

CLASS – XII
SUB – MATH

FM – 80
TIME – 3 HR

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 **MCQ's 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**(4 marks each) with sub parts.

SECTION-A

1. $\cos^{-1}(\cos \frac{7\pi}{6})$ is equal to (a) $\frac{7\pi}{6}$ (b) $\frac{5\pi}{6}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$.
2. The principal value of $\tan^{-1}(-\sqrt{3})$ is (a) $-\frac{\pi}{3}$ (b) $-\frac{\pi}{6}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$.
3. What must be the matrix X if $\begin{bmatrix} 2 & -5 \\ 4 & 6 \end{bmatrix} + 3X = \begin{bmatrix} 8 & 4 \\ 1 & 0 \end{bmatrix}$. (a) $\begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix}$ (b) $\begin{bmatrix} 5 & 14 \\ -7 & 16 \end{bmatrix}$ (c) $\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$.
4. Which of the following can be both a symmetric and skew-symmetric matrix?
(a) Unit Matrix (b) Diagonal Matrix (c) Null Matrix (d) Row Matrix.
5. The value of $x-y+z$ from the following equation is $\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$.
6. If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$, then the value of $|adj A|$ is (a) a^{27} (b) a^9 (c) a^6 (d) a^2 .
7. The equation $\begin{vmatrix} x & 3 & 4 \\ 1 & 2 & 1 \\ 1 & 4 & 1 \end{vmatrix} = 0$ is satisfied for (a) $x=1$ (b) $x=2$ (c) $x=3$ (d) $x=4$.
8. If $y = \sin^{-1} x$, then $(1-x^2)y_2$ is equal to (a) xy_1 (b) xy (c) xy_2 (d) x^2 .
9. If $x = t^2$ and $y = t^3$, then $\frac{d^2y}{dx^2}$ is equal to (a) $\frac{3}{2}$ (b) $\frac{3}{4t}$ (c) $\frac{3}{2t}$ (d) $\frac{3}{4}$.
10. What is the angle between vectors \vec{a} and \vec{b} if $|\vec{a}| = 1$, $|\vec{b}| = 2$, and $\vec{a} \times \vec{b} = \hat{i} + \hat{j} + \hat{k}$?
(a) $\pi/2$ (b) $\pi/3$ (c) $2\pi/3$ (d) $\pi/6$.
11. A point out of following points lie in plane represented by $2x + 3y \leq 12$ is
(a) (0,3) (b) (3,3) (c) (4,3) (d) (0,5).
12. If \vec{a} and \vec{b} are unit vectors, then the angle between \vec{a} and \vec{b} for $\sqrt{3}\vec{a} - \vec{b}$ to be a unit vector is
(a) 30° (b) 45° (c) 60° (d) 90°
13. P is the point on the line segment joining the points (3,2,-1) and (6,2,-2). If x coordinates of P is 5, then the y coordinate is
(a) 2 (b) 1 (c) -1 (d) -2.
14. If the line makes an angle of $\pi/4$ with each of y and z axes, then the angle which it makes with x-axis is
(a) 0 (b) π (c) $\pi/2$ (d) $\pi/4$.
15. The domain of the function $\sin^{-1}x$ is (a) [-1,1] (b) (-1,1) (c) (0,1) (d) (-1,0).
16. P is the point on the line segment joining the points (3,2,-1) and (6,2,-2). If x co-ordinate of P is 5, then its y co-ordinate is
(a) 2 (b) 1 (c) -1 (d) -2
17. The angle between the lines $2x=3y=-z$ and $6x=-y=-4z$ is (a) 0° (b) 30° (c) 45° (d) 90°
18. If A is a non-singular matrix of order 3 then $|AA^{-1}|$ is equal to.
(a) 1 (b) $|AA|$ (c) $|A^{-1}|$ (d) -1

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choosethe correct answer out of the following choices.

- (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.

19. Assertion (A) : Determinant is a number associated with square matrix

Reason (R) : Determinant is a square matrix.

20. Assertion (A): The direction cosines of the vector $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ are $\frac{2}{\sqrt{45}}, \frac{4}{\sqrt{45}}, -\frac{5}{\sqrt{45}}$.

Reason (R) : A vector having zero magnitude and arbitrary direction is called zero vector or null vector.

SECTION-B

21. Find the position vector of a point A in space such that \vec{OA} is inclined at 60° to OX and at 45° to OY and $|\vec{OA}| = 10$ units.

Or

Prove that the line through A(0,-1,-1) and B(4,5,1) intersects the line through C(3,9,4) and D(-4,4,4).

22. Find $\int 2x^3 e^{x^2} dx$.

23. Find the minor and cofactors of diagonal elements of the matrix $\begin{bmatrix} 3 & -1 & 3 \\ 4 & 2 & 2 \\ 1 & 3 & 1 \end{bmatrix}$.

24. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & x \\ -2 & 2 & -1 \end{bmatrix}$ is a matrix satisfying $AA' = 9I$, find x.

25. If $y = x^3 \log\left(\frac{1}{x}\right)$, then prove that $x \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + 3x^2 = 0$.

SECTION-C

26. If $x = e^{\frac{x}{y}}$, then prove that $\frac{dy}{dx} = \frac{x-y}{x \log x}$.

27. $\tan^{-1}\left(\tan \frac{5\pi}{6}\right) + \cos^{-1}\left(\cos \frac{13\pi}{6}\right)$.

28. Express the matrix $B = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ as the sum of a symmetric and skew symmetric matrix.

Or

If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, then show that $A^3 - 23A - 40I = O$.

29. Find the coordinates of the foot of the perpendicular drawn from the point P(-1,-2,-1) to the line joining A(2,4,6) and B(4,5,2).

30. Find the distance between the line $\frac{x}{2} = \frac{2y-6}{4} = \frac{1-z}{-1}$ and another line parallel to it and passing through the point (4,0,-5).

31. Solve the following linear programming graphically Minimize $Z = 2x + y$

Subject to constraints $3x + y \geq 9$, $x + y \geq 7$, $x + 2y \geq 8$, $x, y \geq 0$.

SECTION-D

32. Solve the following LPP graphically maximize and minimize $Z=0.04x + 0.06y$ subject to constraints $0.2x+0.1y \geq 100$, $0.5x + y \geq 400$ and $x,y \geq 0$. Also find the difference between maximum and minimum value of Z .

Or

Maximize and minimize $Z=3x-4y$ subject to constraints $x-2y \leq 0$, $-3x+y \leq 4$, $x-y \leq 6$, $x,y \geq 0$.

33. Find $\int x^7 \sin(2x^4) dx$.

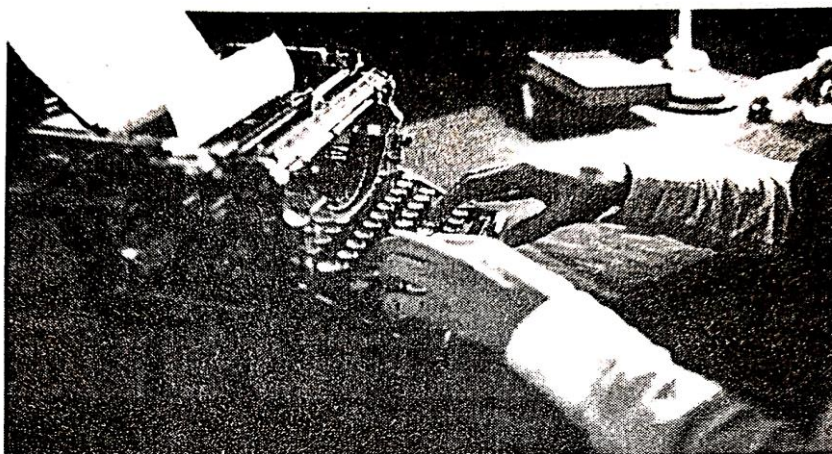
34. If $x=\sqrt{m^{\tan^{-1}\theta}}$, $y=\sqrt{m^{\cot^{-1}\theta}}$ prove that $\frac{dy}{dx} = -\frac{y}{x}$.

35. An amount of 5000 put into three investments at rate of interest of 6%, 7% and 8% per annum respectively. The total annual interest is 358. If the combined 70 more than the interest from the third, find the amount of each investment by matrix method.

SECTION-E

36.

A typist charges ₹ 145 for typing 10 English and 3 Hindi pages, while charges for 3 English and 10 Hindi pages are ₹ 180. However, typist charged ₹ 2 per page from a poor student Shyam for 5 Hindi pages and ₹ 1 per page for 4 English pages.



Let the charges for typing one English and one Hindi page be ₹ x and ₹ y respectively.

Based on the given information, answer the following questions:

(A) Write the pair of linear equations formed with the given situation and also converting these in the matrix form $AX = B$.

(B) Find the values of x and y and how much less was charged from the poor student?

