

*A Valuable material from SS PRITHVI's*

**Class 12**

**2023-24**



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# LATEST COMPULSORY QUESTIONS 2024

**COLLECTED FROM PTA 2024, REVISION TESTS  
2024, HALF YERLY 2023**

**SUBJECT:**

**M A T H**

**MR. SS PRITHVI**

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## HALF YEARLY 2023

- |   |   |
|---|---|
| 1 | A sphere is made of ice having radius 5 cm. Its radius decreases from 5 cm to 4.7 cm, Find the change in the volume approximation.?   |
| 2 | Prove, using mean value theorem, $ \sin \alpha - \sin \beta  \leq  \alpha - \beta , \alpha, \beta \in \mathbb{R}$   |
| 3 | Find the angle between the lines $\frac{x-4}{2} = \frac{y}{1} = \frac{z+1}{-2}$ and $\frac{x-1}{4} = \frac{y+1}{-4} = \frac{z-2}{2}$  |
| 4 | Verify (i) closure property (ii) commutative property of the following operation on the given set $a * b = a^b \forall a, b \in \mathbb{N}$ .   |
| 5 | Decrypt the received encoded message (10 1) (6 1) with encryption matrix $\begin{pmatrix} -1 & 1 \\ 2 & 1 \end{pmatrix}$ and the decryption matrix as its inverse, where the system of codes is described by the numbers 1-26 to the letters A-Z respectively, and the number 0 to a blank space. |
| 6 | The Earth is revolving around the Sun in elliptical orbit when Sun is located at one of the focus. If the distance between Sun and the other focus is $575 \times 10^5$ km and eccentricity is $1/2$ then find the maximum and minimum distance between the earth and sun in earth's orbit.       |

7	Solve : $\frac{dy}{dx} + y \cot x = 2 \cos x$
8	Find the value of $\tan\left(2 \tan^{-1}\left(\frac{1}{5}\right) - \frac{\pi}{4}\right)$
9	Compute $P(X = k)$ for the binomial distribution, Where $B(n, p)$ $n = 10, p = \frac{1}{5}, k = 4$
10	Show that the number given by the Rolle's theorem for the function $x^3 - 3x^2, x \in [0, 3]$ is 2.
11	If $u(x, y, z) = \log(e^{2x} + e^{2y} + e^{2z})$ , find $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$
12	Write the Maclaurin series expansion of the following functions: $\tan^{-1}(x); -1 \leq x \leq 1$
13	Evaluate : $\int_{-1}^1 \log\left(\frac{5-x}{5+x}\right) dx$

14	For which values of $m$ , the vectors $\vec{a} = i + j + m\hat{k}$ , $\vec{b} = i + j + (m + 1)\hat{k}$ , $\vec{c} = i - j + m\hat{k}$ are coplanar.
15	Give your own example of a matrix of rank 1 of order $3 \times 3$ .
16	Test the point of inflection of the curve $y = x^4$ .
17	Solve: $(1 + x) \frac{dy}{dx} = 1 + y$
18	The mean and standard deviation of a binomial variate $X$ are respectively 4 and 1 Find (i) the probability mass function (ii) $P(X = 2)$
19	Solve: $\frac{dy}{dx} = \frac{x + y}{x}$
20	Find the value of $\left[ \frac{1+i}{\sqrt{2}} \right]^8 + \left[ \frac{1-i}{\sqrt{2}} \right]^8$
21	Find the critical point of the function $f(x) =  x-17 $

22	Find the area of the circle of radius $r$ .
23	Find the asymptotes of the curve $f(x) = \frac{x^2}{x+1}$
24	Form the differential equation by eliminating the arbitrary constants A and B from $y = A \cos x + B \sin x$
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## 2024 JANUARY REVISION 1 AND 2

1	Verify associative property of the following operation $*$ defined by $a*b = a^b$ , $\forall a, b \in \mathbb{N}$
2	Find the rank of the matrix $\begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & -1 & 3 & 4 \\ 5 & -1 & 7 & 11 \end{bmatrix}$
3	Prove that, In an algebraic structure the identity element (if exists) must be unique.
4	Find the torque of the resultant of the three forces represented by $-3\hat{i} + 6\hat{j} - 3\hat{k}$ , $4\hat{i} - 10\hat{j} + 12\hat{k}$ and $4\hat{i} + 7\hat{j}$ acting at the point with position vector $8\hat{i} - 6\hat{j} - 4\hat{k}$ about the point with position vector $18\hat{i} + 3\hat{j} - 9\hat{k}$ .
5	Express $[\bar{a} + \bar{b} + \bar{c}, \bar{a} - \bar{b}, \bar{c}]$ in terms of $[\bar{a} \ \bar{b} \ \bar{c}]$ .
6	Evaluate: $\lim_{x \rightarrow \infty} \frac{\frac{1}{x^2} - 2 \tan^{-1}\left(\frac{1}{x}\right)}{\frac{1}{x}}$

7	Let $M = \left\{ \begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in \mathbb{R} - \{0\} \right\}$ and let $\cdot$ be the matrix multiplication. $M$ is closed under $\cdot$ . If so, examine the existence of identity, existence of inverse properties for the operation $\cdot$ on $M$ . <i>(x=12, (9)</i>
8	Solve by determinant method: $5x + 2y = 17, 3x + 7y = 31$
9	Find the value of $\cot^{-1}(-1)$
10	From the differential equation by eliminating the arbitrary constants $A$ and $B$ from $y = A \cos 5x + B \sin 5x$
11	Show that $p \rightarrow q$ and $q \rightarrow p$ are not equivalent.
12	The probability that a certain kind of component will survive a electrical test is $\frac{3}{4}$ . Find the probability that exactly 5 components tested survive.
13	Identify the type of the conic for the following equations. $4x^2 + 4xy + y^2 + 4x + 32y + 16 = 0$ <i>Ex. 5.</i>
14	Evaluate: $\lim_{x \rightarrow 0} \frac{\sin mx}{\sin nx}$

15	$w \neq 1$ is a cube root of unity and $(1 + w)^7 = A + Bw$ then find A and B.
16	Solve $\frac{dy}{dx} = \frac{-(1+y^2)}{\sqrt{1+x^2}}$
17	In a newly developed city, it is estimated that the voting population (in thousands) will increase according to $V(t) = 30 + 12t^2 - t^3, 0 \leq t \leq 8$ where $t$ is the time in years. Find the approximate change in voters for the time change from 4 to $4\frac{1}{6}$ year.
18	If $\alpha$ and $\beta$ are the roots of the quadratic equation $2x^2 - 7x + 13 = 0$ , then find the value of $\alpha^2 + \beta^2 + 3\alpha\beta$ .
19	Find the torque of the force $3\vec{i} + 2\vec{j} - 4\vec{k}$ about the point $(2, -1, 3)$ acting through the point $(1, -1, 2)$ .
20	The volume of the parallelepiped whose coterminus edges are $7\vec{i} + \lambda\vec{j} - 3\vec{k}$ , $\vec{i} + 2\vec{j} - \vec{k}$ , $-3\vec{i} + 7\vec{j} + 5\vec{k}$ is 90 cubic units. Find the value of $\lambda$ .
21	Evaluate: $[2\vec{i} \ \vec{j} \ \vec{k}] + [\vec{i} \ \vec{k} \ \vec{j}] + [\vec{k} \ \vec{j} \ 2\vec{i}]$
22	Find the area of the region bounded by the line $5x + 3y = 15$ , x-axis and the lines $x = -1$ and $x = 2$ .



23

Find  $A^{-1}$  if  $\text{adj } A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 \end{bmatrix}$

24

Prove De Morgan's law by using Truth table

25

Find the local extrema of the function  $f(x) = x^4 + 32x$ .

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# PTA - 2024

1	Show that the solution of the differential equation $\frac{dy}{dx} = 2xy$ is $\log y = x^2 + c$ .
2	A force given by $3\hat{i} + 2\hat{j} - 4\hat{k}$ is applied at the point $(1, -1, 2)$ . Find the moment of force about the point $(2, -1, 3)$
3	Show that the integrating factor of the differential equation $\frac{dy}{dx} = \frac{x+y+1}{x+1}$ is $\frac{1}{x+1}$ .
4	Find the direction cosines and torque of the force $2\hat{i} + \hat{j} - \hat{k}$ if it acts about the point $(2, 0, -1)$ and through the origin.
5	Find the value of $\sin^{-1}\left(-\frac{1}{2}\right) + \sec^{-1}(2)$ .
6	Evaluate $\int_1^3 \frac{\sqrt{x}}{\sqrt{5-x} + \sqrt{x}} dx$ .
7	Prove that $\sum_{n=1}^{204} (i^{n+1} - i^{n+2}) = 0$ .
8	Show that the differential equation for the function $y^2 = 4ax$ , where $a$ is arbitrary, is $y = 2y'x$ .

9	If $f(x, y) = \frac{x^2 + y^2 + xy}{x^2 - y^2}$ then show that $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = 0$ .
10	Show that the area of the region bounded by $y = \sin x, x = 0$ and $x = \pi$ is 2
11	Find the value of $\tan^{-1}(-1) + \cos^{-1}\left(\frac{1}{2}\right) + \sec^{-1}(-2)$ .
12	Find the equation of the parabola with focus $(-1, -2)$ and the directrix is $x - 2y + 3 = 0$

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