Pune Vidyarthi Griha's

Muktangan English School & Jr. College, Pune - 9

Terminal Examination (2024-25)

Standard - XII

Subject - **MATHEMATICS**
Date - **17-10-2024**

Marks - 50
Time - 9.00 a.m. to 11.30 a.m.

Instructions : *The question paper is divided into four sections.*

1) ***Section A :*** *Q. No. 1 contains five multiple choice type of questions carrying two mark each. Q. No. 2 contains four very short answer type of questions carrying one mark each.*
2) ***Section B :*** *Q. No. 3 to Q. No. 13 are eleven short answer type of questions carrying two marks each. (Attempt any eight.)*
3) ***Section C :*** *Q. No. 14 to Q. No. 19 are six short answer type of questions carrying three marks each. (Attempt any four)*
4) ***Section D :*** *Q. No. 20 to Q. No. 23 are four long answer type of questions carrying four marks each. (Attempt any two.)*
5) *Use of log table is allowed. use of calculator is not allowed.*
6) *Figures to the right indicate full marks.*
7) *For each multiple choice type of question only the first attempt will be considered for evaluation.*

SECTION - 'A'

Q. 1 Select and write the most appropriate answer from the given alternative for each subquestions. (2 marks each) **(10)**

i) $2\tan^{-1}\left(\frac{1}{3}\right) + \cos^{-1}\left(\frac{3}{5}\right) = ...$

(a) $\frac{\pi}{2}$ (b) $\tan^{-1}\left(\frac{5}{4}\right)$ (c) 0 (d) $\frac{\pi}{4}$

ii) For a 3 X 3 matrix A, if A(adj A) = $\begin{bmatrix} -10 & 0 & 0 \\ 0 & -10 & 0 \\ 0 & 0 & -10 \end{bmatrix}$ then value of determinant of A is ....

(a) 1000 (b) -1000 (c) -10 (d) 10

iii) If $y = \sin^{-1}x$ then $(1-x^2)\frac{d^2y}{dx^2}$ = ...

(a) 0 (b) $\frac{1}{\sqrt{1-x^2}}\frac{dy}{dx}$ (c) $x\frac{dy}{dx}$ (d) 1

iv) Which of the following equation does not represent the pair of lines.

(a) $x^2 - x = 0$ (b) $xy - x = 0$
(c) $y^2 - x + 1 = 0$ (d) $xy + x + y + 1 = 0$

v) If $\int_0^1 \tan^{-1}x\,dx = p$ then $\int_0^1 \tan^{-1}\left(\frac{1-x}{1+x}\right)dx$ = ...

(a) $\frac{1-p}{1+p}$ (b) $1 - p$ (c) $\frac{\pi}{4} - p$ (d) $\frac{\pi}{4} + p$

Q.2 Answer the following questions. (1 mark each.) **(4)**

i) Write the negation of the following : $\forall n \in N, n^2 + n + 2$ is divisible by 4

ii) Find the general solution of $\cos \theta = \frac{\sqrt{3}}{4}$

iii) State whether following function is increasing or decreasing, justify your answer.
$f(x) = x^3 + 2x - 1$

iv) $\int \frac{\sin 2x}{\cos x} dx =$ ....

SECTION - 'B'

Attempt any eight of the following questions. (2 marks each.) **(16)**

Q.3 Write the negation of the following stating rules used : $(p \rightarrow q) \vee r$

Q.4 Solve the following equations by inversion method $2x + 5y = 1, 3x + 2y = 7$

Q.5 With usual notations prove that
$2 \{a \sin^2 \frac{C}{2} + c \sin^2 \frac{A}{2}\} = a - b + c$

Q.6 If slope of one of the lines given by $ax^2 + 2hxy + by^2 = 0$ is four times the other then show that $16h^2 = 25ab$

Q.7 Find the principal solution of $\sqrt{3} \operatorname{cosec} \theta + 2 = 0$

Q.8 Differentiate w.r.t. x : $\tan^{-1} \left[\frac{1 - \tan (x/2)}{1 + \tan (x/2)} \right]$

Q.9 Evaluate : $\int \frac{3x^3 - 2x + 5}{x \sqrt{x}} dx$

Q.10 Show that $\int \sec x \, dx = \log | \sec x + \tan x | + C$

Q.11 Evaluate $\int_3^5 \frac{1}{\sqrt{2x + 3} - \sqrt{2x - 3}} dx$

Q.12 Find the area of the region bounded by the following curves, X - axis and given lines : $x = 2y, y = 0, y = 4$

Q.13 Evaluate : $\int_0^{\pi/2} \frac{\sqrt[3]{\cos x}}{\sqrt[3]{\cos x} + \sqrt[3]{\sin x}} dx$

SECTION - 'C'

Attempt any FOUR of the following questions. (3 marks each) **(12)**

Q.14 A particle moves along the curve $6y = x^2 + 2$. Find the points on the curve at which y - coordinate is changing 8 times as fast as the X-coordinate.

Q.15 If $x = f(t)$ and $y = g(t)$ are differentiable function of t so that y is differentiable function of x and if $\frac{dx}{dt} \neq 0$ then show that $\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$

Q.16 Find the area of the region bounded by the curves $y^2 = 9x$ and $x^2 = 9y$.

Q.17 Prove that $\cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{33}{65}\right)$

Q.18 Show that : The acute angle θ between the lines represented by $ax^2 + 2hxy + by^2 = 0$ is given by $\tan\theta = \left|\frac{2\sqrt{h^2 - ab}}{a + b}\right|$

Q.19 Find inverse of $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ by adjoint method.

SECTION - 'D'

Attempt any two of the following questions. (4 marks each) **(8)**

Q.20 Solve the following L.P.P. by graphical method.

Minimize : $z = 5x + 2y$, subject to $5x + y \geq 10$, $x + y \geq 6$, $x \geq 0$, $y \geq 0$

Q.21 Using truth table prove the following logical equivalence.

$p \rightarrow (q \wedge r) \equiv (p \rightarrow q) \wedge (p \rightarrow r)$

Q.22 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.23 If u and v are two differentiable functions of x then $\int u.v\,dx = u\int v dx - \int\left(\frac{du}{dx}\right)\left(\int v dx\right) dx$

Hence evaluate $\int x \log x \, dx$

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