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Class 12

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A COLLECTION OF

COMPULSORY QUESTIONS

SUBJECT:

M A T H

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FIRST MID TERM

1	Write in polar form of the complex number $3 - i\sqrt{3}$
2	Find the rank of the matrix $\begin{bmatrix} 2 & -2 & 4 & 3 \\ -3 & 4 & -2 & -1 \\ 6 & 2 & -1 & 7 \end{bmatrix}$ by reducing it to an echelon form
3	If adjA = $\begin{bmatrix} -1 & 2 & 2 \\ 1 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, find A^{-1}.
4	State and prove triangle inequality of complex number.
5	Construct a cubic equation whose roots are 1, 1, -2
6	Show that the equation z^3+2z has five roots
7	$1950x^{25} + 15x^4 + 26x^4 + 2020 = 0$, discuss the nature of roots for thise equation.
8	Solve: $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$

9	Solve : $\sin^2 x - 5\sin x + 4 = 0$.
10	Find the square root of $-7 + 24i$.
11	Let $A = \{a + \sqrt{5}b : a, b \in z\}$. Check whether the usual multiplication is a binary operation on A.
12	Find the angle between the straight line $\frac{x+3}{2} = \frac{y-1}{2} = -z$ with coordinate axes.
13	Find a polynomial equation of minimum degree with rational coefficients, havin[g] $2 - \sqrt{3}i$ as a root.
14	Form a polynomial equation with integer coefficients $\sqrt{\frac{\sqrt{2}}{\sqrt{3}}}$ as a roots.
15	Show that the equation $x^9-5x^5+4x^4+2x^2+1 = 0$ has atleast 6 imaginary solutions.
16	Find the sum of squares of roots of the equation $2x^4-8x^3+6x^2-3 = 0$.

17	Solve the following system of linear equations using matrix inversion method: $2x-y=3,\ 5x+y=4$
18	Find the square root of $5-12i$.
19	If A is a non-singular matrix of odd order, prove that $\|adj\ A\|$ is positive.
20	If k is a real, discuss the nature of the roots of the polynomial $2x^2+kx+k=0$, in terms of k.
21	Determine the number of positive and negative roots of the equation $x^9-5x^8-14x^7=0$.
22	Solve the equation $3x^3-16x^2+23x-6=0$ if the product of two roots is 1.
23	Solve: $2x+3y=10,\ x+6y=4$ using Cramer's rule.
24	For any vector $\vec{a}$, prove that $\hat{i}\times(\vec{a}\times\hat{i})+\hat{j}\times(\vec{a}\times\hat{j})+\hat{k}\times(\vec{a}\times\hat{k})=2\vec{a}$.

25	Find the point of intersection of the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=z$.

QUARTERLY

1	If the system of linear equation $x+2ay+az = 0$, $x+3by+bz = 0$, $x+4cy+cz = 0$ has a non-trivial solution then show that a, b, c are in H.P.
2	Prove that $\tan\left(\frac{\pi}{4}+\frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right)+\tan\left(\frac{\pi}{4}-\frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right)=\frac{2b}{a}$
3	Find the volume of the parallelopiped whose coterminus edges are given by the vectors $2\vec{i}-3\vec{j}-4\vec{k}$, $\vec{i}+2\vec{j}-\vec{k}$ and $3\vec{i}-\vec{j}+2\vec{k}$
4	A particle acted on by constant forces $8\vec{i}+2\vec{j}-6\vec{k}$ and $6\vec{i}+2\vec{j}-2\vec{k}$ is displaced from the point (1, 2, 3) to the point (5, 4, 1). Find the total work done by the forces.
5	Find the angle between the planes $\vec{r}\cdot(\hat{i}+\hat{j}-2\hat{k})=3$ and $2x-2y+z=2$
6	Find the equation of the ellipse with foci $(\pm2, 0)$ and vertices $(\pm3, 0)$
7	Show that the points (2, 3, 4), (-1, 4, 5) and (8, 1, 2) are collinear.

8	Show that $\vec{r} = (6\hat{i} + \hat{j} + 2\hat{k}) + s(\hat{i} + 2\hat{j} - 3\hat{k})$ and $\vec{r} = (3\hat{i} + 2\hat{j} - 2\hat{k}) + t(2\hat{i} + 4\hat{j} - 5\hat{k})$ are skew lines.
9	If $2\hat{i} - \hat{j} + 3\hat{k}$, $3\hat{i} + 2\hat{j} + \hat{k}$, $\hat{i} + m\hat{j} + 4\hat{k}$ are coplanar, find the value of m.
10	If $\|z\| = 2$ show that $3 \le \|z + 3 + 4i\| \le 7$.
11	Find the value of tan-1 $(\sqrt{3})$ - $\sec^{-1}(-2)$.
12	Prove that the point of intersection of the tangents at 't_1' and 't_2' on the parabola $y^2 = 4ax$ is $[at_1 t_2, a(t_1 + t_2)]$
13	If $\omega \neq 1$ is complex cubic root of unity prove that $(2 - \omega)(2 - \omega^2)(2 - \omega^{10})(2 - \omega^{11}) = 49$
14	If e_1 and e_2 are the eccentricities of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $(a^2 > b^2)$ and the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ then prove that $e_1^2 + e_2^2 = 2$.
15	Show that the points (2, 3, 4), (- 1, 4, 5) and (8 , 1, 2) are collinear

16	Show that $\|3z - 5 + i\| = 4$ represents a circle and find its centre and radius.
17	If $z = (2 + 3i)(1 - i)$ find z^{-1}.
18	For any vector $\vec{a}$, prove that $\hat{i} \times (\vec{a} \times \hat{i}) + \hat{j} \times (\vec{a} \times \hat{j}) + \hat{k} \times (\vec{a} \times \hat{k}) = 2\vec{a}$.
19	Prove by vector method that the parallelograms on the same base and between the same parallels are equal in area.
20	Find the angle between the line $\vec{r} = (2\hat{i} - \hat{j} + \hat{k}) + t(\hat{i} + 2\hat{j} - 2\hat{k})$ and the plane $\vec{r}.(6\hat{i} + 3\hat{j} + 2\hat{k}) = 8$
21	Determine whether the three vectors $2\vec{i} + 3\vec{j} + \vec{k}$, and , $\vec{i} - 2\vec{j} + 2\vec{k}$ and $3\vec{i} + \vec{j} + 3\vec{k}$ are coplanar .
22	The volume of the parallelepiped whose co terminous edges are $7\hat{i} + \lambda\hat{j} - 3\hat{k}, \hat{i} + 2\hat{j} - \hat{k}, -3\hat{i} + 7\hat{j} + 5\hat{k}$ is 90 cu.units. Find the value of λ

23	Find the volume of the parallelopiped with its edges represented by the vectors $\hat{i}+\hat{j},\ \hat{i}+2\hat{j},\ \hat{i}+\hat{j}+\pi\hat{k}$
24	If α and β are the roots of $x^2+x+1=0$ then find the value of $\alpha^{2020}+\beta^{2020}$.
25	If z is a complex number of unit modulus and argument θ. Find the value of $\arg\left(\frac{1+z}{1+z}\right)$.
26	If $\vec{a}=2\hat{i}+3\hat{j}-5\hat{k},\ \vec{b}=-\hat{i}+\hat{j}+2\hat{k}$ and $\vec{c}=4\hat{i}-2\hat{j}+3\hat{k}$, show that $(\vec{a}\times\vec{b})\times\vec{c}\neq\vec{a}\times(\vec{b}\times\vec{c})$
27	Find the square root of 7−24i.
28	A ball is thrown vertically upwards, moves according to the law $S=13.8t-4.9t^2$ where S is in metres and t is in seconds. (i) Find the velocity at t = 1 (ii) Find the acceleration at t = 1 (iii) Find the maximum height reached by the ball?
29	If $\vec{a}=\vec{i}-\vec{k},\ \vec{b}=\vec{j}-\vec{k},\ \vec{c}=\vec{i}+\vec{j}+\vec{k}$ find $\vec{a}\cdot(\vec{b}\times\vec{c})$ {blurred content is [b x c] }

30	Find the inverse of the non - singular matrix $A = \begin{bmatrix} 0 & 5 \\ -1 & 6 \end{bmatrix}$ by Gaws - Jordan method.
31	obtain the polar form of $1+i\tan\alpha$. where α is an acute angle
32	Solve the equation $x^3 - 9x^2 + 26x - 24 = 0$.
33	Find the acute angle between the planes $\vec{r}.(2\hat{i}+2\hat{j}+2\hat{k}) = 11$ and $4x - 2y + 2z = 15$
34	Prove that $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) = \frac{\pi}{4}$
35	Find the length of latus rectum of parabola $y^2 = 4ax$
36	Prove that $\|z_1 + z_2\| \leq \|z_1\| + \|z_2\|$.
37	If z is a complex number of unit modulus and argument θ. Find the value of $\arg\left(\frac{1+z}{1+\bar{z}}\right)$.

38	If $P=\begin{pmatrix}1 & \alpha & 3\\ 1 & 3 & 3\\ 2 & 4 & 4\end{pmatrix}$ is the adjoint of a 3 x 3 matrix A and $\lvert A\rvert=4$. Find the value of α.

	SECOND MID TERM
1	If $U(x,y,z) = \log(x^3 + y^3 + z^3)$, find $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$.
2	Determine whether $*$ is a binary operation on R defined by $a * b = a\sqrt{b}$
3	Assuming $\log_{10} e = 0.4343$ find an approximate value of $\log_{10} 1003$.
4	Prove that in an algebraic structure the ldentity element (If exists) must be unique.
5	Let $A = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$ be any three boolean matrices of the same type. Find (i) $A \wedge B$ ii) $(A \wedge B) \vee C$
6	Let $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ be any two boolean matrices of the same type Find A v B and A^ B.
7	State and prove commutatives laws of conjunction and disjunction by using Truth table
8	Prove that the function $f(x) = x^3$ is strictly increasing on $(-\infty, \infty)$.

9	Evaluate : $\lim_{x \to 0} \lvert x \rvert^{\sin x}$
10	Evaluate: $\int_0^1 x^5(1-x^2)^5\,dx$
11	If $g(x, y) = 3x^2-5y+2y^2$, $x(t) = e^t$ and $y(t) = \cos t$, then $\frac{dg}{dt}$ is equal to
12	Prove that the function $f(x)=x^2-2x-3$ is strictly increasing in $(2,\infty)$
13	Show that the percentage error in the n^{th} root of a number is approximately $\frac{1}{n}$ times the percentage error in the number.
14	Check whether the statement $p \to (q \to p)$ is a tautology or a contradiction.
15	Let $U(x, y, z) = x^2 - xy + 3 \sin t$ $x, y, z \in R$. Find the linear approximation for u at $(2, -1, 0)$.
16	If X is the random variable with distribution function F(x) given by $F(x) = \begin{cases} 0 & x < 0 \\ x & 0 \le x < 1 \\ 1 & 1 \le x \end{cases}$ then find i) the probability density function (ii) $P(0.2 \le x \le 0.7)$

17	Evaluate $\int_0^8 \lvert x-5 \rvert dx$

Half - Yearly

1	Write the Maclaurin series expansion of e^{-x}.
2	Draw the Geometrical diagram for the sum of two complex numbers Z_1 and Z_2 and verify the result.
3	In the set Q define $a \odot b = a+b+ab$. For what value of y, $3 \odot (y \odot 5) = 7$?
4	Evaluate: $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\cot x}}$
5	Solve $2x^3-9x^2+10x-3=0$
6	If $A = \begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix}$ show that $A^2-3A-7I_2 = 0$ then find A^{-1}.
7	Find the differential equation of the curve represented by $xy = ae^x + be^{-x} + x^2$
8	If $A = \begin{bmatrix} -3 & -2 \\ \lambda & -2 \end{bmatrix}$, find the value of λ so that $A^2 = \lambda A - 2I$

9	If $\omega \neq 1$ is complex cubic root of unity from a quadratic equation with roots 2ω and $2\omega^2$.
10	Evaluate $\int_0^1 \log\left(\frac{1-x}{x}\right) dx$
11	Prove that the function $f(x) = x^2 - 2x - 3$ is strictly increasing in $(2, \infty)$.
12	Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\tan x}}$
13	Evaluate: $\sin(\sin^{-1}(16))$
14	Evaluate : $\int_0^{\frac{\pi}{2}} \log(\tan x)\, dx$
15	If $\lvert z - 2 + i \rvert \leq 2$, then find the greatest value of $\lvert z \rvert$

16	The line PP' is a focal chord of the parabola $y^2 = 8x$ and if the coordinates of P are (18,12) then find the coordinates of P'
17	Find polynomial equation of minimum degree with rational coefficients, having $2 + \sqrt{3}i$ as a root.
18	Evaluate : $\int_{2}^{3} \frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}}\,dx$
19	Suppose that f(x) given below represents a probability mass function. x: 1, 2, 3, 4, 5, 6 f(x): k^2, $2k^2$, $3k^2$, $4k^2$, k, 2k Find the value of K.
20	Establish the equivalence property connecting the bi-conditional with conditional: $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$
21	If $\lvert z-2+i \rvert \leq 2$, then find the greatest value of $\lvert z \rvert$
22	The line PP' is a focal chord of the parabola $y^2 = 8x$ and if the coordinates of P are (18,12) then find the coordinates of P'

23	Evaluate: $\int_0^{2\pi} \sin^7\left(\frac{x}{4}\right)dx$
24	Find the distance between the planes $x+2y+3z+7=0$ and $2x+4y+6z+7=0$
25	Find the modulus and amplitude of $\frac{1+2i}{1-(1-i)^2}$.
26	If $A=\begin{pmatrix}1 & 3 & 4\\ 1 & 4 & 5\\ 2 & 5 & 7\end{pmatrix}$, find A^{-1}.
27	If $u(x,y,z)=\log(e^x+e^y+e^z)$, find $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}$
28	Verify $(AB)^{-1}=B^{-1}A^{-1}$ with $A=\begin{bmatrix}4 & 0\\ -1 & 2\end{bmatrix}$, $B=\begin{bmatrix}-4 & -2\\ 1 & -1\end{bmatrix}$
29	Find df for $f(x)=x^2+3x$ for $x=3$ and $dx=0.002$

30	Evaluate : $\sin\left[\sin^{-1}\left(\frac{3}{5}\right)+\sec^{-1}\left(\frac{5}{4}\right)\right]$
31	Find polynomial equation of minimum degree with rational coefficients, having $2+\sqrt{3}i$ as a root.
32	Evaluate : $\int_{2}^{3}\frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}}dx$

Revision – I & 2

1	If the radius of a sphere, with radius 10cm, has to decrease by 0.1 cm, approximately how much will its volume decrease.
2	If $x + y \geq 0$ prove $\cos^{-1}x + \cos^{-1}y = \cos^{-1}[xy - \sqrt{1-x^2}\sqrt{1-y^2}]$
3	Prove that $q \to p \equiv \neg p \to \neg q$
4	Establish the equivalence property connecting the bi-conditional $p \leftrightarrow q \equiv (p \to q) \wedge (q \to p)$
5	If $w = x + 2y + z^2$ and $x = \cos t$, $y = \sin t$, $z = t$, find $\frac{d\omega}{dt}$
6	Two balls are chosen randomly from an urn containing 6 red and 8 black balls. Suppose that we win · 15 for each red ball selected and we lose · 10 for each black ball selected X denotes the winning amount, then find the value of x and number of points in its reverse images.
7	State Rolle's Theorem.

8	Find the distance between the parallel planes $x + 2y - 2z + 1 = 0$ and $2x + 4y - 4z + 5 = 0$
9	The probability density function of X is given by $f(x) = \begin{cases} k\,x\,e^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \le 0 \end{cases}$ Find the value of k
10	If μ and σ^2 are the mean and variance of the discrete random variable X, and $E(X + 3) = 10$ and $E(X + 3)^2 = 116$, find μ and σ^2.
11	Find the length of the perpendicular from the point $(1, -2, 3)$ to the plane $x - y + z = 5$
12	Solve $(1 + x^2)\frac{dy}{dx} = 1 + y^2$.
13	Construct truth table for $(p \vee q) \vee \neg q$
14	If $A = \begin{bmatrix} 8 & -4 \\ -5 & 3 \end{bmatrix}$ verify that $A(\text{adj}A) = (\text{adj}A)A = \|A\| I_2$

15	Find the volume of the solid formed by revolving the the region bounded by the parabola $y = x^2$, x–axis, ordinates $x = 0$ and $x = 1$ about the x–axis.
16	Find the values in the interval $\left(\frac{1}{2}, 2\right)$ satisfied by the Rolle's theorem for the function $f(x) = x + \frac{1}{x}, x \in \left[\frac{1}{2}, 2\right]$.
17	Write the Properties of cumulative distribution function
18	G = { 1, -1, i, -i } Verify (i) Closure Property (ii) Identity property (iii) Inverse property with respect to complex number Multiplication on G
19	Write the statements in words corresponding to ~p, q ∨ ~p, where p is 'it is cold' and q is it is raining.
20	If $A = \begin{bmatrix} 8 & -4 \\ -5 & 3 \end{bmatrix}$ verify that $A(\text{adj } A) = (\text{adj } A)A = \|A\| I_2$
21	Express $[\vec{a}+\vec{b}+\vec{c}, \vec{a}-\vec{b}, \vec{c}]$ in terms of $[\vec{a}\ \vec{b}\ \vec{c}]$

22	Construct the truth table for $(\sim p \vee q) \rightarrow (q \wedge p)$
23	Find the equation of tangent to the curve $y = x^2 - x^4$ at (1,0).
24	Obtain the equation of circle for which (3,4) and (2,-7) are the end of a diameter.
25	If $z_1=3$, $z_2=-7i$, $z_3=5+4i$ show that $z_1(z_2z_3)=(z_1z_2)z_3$.
26	If $A=\begin{pmatrix}5 & 2\\ 7 & 3\end{pmatrix}$ and $B=\begin{pmatrix}2 & -1\\ -1 & 1\end{pmatrix}$ then verify $(AB)^{-1}=B^{-1}A^{-1}$.
27	On Z, define $\otimes$ by $(m\otimes n) = m^n+n^m : \forall m,n\in Z$. Is $\otimes$ binary on Z?
28	If $\vec{a},\vec{b},\vec{c}$ are three vectors prove that $[\vec{a}+\vec{b},\vec{b}+\vec{c},\vec{c}+\vec{a}] = 2[\vec{a},\vec{b},\vec{c}]$
29	Find a polynomial equation of minimum degree with rational coefficients having $2-\sqrt{3}$ as a root.

30	Determine whether the pair of straight lines $\vec{r} = (2\hat{i} + 6\hat{j} + 3\hat{k}) + t(2\hat{i} + 3\hat{j} + 4\hat{k})$, $\vec{r} = (2\hat{j} - 3\hat{k}) + s(\hat{i} + 2\hat{j} + 3\hat{k})$ are parallel. Find the shortest distance between them.
31	The probability density function of X is given by $f(x) = \begin{cases} k\,x\,e^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \le 0 \end{cases}$ Find the value of k
32	Prove De Morgan's law by using Truth table.
33	Find the local extrema of the function $f(x) = x^4 + 32x$.
34	Find the length of the perpendicular from the point $(1, -2, 3)$ to the plane $x - y + z = 5$
35	Construct the truth table for the following statements. $\neg(p \wedge \neg q)$
36	If $f(x, y) = \frac{1}{\sqrt{x^2 + y^2}}$ then, prove that $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = -f$.
37	If $A = \begin{vmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{vmatrix}$ find A^{-1}

38	The time T, taken for a complete oscillation of a single pendulum with length l, is given by the equation $T = 2\pi\sqrt{\frac{l}{g}}$, where g is a constant. Find the approximate percentage error in the calculated value of T corresponding to an error of 2 percent in the value of l.
39	Form the differential equation obtained by eliminating a and b from $y = ae^{3x} + be^{-3x}$ is
40	Evaluate: $\int_0^3 \frac{\sqrt{x}\,dx}{\sqrt{x}+\sqrt{3-x}}$.
41	Show that $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right) = -2i$.
42	Which one of the points 10 - 8i, 11 + 6i is closest to 1 + i.
43	Let $A = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ are the boolean matrices. Find i) $A \cup B$ ii) $A \cap B$
44	Compute P(X = k) for the binomial distribution, B(n,p) when n = 9, $p = \frac{1}{2}$, k = 7

45	Show that the points $1, -\frac{1}{2}+i\frac{\sqrt{3}}{2}$ and $-\frac{1}{2}-i\frac{\sqrt{3}}{2}$ are the vertics of an equilateral triangle.
46	Determine whether the three vectors $2\hat{i}+3\hat{j}+\hat{k}$, $\hat{i}-2\hat{j}+2\hat{k}$ and $3\hat{i}+\hat{j}+3\hat{k}$ are coplanar.
47	A binary operation * is defined on Q by $a*b=\frac{a+b}{2}$, $\forall a,b\in Q$ verify whether * satisfies closure property, commutative property and associative property.
48	Find the inverse the non-singular matrix $A=\begin{bmatrix}0 & -5\\ -1 & -6\end{bmatrix}$, by Gauss-Jordan method.
49	Verify $(AB)^T=B^TA^T$ with $A=\begin{bmatrix}-4 & 1\\ 1 & 3\end{bmatrix}$, $B=\begin{bmatrix}4 & -3\\ 3 & 0\end{bmatrix}$.
50	Find differential dy for the function $y=(3+\sin 2x)^{\frac{2}{3}}$
51	If the straight lines $\frac{x-5}{5m+2}=\frac{2-y}{5}=\frac{1-z}{-1}$ and $x=\frac{2y+1}{4m}=\frac{1-z}{-3}$ are perpendicular to each other. Find the value of m

52	Determine whether * is a binary operation on R, defined by $a * b = a\sqrt{b}$
53	Find the value of $\cos^{-1}\left(\cos\frac{\pi}{7}\cos\frac{\pi}{17} - \sin\frac{\pi}{7}\sin\frac{\pi}{17}\right)$
54	Show that $\neg(p \wedge q) \equiv \neg p \vee \neg q$
55	Prove that $[\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}] = [\vec{a}, \vec{b}, \vec{c}]^2$

Public ,Common and PTA

1	Let * be a binary operation on set Q of rational numbers defined as $a * b = \frac{ab}{8}$. Write the identity for *, if any.
2	A fair coin is tossed a fixed number of times. If the probability of getting seven heads is equal to that of getting nine heads, find the probability of getting exactly two heads.
3	If the system of linear equation $x+2ay+az = 0$, $x+3by+bz = 0$, $x+4cy+cz = 0$ has a non-trivial solution then show that a, b, c are in H.P.
4	Prove that $\tan\left(\frac{\pi}{4}+\frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right)+\tan\left(\frac{\pi}{4}-\frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right)=\frac{2b}{a}$.
5	Write the Maclaurin series expansion of e^{-x}.
6	Draw the Geometrical diagram for the sum of two complex numbers Z_1 and Z_2 and verify the result.

7	முனை (2, 1) மற்றும் (1, 3) என்ற புள்ளி வழியாக செல்வதும், இடப்பக்கம் திறப்பு உடையதுமான பரவளையத்தின் சமன்பாடு காண்க. Find the equation of the parabola if the curve is open leftward, vertex is (2, 1) and passing through the point (1, 3).
8	If the lines $\frac{x-x_1}{l_1}=\frac{y-y_1}{m_1}=\frac{z-z_1}{n_1}$ and $\frac{x-x_2}{l_2}=\frac{y-y_2}{m_2}=\frac{z-z_2}{n_2}$ lie on the same plane, then write the number of ways to find the Cartesian equation of the above plane and explain in detail.
9	Show that, if $x=r\cos\theta$, $y=r\sin\theta$, then $\frac{\partial r}{\partial x}$ is equal to $\cos\theta$.
10	Show that $((\neg q)\wedge p)\wedge q$ is a contradiction.
11	Show that the differential equation corresponding to $y=A\sin x$, where A is an arbitrary constant, is $y=y'\tan x$.
12	Show that $\int_0^1 \frac{\sqrt{x}}{\sqrt{1-x}+\sqrt{x}}\,dx=\frac{1}{2}$.

13	Find the equation of the tangent to the parabola $y^2 = 4ax$ at $(at^2, 2at)$.
14	If $\vec{a}, \vec{b}, \vec{c}$ are three vectors then prove that $[\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}] = 2[\vec{a}\ \vec{b}\ \vec{c}]$.
15	Show that the distance from the origin to the plane $3x+6y+2z+7=0$ is 1.
16	Prove that the general equation of the circle whose diameter is the line segment joining the points $(-4, -2)$ and $(-1, -1)$, is $x^2+y^2+5x+3y+6=0$.
17	Form the differential equation of the curve $y=ax^2+bx+c$ where a, b and c are arbitrary constants.
18	Prove that $\int_0^1 x\, e^x dx = 1$.
19	Express $e^{\cos\theta + i\sin\theta}$ in a+ib form.
20	If a+b+c=0 and a, b, c are rational numbers then, prove that the roots of the equation $(b+c-a)x^2+(c+a-b)x+(a+b-c)=0$ are rational numbers.

21	Let $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ be any two boolean matrices of the same type. Find $A \vee B$ and $A \wedge B$.
22	Show that the polynomial equation $9x^9 + 2x^5 - x^4 - 7x^2 + 2 = 0$ has at least six imaginary roots.
23	Evaluate $\lim_{x \to 0} \frac{xe^x - \sin x}{x}$
24	If $\vec{a}, \vec{b}, \vec{c}$ are three vectors prove that $[\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}] = 2[\vec{a}, \vec{b}, \vec{c}]$
25	Evaluate : $\int_0^{\frac{\pi}{2}} \frac{\sin x}{1+\cos^2 x} dx$
26	If $A = \begin{bmatrix} 3 & -2 \\ \lambda & -2 \end{bmatrix}$, find the value of λ so that $A^2 = \lambda A - 2I$.
27	If $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 0 \\ 2 & 5 \end{bmatrix}$, find $adj(AB)$.

28	Find the magnitude and direction cosines of the moment about the point $(0,-2,3)$ of a force $\hat{i}+\hat{j}+\hat{k}$ whose line of action passes through the origin.
29	If $\omega \neq 1$ is a cubic root of unity and $(1+\omega)^7 = A+B\omega$, then find A and B.
30	The population of a city grows at the rate of 5 % per year. Calculate the time taken for the population doubles. [Given $\log 2 = 0.6912$]
31	Find the vector equation of the plane passing through the point $(2,2,3)$ having 3,4,3 as direction ratios of the normal to the plane
32	If $x+iy=\sqrt{\frac{a+ib}{c+id}}$, prove that $x^2+y^2=\sqrt{\frac{a^2+b^2}{c^2+d^2}}$
33	Find the value of $\cos^{-1}\left(\frac{1}{2}\right)-2\sin^{-1}\left(-\frac{1}{2}\right)$
34	Find the equation of the tangent to the curve $x^2y-x=y^3-8$ at $x=0$

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