{j} + 7\hat{k})$

$\vec{r} = (15\hat{i} + 29\hat{j} + 5\hat{k}) + \mu(3\hat{i} + 8\hat{j} - 5\hat{k})$

28. Express the vector $\vec{a} = 5\hat{i} - 2\hat{j} + 5\hat{k}$ as the sum of the vectors such that one of them is parallel to $\vec{b} = 3\hat{i} + \hat{k}$ and other is perpendicular to $\vec{b}$.

29. Solve the differential equation :

$$\left(x\text{Cos}\frac{y}{x} + y\text{Sin}\frac{y}{x}\right)y - \left(y\sin\frac{y}{x} - x\text{Cos}\frac{y}{x}\right)x\frac{dy}{dx} = 0.$$

OR

Solve the differential equation :

$$\left(1+y^2\right) + \left(x - e^{\tan^{-1}y}\right)\frac{dy}{dx} = 0.$$

30. Evaluate : $\int_0^{\pi/2} \frac{x\,\text{Sin}\,x\,\text{Cos}\,x}{\text{Sin}^4x + \text{Cos}^4x}\,dx$

OR

Evaluate : $\int_{-1}^{2} \left|x^3 - x\right| dx$

31. Find the value of k, for which the function of defined below is continuous :

$$f(x) = \begin{cases} \dfrac{1-\cos kx}{x\sin x}, & x \neq 0 \\ \dfrac{1}{2}, & \text{if } x = 0 \end{cases} .$$

OR

Prove that the greatest integer function defined by f (x) = [x], 0 < x < 2 is not differentiable at x = 1.

SECTION - D (5 x 4 = 20)

32. Let A={1.2.3, ...,9} and R be the relation in A x A defined by (a, b)R(c, d) if a+d = b+c for (a, b), (c, d) in A x A. Prove that R is an equivalence relation. Also obtain the equivalence class [(2, 5)].

OR

Consider $f : R_+ \to [-5, \infty)$ given by f (x) = $9x^2 + 6x - 5$ where R_+ is the set of all non-negative real numbers. Prove that f is one-one and onto function.

33. Find the inverse of the matrix $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$ Hence solve the system of equations :

x- y + 2z = 1, 2y - 3z = 1, 3x - 2y + 4z = 2.

OR

Find the product of $\begin{bmatrix} 1 & 0 & 3 \\ -1 & 2 & -2 \\ 2 & -3 & 4 \end{bmatrix} \begin{bmatrix} -4 & 18 & 12 \\ 0 & 4 & 2 \\ 2 & -6 & -4 \end{bmatrix}$ Hence solve the system of equations :

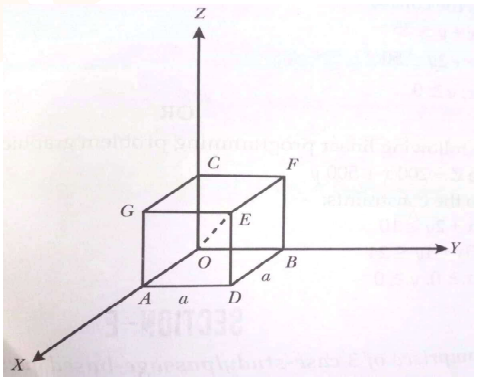
x- y + 2z = 1, 2y - 3z = 1, 3x - 2y + 4z = 2

34. Two numbers are selected at random (without replacement) from positive integers 2, 3, 4, 5, 6 and 7. Let X denote the larger of the two numbers obtained, Find the probability distribution of X.

35. Using integration, find the area of the region bounded by $x^2 = 8y$, x = 1, x = 4 and x-axis in first quadrant.

SECTION- E(4 x 3 = 12)

36. Read the following passage and answer the questions given below :
A student designs a cube with each side of length a units, and name it OADBFEGC (shown in figure), taking O as origin.



(i) Write the co-ordinates of the vertex F.
(ii) Find the direction cosines of the line AF.

OR

Find the direction ratio of CD.

(iii) If l, m, n are direction cosines of any line then write the vlaue of $l^2 + m^2 + n^2$.

37. Senior students tend to stay up all night and therefore are not able to wake up on time in morning. Not only this but their dependence on tuitions further leads to absenteeism in school. Of the students in class XII, it is known that 30% of the students have 100% attendance. Previous year results report that 80% of all students who have 100% attendance attain A grade and 10% irregular students attain A grade in their annual examination. At the end of the year, one student is chosen at random from the class XII.

Using above information answer the following:

(i) Find the conditional probability that a student attains A grade given that he is not 100% regular student.

(ii) Find the probability of attaining A grade by the students of class XII

(iii) Find the probability that student is 100% regular given that he attains A grade.

OR

Find the probability that student is iregular given that he attains A grade.

38. In a park, an open tank is to be constructed using metal sheet with a square base 'x' and vertical sides 'y' so that it contains 500 cubic meters of water.

Using above information answer the following :

(i) Find the relation between 'x' and 'y'.

(ii) Find the minimum surface area of the tank.

(iii) Find the percentage increase in volume of the tank, if size of square base of tank become twice and height remains same.

OR

Find the value of x, y so that Surface area of the tank is minimum.

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