PVG's
Muktangan English School & Jr. College, Pune - 9
Preliminary Examination (2024-25)
STD XII

Subject : Mathematics   Marks - 80

Date : 03.01.2025   Time : - 8.15 - 11.15 am

General Instructions : The questions paper is divided into Four sections

1) Section A :   Q1 contains 8 multiple choice type questions carrying 2 marks each.

                  Q 2 contains very short answer type questions carrying 1 mark each.

2) Section B :   Q 3 to Q 14 contains twelve short answer type questions carrying 2 marks each (Attempt any eight)

3) Section C :   Q 15 to Q 26 contains twelve short anwer type questions carrying 3 marks each (Attempt any eight)

4) Section D :   Q 27 to Q34 contains eight long answer type questions carrying 4 marks each (Attemp any five)

5) Use of calculator is not allowed. Use of log table is allowed.

6) Figures to right indicate full marks.

7) Use of graph paper is not necessary. Only rough sketch is expected.

8) For each multiple choice question only first attempt will be considered for evaluation.

9) Start answer to each section on a new page.

Section A

Q.1 Select and write the correct answer for the following multiple choice type of questions   **[16]**

   i)   The negation of $(p \vee \sim q) \wedge r$ is _____ .

        a) $(\sim p \wedge q) \wedge r$ b) $(\sim p \wedge q) \vee r$ c) $(\sim p \wedge q) \vee \sim r$ d) $(\sim p \vee q) \wedge \sim r$

   ii) The area of the region bounded by the curve y= sinx, x- axis and line x=0 is _____ sq. unit.

        a) 2   b) 3   c) 4   d) 1

   iii) If the mean and variance of a Binomial distribution are 18 and 12 respectively then value of n is _____

        a) 36   b) 54   c) 18   d) 27

iv) In a $\triangle ABC$ if $c^2 + a^2 - b^2 = ac$ then $\angle B =$ _____

    a) $\dfrac{\pi}{4}$ b) $\dfrac{\pi}{3}$ c) $\dfrac{\pi}{2}$ d) $\dfrac{\pi}{6}$

v) Equation of line passing through the points $(0, 0, 0)$ and $(2, 1, -3)$ is _____.

    a) $\dfrac{x}{2} = \dfrac{y}{1} = \dfrac{z}{-3}$ b) $\dfrac{x}{2} = \dfrac{y}{-1} = \dfrac{z}{-3}$ c) $\dfrac{x}{1} = \dfrac{y}{2} = \dfrac{z}{3}$ d) $\dfrac{x}{3} = \dfrac{y}{1} = \dfrac{z}{2}$

vi) The value of $\hat{i} \cdot (\hat{j} \times \hat{k}) + \hat{j} \cdot (\hat{k} \times \hat{i}) + \hat{k} \cdot (\hat{i} \times \hat{j})$ is

    a) 0   b) -1   c) 1   d) 3

vii) If $\int \dfrac{dx}{4x^2 - 1} = A \log \left(\dfrac{2x-1}{2x+1} \right) + C$ then $A =$ _____.

    a) 1   b) $\dfrac{1}{2}$ c) $\dfrac{1}{3}$ d) $\dfrac{1}{4}$

viii) If $y = x\log x$ then $\dfrac{d^2y}{dx^2} =$ _____

    a) $1 + \log x$ b) $\dfrac{1}{\log x}$ c) $\dfrac{1}{x}$ d) $x + \dfrac{1}{\log x}$

Q.2 Answer the following questions :   [4]

i) If $\bar{a}, \bar{b}, \bar{c}$ are the position vectors of the A, B, C respectively and $5\bar{a} - 3\bar{b} - 2\bar{c} = 0$ then find the ratio in which the point C divides the line segment BA.

ii) Write the degree of the differntial equation $(y''')^2 + 3(y'') + xy' + 5y + 0$

iii) Write the joint equation of coordinate axes.

iv) Evaluate $\int \tan x \, dx$

Section B

Attempt any Eight of the following questions   [16]

Q. 3 Find the cartesian coordinates of the point whose polar coordinates are $\left(\sqrt{2}, \dfrac{\pi}{4} \right)$

Q.4 Examine whether the following statement pattern is tautology or a contradiction or a contingency using truth table: $p \rightarrow (q \rightarrow p)$.

Q.5 Find the cofactors of the element a_{22} and a_{32} for the matrix $\begin{bmatrix} 2 & 0 & -1 \\ 3 & 1 & 2 \\ -1 & 1 & 2 \end{bmatrix}$

Q.6 Find $\bar{a} \cdot (\bar{b} \times \bar{c})$, if $\bar{a} = 3\hat{i} - \hat{j} + 4\hat{k}$, $\bar{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\bar{c} = -5\hat{i} + 2\hat{j} + 3\hat{k}$

Q.7 Find K if the following equation represents a pair of lines : $3x^2 + 10xy + 3y^2 + 16y + K = 0$

Q.8 In $\triangle ABC$, if a =13, b=14, c=15 then find the value of cos $\left(\frac{A}{2}\right)$.

Q.9 If each side of an equilateral triangle increase at the rate $\sqrt{2}$ cm/sec, find the rate of increase of its area when its side has length 3 cm.

Q.10 Evaluate $\int\limits_{-2}^{-1} x^2 dx$

Q.11 Find the area bounded by the curve $y = x^2$, the Y-axis, X-axis and $x = 3$

Q.12 A random variable X has the following probability distribution

X	0	1	2	3	4	5	6	7
P(X)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$

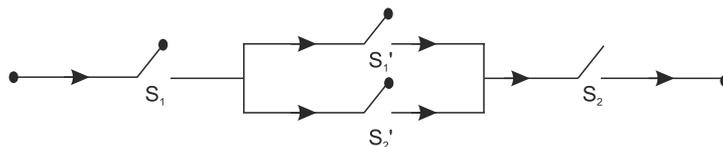then find K

Q.13 Evaluate $\int \dfrac{1}{x^2-3} dx$

Q.14 Evaluate $\int \sec^3 x\ dx$

Section C

Attempt any Eight of the following questions [24]

Q.15 Simplify the given circuit by writting its logical expression

Q.16 Prove that : $\tan^{-1}1 + \tan^{-1}2 + \tan^{-1}3 = \pi$

Q.17 Find the joint equation of pair of lines through the point (2, -1) and parallel to lines represented by $2x^2 + 3xy - 9y^2 = 0$

Q.18 Find the volume of a tetrahedron whose verties are A(-1, 2, 3), B(3, -2, 1), C(2, 1, 3) and D(-1, -2, 4).

Q.19 Find the vector equation of the line passing through A(1, 2, 3) and B(2, 3, 4).

Q.20 The foot of perpendicular drawn from the origin to a plane is M(2, 1, -2). Find vector equation of the plane.

Q.21 Evaluate $\int \dfrac{e^x \log (\sin e^x)}{\tan e^x} dx$

Q.22 The ball is thrown in the air, It's height at any time t is given by $h = 3 + 14t - 5t^2$. Find the maximum height it can reach.

Q.23 Solve the following differential equation:

$$\frac{dy}{dx} + y = e^{-x}$$

Q.24 For the following probability density function on a random variable X, find a) P(X<1)
b) P($|x| < 1$)

$$f(x) = \frac{x+2}{18} \quad \text{for } -2 < x < 4$$
$$= 0 \quad \text{otherwise}$$

Q.25 A bag contains 10 balls each marked with one of the digits 0 to 9. If four balls are drawn successively with replacement from the bag, what is the probability that none is marked with the digit 0?

Q.26 Water at 100^0C cools in 10 minutes to 80^0C in a room temprature of 25^0C. Find the temprature of water after 20 minutes.

Section D

Attempt any five of the following questions [20]

Q.27 Solve the following system of equations by method of inversion

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

Q.28 Solve the following L.P. P graphically

Maximize Z = 4x + 3y

Subject to, $3x + y \le 15$,

$3x + 4y \le 24$,

$x \ge 0, y \ge 0$

Q.29 Prove that the medians of a triangle are concurrent

Q.30 Lines $\bar{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(2\hat{i} - 2\hat{j} + \hat{k})$ and $\bar{r} = (4\hat{i} - 3\hat{j} + 2\hat{k}) + \mu(\hat{i} - 2\hat{j} + 2\hat{k})$

are coplanner. Find the equation of the plane determined by them.

Q 31. If y = cos (m $\cos^{-1}$x) then show that

$$(1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} + m^2y = 0$$

Q.32 Prove that

$$\int_0^{2a} f(x) \, dx = \int_0^a f(x) \, dx + \int_0^a f(2a-x) \, dx$$

Q.33 Verify Lagrange's mean value theorem for the function

$$f(x) = \sqrt{x+4} \text{ on the internal } [0, 5]$$

Q.34 Prove that : If y = f(u) is a differentiable function of u and u=g(x) is a differentiable function of x and $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$
hence find derivative of sin (logx) w.r.t.x

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