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IIT-JEE/NEET/MHTCET/FOUNDATION

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Subject : Mathematics BOARD QUESTION PAPER Total Marks : 80
Class : XII Prelim No. - I Time : 3 Hour

Section - A
(MCQ & VSA Questions)

Q.1. Select and write the correct answer: (16)

i) In a binomial distribution, n = 4. If 2 P (X = 3) = 3 P (X = 2) then p = ...

(a) $\frac{4}{13}$ (b) $\frac{5}{13}$

(c) $\frac{9}{13}$ (d) $\frac{6}{13}$

ii) Given that X ~ B(n, p). If n = 10, p = 0.4, then E(X) = ...

(a) 1 (b) 2

(c) 3 (d) 4

iii) The foot of the perpendicular from the point (α, β, γ) on Y-axis is

(a) (0, 0, 0) (b) $(0, 0, \gamma)$

(c) $(0, \beta, 0)$ (d) $(\alpha, 0, 0)$

iv) What is the below formula known as?

$$P(A \mid B) = P(B \mid A)\frac{P(A)}{P(B)}$$

(a) Poisson Formula
(b) Cumulative Distribution Function
(c) Bays Formula
(d) Disjoint Events

v) $\tan^{-1}\left(\tan\frac{7\pi}{6}\right) =$ .....

(a) $-\frac{\pi}{6}$ (b) $\frac{\pi}{6}$

(c) $\frac{13\pi}{6}$ (d) $\frac{5\pi}{6}$

vi) $\int \frac{1}{\cos x - \cos^2 x}\,dx =$

(a) $\log(\operatorname{cosec} x - \cot x) + \tan\left(\frac{x}{2}\right) + c$

(b) $\sin 2x - \cos x + c$

(c) $\log(\sec x + \tan x) - \cot\left(\frac{x}{2}\right) + c$

(d) $\cos 2x - \sin x + c$

vii) The dot product of two vectors is 5 and the angle between them is 60°. Then product of their magnitudes is.

(a) 10 (b) 12

(c) 14 (d) 16

viii) Find the minimum value of f(x) = x log x

(a) $\frac{1}{20}$ (b) 0

(c) $\frac{1}{10}$ (d) $-\frac{1}{10}$

Q.2 Answer the following: (4)

i) Find the area under the curve y = cos x in the interval $[0, \pi]$?

ii) Is the following sentence a statement in logic? Justify. Write down the truth value of the statement:
If x is a whole number then x + 6 = 0.

iii) Write the truth value of the following:
It is not true that 5-3i is a real number.

iv) Find the area under y = x in the interval [0, 2]?

Section - B
(2 MARKS EACH)

Attempt any Eight: (16)

Q3. Find the vector equation of the plane

which makes intercepts 1, 1, 1 on the co-ordinates axes.

Q.4. Form the differential equation of all parabolas whose axis is the X-axis.

Q.5. Differentiate the following w.r.t. x

$\cot^3[\log(x^3)]$

Q.6. Find the combined equation of lines

$x - 2 = 0$ and $y + 2 = 0$.

Q.7. In Δ ABC, if $a = 18, b = 24, c = 30$ then find the values of A(Δ ABC).

Q.8. Find the principal value of the following:

$\sin^{-1}\left(\frac{1}{2}\right)$

Q.9. Find the general solutions of the following equation: $\sec\theta = \sqrt{2}$

Q.10. Solve the following differential equation:

$\log\left(\frac{dy}{dx}\right) = 2x + 3y$

Q.11. Solve graphically: $x \geq 0$ and $y \leq 0$

Q.12. Find the area of the region bounded by the following curve, the X-axis and the given line: $y = x^2$, $x = 1$, $x = 3$

Q.13. Find the area of the region bounded by the following curve, the X-axis and the given line:

$y = \sin x$, $x = 0$, $x = \frac{\pi}{3}$

Q.14 Find the direction cosines of the line

$\vec{r} = \left(-2\hat{i} + \frac{5}{2}\hat{j} - \hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j}\right)$

Section - C

(3 MARKS EACH)

Attempt any Eight: **(24)**

Q.15. Find expected value and variance of X ,where X is number obtained on uppermost face when a fair die is thrown.

Q.16. Find the largest size of a rectangle that can be inscribed in a semi circle of radius 1 unit, So that two vertices lie on the diameter.

Q.17. Find the area of the region included between: $y^2 = 4ax$ and the line $y = x$

Q.18. In ΔABC if $\frac{\cos A}{a} = \frac{\cos B}{b}$ then show that it is an isosceles triangle.

Q.19. Find which of the following matrices are invertible:

(i) $A = \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}$

(ii) $B = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$

(iii) $C = \begin{bmatrix} 1 & 3 & 2 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$

Q.20. Prove that $\tan^{-1}1 + \tan^{-1}2 + \tan^{-1}3 = \pi$

Q.21. Examine whether following statement pattern is a tautology or a contradiction or a contingency:

$[(p \rightarrow q) \wedge \sim q] \rightarrow \sim p$

Q.22 If $\vec{a} \cdot \vec{b} = \sqrt{3}$ and $\vec{a} \times \vec{b} = 2\hat{i} + \hat{j} + 2\hat{k}$, find the angle between a and b.

Q.23. Find the Cartesian equations of the passing through the point A(1, 1, 2) and perpendicular to vectors

$\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + 2\hat{j} - \hat{k}$.

Q.24. Write the vector equation of the line whose Cartesian equations are $y = 2$ and $4x - 3z + 5 = 0$.

Q.25. Find the acute angle between the line

$\vec{r}.\left(\hat{i} + 2\hat{j} + 2\hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} - 6\hat{k}\right)$ and

the plane $\vec{r}.\left(2\hat{i} - \hat{j} + \hat{k}\right) = 0$.

Q.26. Solve:

$(2x - 2y + 3)\,dx - (x - y + 1)\,dy = 0$, when $x = 0$, $y = 1$.

Section D
(4 MARKS EACH)

Attempt any Five: **(20)**

Q.27. Two cards are drawn simultaneously (or successively without replacement) from a well shuffled pack of 52 cards. Find the mean, variance and standard deviation of the number of kings drawn.

Q.28. If lines represented by $ax^2 + 2hxy + by^2 = 0$ make angles of equal measures with the co-ordinate axes then show that $a = \pm b$.

Q.29. Maximize: $z = 9x + 13y$, subject to $2x + 3y \leq 18$, $2x + y \leq 10$, $x \geq 0$, $y \geq 0$.

Q.30. Divide that number 20 into two parts such that sum of their squares is minimum.

Q.31. Find the equation of tangents and normals to the curve at the point on it:

$$x = \sqrt{t} \text{ and } y = t - \frac{1}{\sqrt{t}} \text{ at } t = 4$$

Q.32. Solve the following L.P.P.:
Maximize : $z = 60x + 50y$, subject to $x + 2y \leq 40$, $3x + 2y \leq 60$, $x \geq 0$, $y \geq 0$

Q.33. Solve the following differential equation:

$$y - x\frac{dy}{dx} = 0$$

Q.34. Differentiate w. r. t. x.:
$(1 + \sin^2 x)^2 (1 + \cos^2 x)^3$

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