TRILOKI PUBLIC SCHOOL, KATGHORA

TERM: 1 (2025 – 26)

SUBJECT : MATHS

CLASS – XII

TIME : 3 HOURS **MAX. MARKS : 80**

General instructions:

1. **There are 38 Questions in all. All Questions are compulsory.**
2. **Section A comprises 20 Question. 1 marks for each question.**
3. **Section B comprises 5 Question. 2 marks for each question.**
4. **Section C comprises 6 Question. 3 marks for each question.**
5. **Section D comprises 5 Question, among these attempt any 4.**

   5 marks for each question
6. **Section E comprises 3 Question. 4 marks for each question.**

SECTION A

Q1) The principal value of $cos^{-1}(\sqrt{3}/2)$ is

(a) 6π (b) 65π (c) 67π (d) none of these

Q2) $cos^{-1}(1/2) + 2sin^{-1}(1/2) = ?$

a) $2\pi/3$ b) $3\pi/2$ c) 2π d) None of these

Q3) $tan^{-1}1 + tan^{-1}(1/3) = ?$

(a) $tan^{-1}(4/3)$ (b) $tan^{-1}(2/3)$ (c) $tan^{-1}2$ (d) $tan^{-1}3$

Q4) A = $\begin{bmatrix} 0 & 2 & 3 \\ 1 & 3 & 7 \end{bmatrix}$ B = $\begin{bmatrix} 1 & 3 & 7 \\ 2 & 4 & 1 \end{bmatrix}$

then A + B = ?

a) $\begin{bmatrix} 1 & 5 & 10 \\ 3 & 7 & 8 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 6 & 21 \\ 2 & 12 & 7 \end{bmatrix}$ c) $\begin{bmatrix} 0 & -1 & -4 \\ -1 & -1 & 6 \end{bmatrix}$ d) $\begin{bmatrix} 0 & 1 & 4 \\ 1 & 1 & 6 \end{bmatrix}$

Q5) Matrices A and B are inverse of each other, if:
(a) AB = BA (b) AB = BA = 0 (c) AB = 0, BA = I (d) AB = BA = I

Q6) If A = $\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ and A+A′=I, then the value of α is:

a) $\pi/6$ b) $\pi/3$ c) π d) $3\pi/2$

Q7) The function $f(x) = 3x + cos3x$ is
(a) increasing on R (b) decreasing on R (c) strictly decreasing on R
(d) strictly increasing on R

Q8) Area lying in the first quadrant and bounded by the circle $X^2 + Y^2 = 4$ and the lines x=0 and x=2 is
a) π b) b) $\pi/4$ c) $\pi/2$ d) $\pi/3$

Q9) Area of the region bounded by the curve $y^2 = 4x$, y-axis and the line y=3 is $y = 3$ is
(A) 2 (B) 9/2 (C) 3 (D) 9/4

Q10) The Integrating Factor of the differential equation $x\frac{dy}{dx} - y = 2x^2$ is
a) e^{-x} b) e^{-y} c) $1/x$ d) x

Q11) The Integrating Factor of the differential equation
$(1 - y^2)\frac{dx}{dy} + yx = ay(-1 < y < 1)$ is
a) $\frac{1}{y^2-1}$ b) $\frac{1}{\sqrt{y^2-1}}$ c) $\frac{1}{\sqrt{1-y^2}}$ d) $\frac{1}{1-y^2}$

Q12) The number of arbitrary constants in the general solution of a differential equation of fourth order are:

(A) 0 (B) 2 (C) 3 (D) 4

Q13) The number of arbitrary constants in the particular solution of a differential equation of third order are:

(A) 3 (B) 2 (C) 1 (D) 0

Q14) Let the vectors a and b be such that $|a| = 3$ and $|b| = \frac{\sqrt{2}}{3}$, then a×b is a unit vector, if the angle between a and b is

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

Q15) Area of a rectangle having vertices A, B, C and D with position vector

$-\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}$, $\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}$, $\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}$ and, $-\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}$

respectively is:

(A) 2 (B) 1 (C) 2 (D) 4

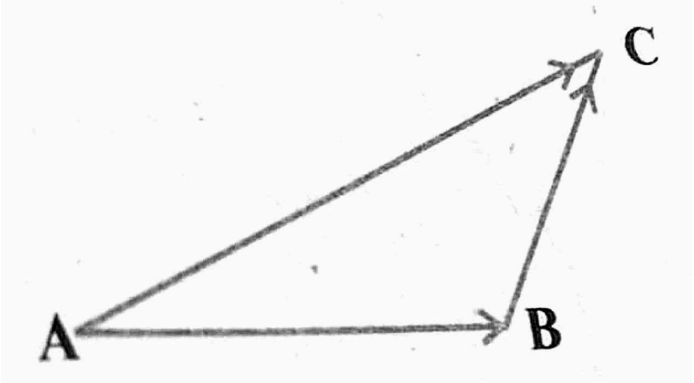
Q16) The value $\hat{i} \bullet (\hat{j} \times \hat{k})$ of will be:

(a) $\hat{i}$ (b) 0 (c) 1 (d) $\hat{j}$

Q17) The angle between the two vectors $3\hat{i} - 2\hat{j} + 4\hat{k}$ and $\hat{i} - \hat{j} + 5\hat{k}$ will be:

a) $\sin^{-1}\frac{25}{\sqrt{783}}$ b) $\sin^{-1} 0^\circ$ c) $\cos^{-1} 0^\circ$ d) $\cos^{-1}\frac{25}{\sqrt{783}}$

Q18) In triangle ABC, which of the following is not true



a) $\overline{AB} + \overline{BC} + \overline{CA} = 0$ (b) $\overline{AB} + \overline{BC} + \overline{AC} = 0$ (c) $\overline{AB} + \overline{BC} - \overline{CA} = 0$

(d) $\overline{AB} - \overline{CB} + \overline{CA} = 0$

Q19)Assertion (A): The function $f(x) = e^x$ has no maximum or minimum value.

Reason (R): Since $f'(x) = e^x > 0$ for all real x, the function is strictly increasing.

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

Q20) Assertion (A): If $a \bullet b = 0$ and $a \neq 0,\ b \neq 0$, then a is perpendicular to b
Reason (R): $a \bullet b = |a||b|cos\theta$, where θ is the angle between a and b
(a) Both A and R true, and R is correct explanation of A
(b) Both A and R true, but R is not the correct explanation of A
(c) A true, R false
(d) A false, R true

SECTION B

Q21) Express $tan^{-1}\frac{cosx - sinx}{cosx + sinx}$, $-\frac{\pi}{4} < x < \frac{\pi}{2}$ in the simplest form

Q22) A = $\begin{bmatrix} -1 & 2 \\ 5 & 7 \end{bmatrix}$, B = $\begin{bmatrix} -1 & 3 & -6 \end{bmatrix}$, verify that (AB)′ = B′A′

Q23) Find the particular solution of the differential equation $\frac{dy}{dx} = -4xy^2$ given that y = 1 when x = 0

Q24) Find Unit vector in the direction of vector $p = 2\hat{i} + 3\hat{j} + \hat{k}$

Q25) If a line has direction ratios 2,−1,−2 determine its direction cosines.

SECTION C

Q26) Find the value of

$tan\frac{1}{2}\left[sin^{-1}\frac{2x}{1+x^2} + cos^{-1}\frac{1-y^2}{1+y^2}\right],\ |x| \leq 1,\ y \geq 0\ and\ xy < 1$

Q27) For matrix A = $\begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$ and verify that

k(i) (A+A′) is a Symmetric matrix.

(ii) (A−A′) is a Skew Symmetric matrix.

Q28) Find the intervals in which the function

$f(x) = sinx + cosx,\ 0 \leq x \leq 2\pi$ is increasing and decreasing.

Q29) Find the general solution of the differential equation

$ydx - (x + 2y^2)dy = 0$

Q30) Show that the points $A(2\hat{i} - \hat{j} + \hat{k})$, $B(\hat{i} - 3\hat{j} - 5\hat{k})$, $C(3\hat{i} - 4\hat{j} - 4\hat{k})$ are the vertices of a right angled triangle.

Q31) Find the angle between the pair of lines given by

$r_1 = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda(\hat{i} + 2\hat{j} + 2\hat{k})$ $r_2 = 5\hat{i} - 2\hat{j} + \mu(3\hat{i} + 2\hat{j} + 6\hat{k})$

SECTION D

Q32) Show that the differential equation $2ye^{\frac{x}{y}}dx + (y - 2xe^{\frac{x}{y}})dy = 0$ is homogeneous and find its Particular Solution, given that $x = 0$ when $y = 1$.

Q33) Find the area enclosed by the Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Q34) Show that the points $A(2\hat{i} + 3\hat{j} + 4\hat{k})$, $B(\hat{i} + 2\hat{j} + 3\hat{k})$ and $C(-\hat{i} - 0\hat{j} - \hat{k})$ are collinear

Q35) Prove the volume of the largest cone that can be inscribed in a Sphere of radius R is $\frac{8}{27}$ of the volume of the Sphere

Q36) A square piece of tin of side 18(cm) is to be made into a box without top by cutting a square from each corner and folding up the flaps to form the box. What should be the side of the square to be cut off so that the volume of the box is the maximum possible

SECTION E