

Bhavan's Tripura Vidyamandir
1st Terminal Examination : (2025-2026)

Class : 12

Time : 3Hours

Name of the student: _____

Subject: Mathematics

Total : 80 Marks

Roll: _____ Sec: _____

General Instructions:

- This question paper contains 5 sections A,B,C,D&E
- Section A contains 18 MCQ and 2 assertion reasoning based questions Each carries 1mark
- Section B contains 5 question each carries 2 marks.
- Section C contain 6 questions each carries 3 marks.
- Section D contains 4 question each carries 5 marks.
- Section E contains 3 case based questions each carries 4 marks.

SECTION: A

(1X20=20)

- 1) If a set A having 3 elements and B set having 2 elements then the number of nonempty relations from A to B is
a) 32 b) 33 c) 64 d) 63
- 2) A is a matrix of order 3×3 , and $\det A = 4$, then $\det (\text{adj} A)$ is
a) 16 b) 64 c) 9 d) none of these
- 3) The principal value of $\text{cosec}^{-1}(-2)$ is
a) $\frac{\pi}{6}$ b) $\frac{-\pi}{6}$ c) $\frac{2\pi}{3}$ d) $\frac{\pi}{2}$
- 4) If $A = \begin{bmatrix} 2 & 6 \\ 6 & x \end{bmatrix}$ is singular matrix then the value of x is.
a) 5 b) 9 c) 18 d) -9
- 5) The domain of the function $\sin^{-1}(2x-3)$ is
a) $[-1, 1]$ b) $(-1, 1)$ c) $(1, 2]$ d) $[1, 2]$
- 6) If $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ then A^{2023} is equal to
a) $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 2023 \\ 0 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 2023 & 0 \\ 0 & 2023 \end{bmatrix}$
- 7) If a set $A = \{x, y, z\}$ and $B = \{p, q\}$ then the number of one one function from B to A is
a) 6 b) 9 c) 8 d) none of these
- 8) The relation R in the set $\{1, 2, 3\}$ given by $R = \{(1, 2), (2, 1), (1, 1)\}$ is
a) Symmetric and transitive but not reflexive
b) Reflexive and symmetric but not transitive
c) symmetric but neither reflexive nor transitive
d) none of these
- 9) A Function f is said to be continuous for $x \in \mathbb{R}$ if it is
a) continuous at $x = 0$ (b) differentiable at $x = 0$
c) continuous at two points (d) differentiable for all $x \in \mathbb{R}$

- 10) A function f is continuous at $x=0$ $f(x) = \begin{cases} \frac{\sin 3x}{5x}, & \text{when } x \neq 0 \\ k, & \text{when } x = 0 \end{cases}$ then the value of k is
- a) 3 b) $\frac{5}{3}$ c) $\frac{3}{5}$ d) none of these
- 11) The derivatives of $\cot^{-1}x$ is
- a) $\frac{1}{x+1}$ b) $\frac{-1}{1+x^2}$ c) $\frac{1}{1-x}$ d) $\frac{2}{2+x}$
- 12) The antiderivatives of $\frac{1}{x}$ is.
- a) $\log(x+1)$ b) $\frac{1}{x+1}$ c) $\log x$ d) none of these
- 13) If $y = 5e^{7x} + 6e^{-7x}$ then $\frac{d^2y}{dx^2}$ is
- a) $48y$ b) $49y$ c) $7y$ d) none of these
- 14) $\int e^x \sec x (1 + \tan x) dx$ is
- a) $e^x \cos x + c$ b) $\frac{e^x}{\cos x} + c$ c) $e^x \tan x + c$ d) $e^x \sec^2 x + c$
- 15) The value of $\int \log x dx$ is
- a) $x \log x + 1$ b) $x \log x - 1 + c$ c) $x(\log x - 1) + c$ d) none of these.
- 16) what is the angle which the vector $\hat{i} + \hat{j} + \sqrt{2}\hat{k}$ makes with z axis?
- a) 30° b) 60° c) 45° d) 120°
- 17) The given two vectors are perpendicular to each other $\vec{a}$ and $\vec{b}$ is where $\vec{a} = \hat{i} + 3\hat{j} - x\hat{k}$ $\vec{b} = \hat{i} + 3\hat{j} + 2\hat{k}$ then the value of x is
- a) 6 b) 8 c) 5 d) -5
- 18) If the direction ratio of two perpendicular lines are $-1, -3, 2$ and $2, p, 4$ then the value of p is
- a) 4 b) 2 c) -3 d) -2

ASSERTION-REASON BASED QUESTIONS

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

- a) Both A and R true and R is the correct explanation of A.
 b) Both A and R 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): $\int \frac{(\log x)^2}{x} dx = \frac{1}{3}(\log x)^3 + c$
 Reason (R): $\int \frac{1}{x} dx = \log x + c$
- 20) Assertion (A): $|\sin x|$ is continuous function.
 Reason (R): If $f(x)$ and $g(x)$ both are continuous function, then $gof(x)$ is also a continuous function

SECTION: B

(2X5=10)

- 21) Find the projection of $\vec{b} + \vec{c}$ vector on $\vec{a}$ where $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$ $\vec{b} = \hat{i} + \hat{j} - 2\hat{k}$ & $\vec{c} = 2\hat{i} - \hat{j} + 2\hat{k}$

22) The function $f(x) = \begin{cases} \frac{1-\cos kx}{x^2}, & x \neq 0 \\ 2, & x = 0 \end{cases}$ is continuous at $x=0$. Then find the value of k ?

23) If $x \sin(a+y) = \sin y$ then show that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$

24) Find the principal value of $\sin^{-1}\left(\frac{-1}{\sqrt{2}}\right) + \cos^{-1}\left(\frac{-\sqrt{3}}{2}\right)$

25) $A = \begin{bmatrix} 1 & 3 \\ -2 & 4 \end{bmatrix}$ then find its A^{-1} ?

SECTION: C

(3X6=18)

26) Integrate $\int \frac{1}{\sin(x+a)\sin(x+b)} dx$

27) Giving a skew symmetric matrix $A = \begin{bmatrix} 0 & a & 1 \\ -1 & b & 1 \\ -1 & c & 0 \end{bmatrix}$, then find the value of $(a+b+c)^2$?

28) prove that $\tan^{-1} \frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}} = \frac{\pi}{4} - \frac{1}{2} \cos^{-1} x$, $-\frac{1}{\sqrt{2}} \leq x \leq 1$

29) Let $A = \mathbb{R} - \{3\}$, $B = \mathbb{R} - \{1\}$. If $f: A \rightarrow B$ be defined by $f(x) = \frac{x-2}{x-3}$, $\forall x \in A$ Then show

that f is bijective function?

30) Evaluate $\int e^x x^2 dx$

31) Find the unit vector perpendicular to both $\vec{a}$ and $\vec{b}$ vector
Where $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$

SECTION: D

(4X3=12)

32) solve the system of linear equation using matrix method

$$x + y + z = 6, \quad x + z = 7, \quad 3x + y + z = 12$$

or

If $\vec{a} = 3\hat{i} - \hat{j}$ and $\vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$ then express $\vec{b}$ in the form of $\vec{b} = \vec{p} + \vec{q}$ where $\vec{p}$ is parallel to $\vec{a}$ and $\vec{q}$ is perpendicular to $\vec{a}$. Also find $\vec{p}$ and $\vec{q}$

33) Let N be the set of all natural numbers and let R be the relation in N defined by

$R = \{(a,b): a \text{ is a multiple of } b\}$ show that R is reflexive and transitive but not symmetric relation.

34) Find: $\int \sin^{-1} \sqrt{\frac{x}{a+x}} dx$

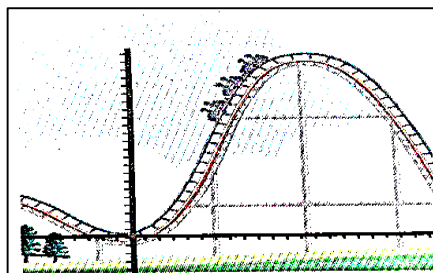
35) If $y = e^{a \cos^{-1} x}$ then prove that $(1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - a^2 y = 0$

Or

$2x = y^{\frac{1}{5}} + y^{-\frac{1}{5}}$ then prove that $(1-x^2) \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - 25y = 0$

SECTION: E

36) **Case1:** Read the following passage and answer the following questions



The equation of the path traced by a roller coaster is given by the polynomial

$$f(x) = a(x + 9)(x + 1)(x - 3).$$

If the roller coaster crosses y axis at a point (0,-1), answer the following

- i) find the value of a?
- ii) find the value of $f''(x)$

37) **Case :2** Read the following passage and answer the following questions

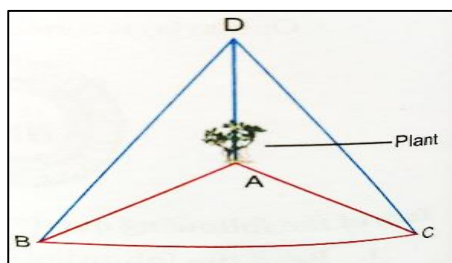
Rubel, the owner of a sweet selling shop, purchased some rectangular cardboard sheets of dimension 25 cm by 40 cm to make container packets without top. Let x cm be the length of the side of the square to be cut out from each corner to give that sheet the shape of the container by folding up the flaps based on the above information answer the following questions.

i) Express the volume (V) of each container as function of x only.

ii) find $\frac{dV}{dx}$

38) **Case :3** Read the following passage and answer the following questions

Raghav purchased a air plant holder which is in the shape of tetrahedron. Let A, B, C and D be the coordinates of the air plant holder where



$$A=(1,2,3), \quad B=(3,2,1), \quad C=(2,1,2), \quad D=(3,4,3)$$

- i) Find the vector AB?
- ii) Find the unit vector along BC vector?
- iii) Find the area of the ΔBCD