کامیابی کا تعویذ

NEW Examination POLICY

پنجاب کے تمام بورڈز کے لیے Annual 2026
(According to Smart Syllabus)

(Unsolved)

Mathematics

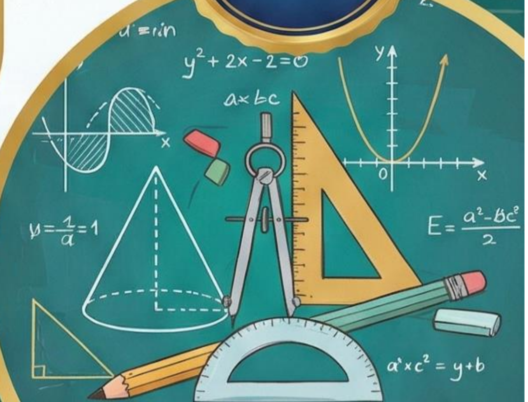
For Inter Part-I

* Most Imp. MCQs
* Most Imp. Short Questions
* Most Imp. Long Questions

اب فیل ہونا بھول جائیں

A+ Challenge

صرف 2 ماہ تیاری کر کے پڑھائی میں کمزور طلباء وطالبات
A+ گریڈ میں کامیابی حاصل کر سکتے ہیں۔



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Mathematics 11th (NEW)

Most Important MCQs

(It is challenge you can get 20/20 marks in Annual 2026)

NO.	Questions	A	B	C	D
1	The number $\sqrt{-1}$ is called:	Real number	Natural number	Complex number ✓	Rational number
2	$(-i)^{19}$ is equal to:	$-i$	i ✓	1	-1
3	$(-1)^{-\frac{21}{2}}$ equals:	i	$-i$ ✓	1	-1
4	The multiplicative inverse of the complex number $(0,-1)$ is equal to:	$(1,0)$	$(0,1)$ ✓	$(-1,0)$	$(0,0)$
5	Multiplicative inverse of $-i$ is:	i ✓	$-i$	1	-1
6	Real part of $\frac{3}{\sqrt{6}-\sqrt{-12}}$ is:	$\frac{\sqrt{6}}{6}$ ✓	$\frac{1}{\sqrt{3}}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{6}}$
7	Any real number 'a' is equal to:	ia	(a,b)	$(a,0)$ ✓	(b,a)
8	The real part of $\frac{1+3i}{2i}$ is:	$\frac{3}{2}$ ✓	$\frac{2}{3}$	1	2
9	The modulus of the complex number $-5i$ is:	±5	-5	$\sqrt{5}$	5 ✓
10	If $Z=-2+3i$ then $\overline{Z}=$?	$-2-3i$ ✓	$2-3i$	$-2+3i$	$2+3i$
11	a^2+b^2 has factors:	$(a+b)(a-b)$	$(a+ib)(a-ib)$ ✓	$(a+ib)(a-b)$	$(a+b)(a-ib)$
12	For a complex number $(0,1)i=$:	$(1,0)$	$(-1,0)$ ✓	$(0,1)$	$(0,-1)$
13	If $Z=-7-24i$ then the real part of $\sqrt{Z}$ is:	2	3 ✓	4	1
14	If ω is a complex cube root of unity then the value of $(3+\omega)(3+\omega^2)=$?	6	7 ✓	9	13
15	Complex cube roots of -1 are:	ω,ω^2	$1,\omega,\omega^2$	$-1,-\omega,-\omega^2$ ✓	$-\omega,-\omega^2$
16	Four fourth roots of 16 are:	$2,-2,2i,-2i$ ✓	$1,-1,i,-i$	$3,-3,3i,-3i$	$4,-4,4i,-4i$
17	Three cube roots of 27 are:	$3,3\omega,3\omega^2$ ✓	$1,\omega,\omega^2$	$-3,-3\omega,3\omega^2$	$3,-3,3i$
18	Sum of all three cube roots of unity is:	1	-1	3	0 ✓
19	Sum of complex roots of unity is:	0	-1 ✓	1	2
20	Product of all cube roots of unity is:	1 ✓	0	-1	2

21	If ω is the imaginary/complex cube root of unity, then $\omega^{-1} = \cdots$	ω	ω^2 ✓	$\frac{1}{\omega^2}$	ω^3
22	If ω is a complex cube root of unity then $\omega^{29} + \omega^{28} + 1 = \cdots$	ω	$-\omega$	0 ✓	1
23	If ω is the cube root of unity then $(1 + \omega - \omega^2)^8 =$:	256 ✓	-256	-256ω	256ω
24	If ω is the cube root of unity then $\omega + \omega^2$ equals:	0	-1 ✓	1	$\frac{1}{\omega}$
25	If ω is the cube root of unity, then $\overline{\omega} = \cdots$	$\frac{-1-\sqrt{3}i}{2}$	ω^2 ✓	-1	1
26	If ω is a complex cube root of unity then $\omega = \cdots$	$\frac{-1+\sqrt{3}i}{2}$ ✓	$\frac{1-\sqrt{3}i}{2}$	1	$\frac{1+\sqrt{3}i}{2}$
27	If ω is a complex cube root of unity then the conjugate of ω is:	ω^2 ✓	$-\omega^2$	$-\omega$	i
28	$(-1+\sqrt{-3})^5 + (-1-\sqrt{-3})^5 = \cdots$	32 ✓	48	-32	-16
29	The sum of the fourth roots of unity is:	0 ✓	1	-1	2
30	The product of all four fourth roots of unity is:	0	1	-1 ✓	4
31	Four fourth roots of 81 are:	$\pm4, \pm4i$	$\pm2, \pm2i$	$\pm3, \pm3i$ ✓	$\pm9, \pm9i$
32	For any $n \in Z, \omega^n$ is equivalent to:	1 or ω or ω^2 ✓	$2, 2\omega, 2\omega^2$	$3, 3\omega, 3\omega^2$	$\pm i, 2$
33	A complex number $1 + i$ can also be expressed as:	$\sqrt{2}(\cos 45° + i\sin 45°)$ ✓	$2(\cos 60° + i\sin 30°)$	$(\cos 90° + i\sin 30°)$	$(\cos 60° + i\sin 30°)$
34	Polar form of the complex number $x + iy = r(\cos\theta + i\sin\theta)$, then $\theta =$:	$\tan^{-1}\frac{y}{x}$ ✓	$\tan\frac{y}{x}$	$\tan^{-1}\frac{x}{y}$	$\tan\frac{x}{y}$
35	$\cos(\frac{\pi}{6}) + i\sin(\frac{\pi}{6})$ equals:	$\frac{\sqrt{3}}{2} + \frac{1}{2}i$ ✓	-1	i	1
36	Argument of $(\sqrt{3} + i)$ is:	60°	30° ✓	45°	90°

37	If f: $A \to B$ is a function such that range $f \subset B$, then f is called an:	Onto function	Injective function	Bijective function	Into function ✓
38	If a function f: $A \to B$ is such that range $f = B$ then f is called:	Injective	Surjective ✓	Into	Periodic
39	If $f(x) = \sqrt{2x-3}$ then $f(1) =$?	±1	$\pm i$ ✓	±2	0
40	The point of intersection of $f(x) = 2x + 5$ and $g(x) = -x + 5$ is a point which satisfies:	$f(x)$	$g(x)$	Both $f(x)$ and $g(x)$ ✓	None
41	For a table of values to graph a function, we require a minimum of values:	1	2	3 ✓	4
42	The graph of a quadratic equation will be a:	Straight line	Curve ✓	Set of lines	None

43	The vertex is a minimum point when:	$a = 0$	$a > 0$ ✓	$a < 0$	None
44	To solve an absolute value quadratic function we must eliminate roots which are:	Real	Imaginary	Extraneous ✓	Double
45	An equation of the form $ax^2 + bx + c = 0$ is called quadratic if:	$a = 0$	$a \neq 0$ ✓	$b = 0$	$b \neq 0$
46	What are the distinct roots of the equation $x^2 + x^{-2} - 2 = 0$:	$\pm1, \pm i$	$\pm i$	±2	±1 ✓
47	An equation involving a radical expression of the variable is called a:	Radical equation ✓	Algebraic equation	Exponential equation	None of these
48	Name the type of equation $\sqrt{x+a} + \sqrt{x+b} = \sqrt{x+c}$:	Radical ✓	Reciprocal	Rational	None of these
49	The solution of $\sqrt{y+3} = \sqrt{3y-5}$ is:	2	4 ✓	1	-4

50	If a matrix A is of order $m \times n$ then A has a number of elements:	$m \times n$ ✓	$m + n$	$m - n$	m
51	A matrix which has only one row is called a:	Row matrix ✓	Column matrix	Square matrix	None of these
52	The matrix $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ is:	Null	Identity	Scalar	Diagonal ✓
53	Transpose of a diagonal matrix is a:	Scalar matrix	Row matrix	Null matrix	Diagonal matrix ✓
54	The matrix $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ is a:	Rectangular	Diagonal	Scalar ✓	Hermitian
55	If A is a matrix of order $m \times n$ and B is a matrix of order $n \times l$ then what is the order of $A \times B$?	$m \times n$	$l \times m$	$m \times l$ ✓	$n \times l$
56	Given that $S = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$, then S^2 is given by:	$\begin{bmatrix} 9 & 0 \\ 0 & 9 \end{bmatrix}$ ✓	$\begin{bmatrix} 0 & 9 \\ 9 & 0 \end{bmatrix}$	$\begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$	$\begin{bmatrix} 0 & 6 \\ 6 & 0 \end{bmatrix}$
57	If each element of a matrix is zero, then it is called a:	Null matrix ✓	Identity matrix	Scalar matrix	Diagonal matrix
58	If the order of a matrix A is $m \times n$, then the order of A^t is:	$m \times n$	$n \times n$	$n \times m$ ✓	$m \times m$
59	If $A = \begin{bmatrix} 1 & 2 \\ 4 & 1 \end{bmatrix}, B = \begin{bmatrix} -1 & 3 \\ 5 & 2 \end{bmatrix}$ then $A + B =$:	$\begin{bmatrix} 0 & 5 \\ 9 & 3 \end{bmatrix}$ ✓	$\begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$	$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 2 & 2 \\ 1 & 1 \end{bmatrix}$
60	If $A = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$ and B = [5 0], then AB is equal to:	$\begin{bmatrix} 10 & 0 \\ -5 & 0 \end{bmatrix}$ ✓	$\begin{bmatrix} 10 \\ 0 \end{bmatrix}$	[0 0]	$\begin{bmatrix} 10 \\ -5 \end{bmatrix}$
61	If $\begin{bmatrix} x+3 & 1 \\ -3 & 3y-4 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ -3 & 2 \end{bmatrix}$ then the value of y will be:	2 ✓	-2	4	-4

62	A matrix of order $1 \times n$ is called a:	Unit matrix	Diagonal matrix	Column matrix	Row matrix ✓
63	If the matrix $\begin{bmatrix} \lambda & 4 \\ 1 & 2 \end{bmatrix}$ is singular then λ=?	4	0	2 ✓	1
64	The matrix $\begin{bmatrix} 5 & 1 \\ 15 & 3 \end{bmatrix}$ is:	Non-singular	Symmetric	Skew-symmetric	Singular ✓
65	If A is a non-singular square matrix, then AA^{-1} equals:	A	A^{-1}	O	I ✓
66	If A and B are square matrices of the same order then:	$(A+B)^2 = A^2 + 2AB + B^2$	$(A-B)^2 = A^2 - 2AB + B^2$	Both a and b	None of these ✓
67	If $A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 3 & 1 \\ 4 & -3 & 2 \end{bmatrix}$ then A_{33} equals:	-1 ✓	1	7	-7
68	$(AB)^t = \cdots$	AB	BA	A^tB^t	B^tA^t ✓
69	$(A^{-1})^t$ is equal to:	A	$A^{-1}A^t$	$(A^t)^{-1}$ ✓	A^t
70	The inverse of a square matrix A exists if A is:	Singular	Non-singular ✓	Symmetric	Rectangular
71	Rank of the matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ is:	1	2 ✓	3	4
72	The rank of the matrix [1 0 3] is:	Zero	1 ✓	2	3
73	If $AX = B$ represents the system of non-homogenous linear equations then $X =$:	BA^{-1}	$B^{-1}A$	$A^{-1}B^{-1}$	$A^{-1}B$ ✓
76	An open sentence formed by using an equality is called:	An equation ✓	An identity	Sentence	Partial fraction
77	$(x+3)(x+4) = x^2 + 7x + 12$ is an:	Equation	Function	Identity ✓	Conditional equation
78	The conditional equation $5x = 4$ is true if $x =$:	4	5	5/4	4/5 ✓
79	If $2x + 1 = A(x+1) + B(x+2)$, then A=?	-1 ✓	4	5	1
80	$x^2 + x - 6 = 0$ is a:	Conditional equation ✓	Identity	Proper fraction	Improper fraction
81	Conditional equation $3x - 1 = 0$ is true only if:	$x = 3$	$x = -3$	$x = 1/3$ ✓	$x = -1/3$
82	$\frac{x^2+1}{q(x)}$ will be a proper fraction if degree of $q(x)$ is:	0	3 ✓	2	1
83	$\frac{x^3+2x-6}{Q(x)}$ is improper if:	Degree of $Q(x) = 4$	Degree of $Q(x) = 5$	Degree of $Q(x) = 2$ ✓	Degree of $Q(x) = 6$

84	Partial fraction of $\frac{1}{x^2-1}$ will be of the form:	$\frac{Ax+B}{x^2-1}$	$\frac{A}{x+1}+\frac{B}{x-1}$ ✓	$\frac{A}{x^2-1}$	None of these
87	$\frac{x^4}{1-x^4}$ is an:	Proper fraction	Improper fraction ✓	Decimal	Equation
89	The expression $\frac{x}{x^2+1}-\frac{1}{x+1}$ is the resolved partial fraction of:	$\frac{x+1}{(x^2+1)(x+1)}$	$\frac{x^2-x-1}{(x^2+1)(x+1)}$	$\frac{x-1}{(x^2+1)(x+1)}$ ✓	$\frac{-1}{(x^2+1)(x+1)}$
90	Partial fraction of $\frac{2x+3}{x^2(x^2-1)}$ will be of the form:	$\frac{A}{x}+\frac{B}{x^2}+\frac{C}{x+1}+\frac{D}{x-1}$ ✓	$\frac{A}{x^2}+\frac{B}{x^2-1}$	$\frac{Ax+B}{x^2}+\frac{Cx+D}{x^2-1}$	$\frac{A}{x^2}+\frac{B}{x-1}+\frac{C}{x+1}$
91	Partial fractions of $\frac{4x^2+8x}{x^4+2x^2+9}$ will be of the form:	$\frac{Ax+B}{x^2+2x+3}+\frac{Cx+D}{x^2-2x+3}$ ✓	$\frac{A}{9}+\frac{Bx+C}{x^4+2x^2}$	$\frac{Ax+B}{x^2-2x+3}$	$\frac{Cx+D}{x^2-2x-3}$

92	A sequence is a function whose domain is a subset of the set of:	Real numbers	Natural numbers ✓	Integers	None of these
93	A sequence is denoted by:	a_n	$\{a_n\}$ ✓	$\{S_n\}$	None of these
94	For a sequence, a_n represents the:	nth term	General term ✓	Tenth term	Last term
95	If the nth term of an A.P is $\frac{1}{2}(3-n)$, then the first three terms are:	3, 2, 1	1, 2, 3	1, 2, 1	$1, \frac{1}{2}, 0$ ✓
96	The 5th term of the sequence $a_n = (-1)^n(2n-3)$ is:	8	-7 ✓	-8	7
97	If $a_n = a_{n-1}+n$, $a_1 = 2$ then $a_3 = \cdots$	6	7 ✓	11	17
98	The next term of the sequence 1, 3, 7, 15, 31, ... is:	63 ✓	62	80	81
99	The nth term of the sequence $\frac{1}{3}, \frac{2}{5}, \frac{3}{7}, \ldots$ is:	$\frac{n}{2n-1}$	$\frac{n}{2n+1}$ ✓	$\frac{n}{3n-1}$	$\frac{n}{3n+1}$
100	If $a_n = \frac{(-1)^{n+1}}{2^n}$ then $a_6 =$?	1/8	1/16	$-1/32$	$-1/64$ ✓
103	If a, b, c are in A.P, then b = ...	$\frac{a-c}{2}$	$\frac{a+c}{2}$ ✓	$\frac{2ac}{a+c}$	$\frac{2ac}{a-c}$
104	If $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P then the common difference is:	$\frac{a-c}{2ac}$	$\frac{a-c}{b}$	$\frac{a+c}{2ac}$	$\frac{a-b}{ab}$ ✓
105	The A.P whose nth term is 2n-1 is:	1, 3, 6, ...	2, 3, 5, ...	1, 3, 5, ... ✓	5, 3, 1, ...
107	If $a_{n-3} = 2n-5$, then the 7th term is:	9	15 ✓	11	13
109	The A.M between two numbers a and b is:	$\frac{a+b}{2ab}$	$\frac{2ab}{a+b}$	$\frac{a+b}{2}$ ✓	$\frac{2}{a+b}$
110	If a, A, b are in A.P, then 2A =:	$\frac{a+b}{2}$	$a+b$ ✓	$2(a+b)$	$a-b$
111	A.M between $3\sqrt{5}$ and $5\sqrt{5}$ is:	$4\sqrt{5}$ ✓	$5\sqrt{5}$	10	$2\sqrt{5}$

112	Arithmetic mean between two numbers $\frac{1}{a}$ and $\frac{1}{b}$ is:	$\frac{a+b}{ab}$	$\frac{a+b}{2ab}$ ✓	$\frac{2ab}{a+b}$	$\frac{ab}{a+b}$
113	A.M between two numbers -2 and -6 is:	4	-4 ✓	$\pm\sqrt{12}$	-3
114	The A.M between x-3 and x+5 is:	$x+1$ ✓	x-1	x-3	x+5
115	For what value of n, $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ is the A.M between a and b?	-1	1 ✓	1/2	0
116	The sum of n arithmetic means between a and b is:	$\frac{n(a+b)}{2}$ ✓	$\frac{a+b}{2}$	$\frac{2ab}{a+b}$	$\sqrt{ab}$
118	Sum of n terms of an A.P is:	$\frac{a(1-r^n)}{1-r}$	$\frac{n}{2}\{2a+(n-1)d\}$ ✓	$\frac{2ab}{a+b}$	$\frac{a+b}{2}$
119	21st term of $2+4+6+\cdots$ is:	40	42 ✓	44	-42
120	Sum of the A.P $-7+(-5)+(-3)+\cdots$ up to 6 terms is:	-12 ✓	12	9	-9
121	What is the sum of n terms with nth term $a_n=4n+1$?	$2n(2n+3)$	$n(2n+3)$ ✓	$2n+3$	$4n+6$
122	In a geometric sequence, the nth term is equal to:	$a_1+(n-1)d$	$\frac{n}{2}[2a_1+(n-1)d]$	a_1r^{n-1} ✓	$\frac{a_1}{1-r}$
123	The common ratio of a G.P. cannot be:	3	1	2	0 ✓
124	The sequence 3, 6, 12, ... is:	A.P	G.P ✓	H.P	Arithmetic series
127	No term of a geometric sequence can be:	0 ✓	1	2	3
129	If $\frac{1}{a},\frac{1}{b},\frac{1}{c}$ are in G.P then the common ratio is equal to:	$\pm\sqrt{\frac{c}{a}}$	$\pm\sqrt{\frac{a}{c}}$ ✓	$\frac{b}{a}$	None
130	If a_1 and r are the first term and common ratio respectively, then the $(n+1)$th term of G.P is:	a_1r^{n-1}	a_1r^{n+1}	a_1r^{n-2}	a_1r^n ✓
131	A geometric mean between a and b is:	$\frac{a+b}{2}$	$\frac{2}{a+b}$	$\pm\sqrt{ab}$ ✓	$\frac{2ab}{a+b}$
132	If a, G, b are in G.P where a, b are numbers then G.M is equal to:	$\sqrt{ab}$	$-\sqrt{ab}$	$\pm\sqrt{ab}$ ✓	ab
134	G.M between $\frac{1}{a}$ and $\frac{1}{b}$ is:	$\pm\frac{1}{\sqrt{ab}}$ ✓	$-\frac{1}{ab}$	$\sqrt{ab}$	None
136	The G.M between 1 and 16 is:	-4	4	± 4 ✓	1/4

137	G.M between two numbers -2 and 4 is:	$\pm\sqrt{8}$	$\pm 2\sqrt{2}$	$\pm 2i\sqrt{2}$ ✓	± 2
138	If a = 2i, b = 4i, then G = ...	$\pm 2\sqrt{2}i$ ✓	$6i$	$\pm 2i$	$4i$

139	Sum of n terms of a G.P with first term 'a' and common ratio 'r' is:	$\frac{n}{2}\{2a+(n-1)d\}$	$\frac{a(1-r^n)}{1-r}$ ✓	$\frac{2ab}{a+b}$	$\frac{a+b}{2}$
140	Sum of the infinite geometric series $2, \sqrt{2}, 1, \ldots$ is:	$4+\sqrt{2}$	$4-\sqrt{2}$	$4+2\sqrt{2}$ ✓	None
141	The sum of the infinite geometric series with $a_1 = 2, r = 1/3$ is:	3 ✓	4	5	6
142	Which one of the following infinite geometric series is convergent?	$1+\frac{1}{2}+\frac{1}{4}+\ldots$ ✓	$1+2+4+\ldots$	$1+3+9+\ldots$	$3+6+12+\ldots$
143	If $y = \frac{2}{3}x + \frac{4}{9}x^2 + \frac{8}{27}x^3 + \ldots$ then the interval of convergence is:	$0 < x < -3/2$	$-\frac{3}{2} < x < \frac{3}{2}$ ✓	$\frac{1}{2} < x < -\frac{1}{2}$	$0 < x < 3/2$
144	The product of A.P and G.P terms is called:	A.P	G.P	H.P	A.G.P ✓
146	No term of a harmonic sequence can be:	3	2	1	0 ✓
147	H.M between 3 and 7 is:	5/21	21/5 ✓	5	51
148	If $\frac{1}{k}, \frac{1}{2k+1}, \frac{1}{4k-1}$ are in H.P then k=?	3 ✓	4	2	1
149	The 10th term of $\frac{1}{2}, \frac{1}{5}, \frac{1}{8}, \ldots$ is:	1/20	1/23	1/26	1/29 ✓
150	If a, H, b are in H.P, then H =?	$\frac{a+b}{2}$	$\frac{2ab}{a+b}$ ✓	$\pm\sqrt{ab}$	None
151	If A, G, H are means between a and b, then:	$G^2 = AH$ ✓	$A^2 = GH$	$H^2 = AG$	$A = G = H$
152	If A, G, H are means between a and b, then A, G, H are in:	A.P	G.P ✓	H.P	None
153	For two unequal positive real numbers:	$A > G$ ✓	$A = G$	$A < G$	$A \leq G$
154	For two unequal negative real numbers:	$A > G$	$A = G$	$A < G$ ✓	$A \leq G$
155	If A, G, and H are means then G/H =	A/G ✓	G/A	H/G	G
156	If x, y, z are in an H.P sequence then the value of y is:	$\frac{2xz}{x+z}$ ✓	$\frac{x+z}{2y}$	$\frac{x-z}{2}$	$\frac{x+z}{2}$
157	If a, b are negative, A.M is negative and G.M is also negative:	$H < G < A$ ✓	$A < G < H$	$G < A < H$	$A < H < G$
159	$S_n = 1+2+3+\ldots+n$ can also be shown as:	$\sum_{k=1}^{n} k$ ✓	$\sum_{k=1}^{n} \frac{1}{k}$	Both a and b	None of these
162	$\sum_{k=1}^{n} k^2 =$ (or $1^2+2^2+\ldots+n^2$):	$\frac{n(n+1)}{2}$	$\frac{n(n+1)(2n+1)}{6}$ ✓	$\frac{n^2(n+1)^2}{4}$	None
163	$\sum_{k=1}^{n} k^3 =$ (or $1^3+2^3+\ldots+n^3$):	$\frac{n(n+1)}{2}$	$\frac{n(n+1)(2n+1)}{6}$	$[\frac{n(n+1)}{2}]^2$ ✓	None

165	How many numbers of two digits can be formed using 1, 2, 3?	3	6	9 ✓	12
167	The value of 5! is:	5	20	60	120 ✓
168	The factorial form of 6.5.4 is:	$\frac{6!}{3!}$ ✓	6!	3!	None
169	The value of 4! . 0! . 1! is:	0	1	4	24 ✓
170	(n-1)(n-2)...(n-r+1) = ?	$\frac{(n-1)!}{(n-r)!}$ ✓	$\frac{n!}{(n-r)!}$	$\frac{(n-1)!}{(n-r-1)!}$	$\frac{n!}{(n-r+1)!}$
171	Factorial form of $\frac{(n+1)(n)(n-1)}{3.2.1}$ is:	$\frac{(n+1)!}{3!(n-2)!}$ ✓	$\frac{(n-1)!}{3!(n-2)!}$	$\frac{n!}{3!(n-2)!}$	None of these
172	The expression $\frac{(n-1)!}{(n-3)!} \div \frac{n!}{(n-2)!}$ reduces to:	$\frac{n-2}{n}$ ✓	$\frac{1}{n^3-n^2}$	$\frac{1}{n^2}$	$\frac{1}{n}$
173	Factorial notation was introduced by:	Leibniz	Euler	Seikkowa	Christian Kramp ✓
174	n different objects taken all at a time can be arranged in:	(n-1)! ways	(n+1)! ways	n! ways ✓	(2n)! ways
175	The value of ${}^5P_2$ is:	5	10	15	20 ✓
176	${}^nP_0 = \cdots$:	n	0	1 ✓	n!
177	If r=1, then ${}^nP_r = \cdots$:	n!	n ✓	n-1	None of these
178	The value of ${}^3P_3$ is:	18	12	6 ✓	0
179	If r=n, then ${}^nP_r$ equals:	1	n! ✓	(n+1)!	(n-1)!
180	$\frac{{}^nP_r}{r!} = \cdots$:	${}^nP_r$	${}^nC_r$ ✓	${}^nP_{r-1}$	${}^nC_{r-1}$
183	The number of permutations of the letters of the word 'APPLE' is:	120	60 ✓	40	20
184	${}^nC_r \times r! = \cdots$:	${}^nP_r$ ✓	${}^nP_{r-1}$	${}^nC_{r-1}$	${}^nP_n$
185	${}^nC_r = {}^nC_{n-r}$ is useful when:	n=r	$n < r/2$	$r < n/2$	$r > n/2$ ✓
186	If r=n, ${}^nC_r$ is equal to:	0	1 ✓	n	n!
187	${}^nC_r + {}^nC_{r-1} = ?$	${}^{n+1}C_r$ ✓	${}^{n+1}C_{r-1}$	${}^nC_r$	None
188	${}^nC_0$ is equal to:	1 ✓	0	n	2
189	$\frac{n!}{r!(n-r)!}$ is equal to:	${}^nC_r$ ✓	${}^nP_r$	${}^nC_n$	${}^nC_0$

191	$x^3 - 3x^2 + 2x - 6$ has a factor:	x-4	x-3 ✓	x+3	x+2
192	If (x-2) is a factor of $ax^3 - 12x + 4$ then a=:	2	5 ✓	7	9
193	If x-2 is a factor of polynomial $x^3 + 2x^2 + kx + 4$ then k equals:	10	-10 ✓	2	4
194	Synthetic division is a process of:	Addition	Multiplicatio n	Subtraction	Division ✓

195	A factor of $f(x) = x^n - a^n$, where n is a positive integer is:	x+a	x-a ✓	x-1	x-2
197	The angles $90° \pm \theta, 180° \pm \theta, \ldots$ are called:	Right angles	Straight angles	Allied angles ✓	Obtuse angles
198	Which of the following is an allied angle?	$45°$	$60°$	$120°$ ✓	$75°$
199	$\tan(180° + \theta) =$:	$\tan\theta$ ✓	$-\tan\theta$	$\cot\theta$	$-\cot\theta$
200	$\sin(360° - \theta) =$:	$\sin\theta$	$-\sin\theta$ ✓	$\cos\theta$	$-\cos\theta$
201	$\sin(\frac{\pi}{2} - \theta) =$?:	$\cos\theta$ ✓	$-\cos\theta$	$\sin\theta$	$-\sin\theta$
202	$\cos(\frac{3\pi}{2} - \theta) =$?:	$\cos\theta$	$-\cos\theta$	$\sin\theta$	$-\sin\theta$ ✓
203	$\cot(\pi/2 - \beta) =$:	$\sin\beta$	$\cot\beta$	$-\cot\beta$	$\tan\beta$ ✓
204	$\tan(\frac{3\pi}{2} - \theta)$ is equal to:	$\tan\theta$	$-\cot\theta$	$\cot\theta$ ✓	$-\tan\theta$
205	$\tan(\pi + \theta) = \cdots$:	$\cot\theta$	$-\cot\theta$	$\tan\theta$ ✓	None
206	If α, β, γ are angles of a triangle ABC, then $\cos(\frac{\alpha+\beta}{2}) =$:	$\sin(\alpha/2)$	$\sin(\gamma)$	$\sin(\gamma/2)$ ✓	$\sin(\beta)$
207	$\cos(\theta - 90°) - \cos(\theta + 90°) = \cdots$:	$-2\cos\theta$	$2\cos\theta$	$2\sin\theta$ ✓	$-2\sin\theta$
208	The value of $\cos 75° = \cdots$:	$\frac{\sqrt{3}-1}{2\sqrt{2}}$ ✓	$\frac{-\sqrt{3}+1}{2\sqrt{2}}$	$\frac{\sqrt{3}+1}{2\sqrt{2}}$	$\frac{-\sqrt{3}-1}{2\sqrt{2}}$
209	$\sin(\theta + \frac{\pi}{6}) + \cos(\theta + \frac{\pi}{3}) = \cdots$:	$\cos\theta$ ✓	$\sin\theta$	$\sec\theta$	$\csc\theta$
210	$\frac{\cos 8° - \sin 8°}{\cos 8° + \sin 8°} = \cdots$:	$\tan 8°$	$\cot 8°$	$\tan 37°$ ✓	$\cot 37°$
211	If $r\cos\theta = 3, r\sin\theta = 4$ then r = ?:	5 ✓	4	3	2
212	$1 - \cos 2\alpha = \cdots$:	$2\sin^2\alpha$ ✓	$2\cos^2\alpha$	$2\sin\alpha$	$2\cos\alpha$
214	$\cos\theta = \cdots$:	$\cos^2(\theta/2) - \sin^2(\theta/2)$ ✓	$2\sin^2(\theta/2) - 1$	$1 + 2\cos^2(\theta/2)$	None
215	$\tan(\alpha/2) = \cdots$:	$\pm\sqrt{\frac{1-\cos\alpha}{1+\tan^2\alpha}}$	$\pm\sqrt{\frac{1-\cos\alpha}{1+\cos\alpha}}$ ✓	$\pm\sqrt{\frac{1-\sin\alpha}{1-\cos\alpha}}$	$\pm\sqrt{\frac{1+\sin\alpha}{1-\sin\alpha}}$
216	$\tan 2\theta = \cdots$:	$\frac{2\tan\theta}{1-\tan^2\theta}$ ✓	$\frac{\tan\theta}{1+\tan^2\theta}$	$\frac{2\tan^2\theta}{1-\tan^2\theta}$	$\frac{1-\tan^2\theta}{1+\tan^2\theta}$
218	$\cos 2\theta = \cdots$:	$\frac{2\tan\theta}{1-\tan^2\theta}$	$\frac{2\tan\theta}{1+\tan^2\theta}$	$\frac{1-\tan^2\theta}{1+\tan^2\theta}$ ✓	None of these
219	$(\cos\theta + \sin\theta)^2 + (\cos\theta - \sin\theta)^2 =$?:	0	2 ✓	4	1
220	$\frac{2\tan\theta}{1+\tan^2\theta}$ is equal to:	$\tan 2\theta$	$\cot 2\theta$	$\sin 2\theta$ ✓	$\cos 2\theta$
221	$\pm\sqrt{\frac{1-\cos\theta}{2}} = \cdots$:	$\sin(\theta/2)$ ✓	$\cos(\theta/2)$	$\sin\theta$	$\cos\theta$
222	$2\cos^2(\theta/2)$ equals:	$1 + \cos\theta$ ✓	$1 - \cos\theta$	$1 - \sin\theta$	$1 + \sin\theta$

223	If $\sin\alpha = 2/3, \cos\alpha = \sqrt{5}/3, \sin2\alpha =$?:	$4\sqrt{5}/9$ ✓	$1/3$	1	2
224	$\sin5\theta + \sin3\theta$ is equal to:	$2\cos2\theta\sin\theta$	$-2\cos4\theta\sin\theta$	$-2\cos4\theta\cos\theta$	$2\sin4\theta\cos\theta$ ✓
225	$\cos48^\circ + \cos12^\circ =$?:	$2\cos18^\circ$	$\sqrt{3}\cos18^\circ$ ✓	$3\cos19^\circ$	None of these
226	$\cos(\alpha+\beta) + \cos(\alpha-\beta) = \cdots$:	$2\sin\alpha\cos\beta$	$2\sin\alpha\sin\beta$	$2\cos\alpha\cos\beta$ ✓	$-2\sin\alpha\sin\beta$
227	$2\sin(\frac{P+Q}{2})\cos(\frac{P-Q}{2}) =$?:	$\sin P + \sin Q$ ✓	$\sin P - \sin Q$	$\cos P + \cos Q$	$\cos P - \cos Q$
228	Trigonometric functions are also called:	Discontinuous	Non-circular functions	Periodic functions ✓	Not periodic
229	The domain of $y = \cot x$ is:	$[-1,1]$	$(-\pi/2, \pi/2)$	R but $x \neq n\pi$ ✓	Q
232	Range of $y = \sin x$ is:	$(-1,1)$	$[-1,1)$	$[-1,1]$ ✓	$(-1,1]$
233	The smallest positive number P for which f(x+p)=f(x) is called:	Domain	Range	Co-domain	Period ✓
234	Sine is a periodic function and its period is:	π	$\pi/2$	2π ✓	None of these
235	Cosine is a periodic function, the period of $\cos\theta$ is:	2π ✓	π	$\pi/2$	None
236	The period of $3\cos2x$ is:	π ✓	2π	3π	$\pi/2$
238	The period of $\cot(x/2)$ is:	$\pi/2$	π	2π ✓	4π
240	Period of $2\cos(3x)$ is equal to:	π	$5\pi/2$	$2\pi/3$ ✓	None of these
243	Range of $y = 3\sin2x$ is:	$[-1,1]$	$[-3,3]$ ✓	$[-5,5]$	$[-6,6]$
244	$a + b\cos(c\theta + d)$ is a type of function:	Trigonometric	Exponential	Constant	Sinusoidal ✓
245	The maximum value of $2 + 3\sin x$ is:	2	3	4	5 ✓
246	$\lim_{x\to1}\frac{x^3-3x^2+3x-1}{x-1}$ equals:	0 ✓	-1	3	1
248	$\lim_{x\to a}\frac{\sqrt{x}-\sqrt{a}}{x-a}$ equals:	0	$1/(2\sqrt{a})$ ✓	$2\sqrt{a}$	$\sqrt{a}$
249	$\lim_{x\to a}\frac{x^3-a^3}{x-a} = \cdots$:	Undefined	$3a^2$ ✓	a^2	0
250	$\lim_{x\to2}\frac{x^5-32}{x-2} =$?:	32	16	80 ✓	64
251	$\lim_{x\to0}\frac{\sin x}{x} = \cdots$:	0	-1	1 ✓	∞
252	$\lim_{x\to0}\frac{\sin ax}{\sin bx} = \cdots$:	a/b ✓	b/a	ab	1
253	$\lim_{\theta\to0}\frac{1-\cos p\theta}{1-\cos q\theta} = \cdots$:	p/q	q/p	p^2/q^2 ✓	q^2/p^2
254	$\lim_{x\to0}\frac{\sin x^\circ}{x} = \cdots$:	1	$\pi/180$ ✓	$180/\pi$	0
255	$\lim_{x\to\pi}\frac{\sin x}{x} = \cdots$:	1	π	0 ✓	-1
256	$\lim_{x\to0}\frac{x}{\sin2x}$ is equal to:	$1/2$ ✓	2	3	-2

257	$\lim_{\theta\to0}\frac{1-\cos\theta}{\theta}$ equals:	Zero ✓	-1	1	None
259	$\lim_{\theta\to0}\frac{\sin7\theta}{\theta}$ =?:	7 ✓	1	-7	1/7
260	$\lim_{x\to0}(\frac{x}{\tan x})$ =?:	0	1 ✓	2	3
261	$\lim_{\theta\to0}\frac{\sin^2\theta}{\theta}$ =?:	0 ✓	1	-1	2
262	$\lim_{n\to\infty}(1+\frac{1}{n})^{2n}$ =?:	e	e^2 ✓	e^{-1}	e^{-2}
263	$\lim_{x\to0}(1+x)^{1/x}$ =?:	e ✓	e^2	e^x	e^{-1}
265	$\lim_{x\to\infty}(1+\frac{x}{2})^{1/x}$ =?:	$e^{1/2}$ ✓	e^2	e	None
266	$\lim_{n\to\infty}(1-\frac{1}{n})^n = \cdots$:	e	e^{-2}	e^{-1} ✓	$\sqrt{e}$
267	$\lim_{n\to\infty}(\frac{5n+1}{5n})^n = \cdots$:	$e^{1/5}$ ✓	e^5	e	e^{-5}
268	$\lim_{x\to\infty}(\frac{1}{2})^x = \cdots$:	0 ✓	1	2	∞
269	$\lim_{x\to\infty}\frac{2-3x}{\sqrt{3+4x^2}} = \cdots$:	3/2	$-3/2$ ✓	$\pm3/2$	None of these
270	$\lim_{x\to\pi}\frac{\sin x}{\pi-x}$ equals:	Zero	1 ✓	2	π
271	$\lim_{h\to0}(1-2h)^{1/h}$ is equal to:	e	e^2	e^{-1}	e^{-2} ✓
273	The function $f(x)=\frac{x^2-1}{x-1}$ is discontinuous at:	$x=-1$	$x=1$ ✓	$x=2$	$x=0$
274	The notation $f'(x)$ was introduced by:	Leibniz	Cauchy	Lagrange ✓	Newton
276	$\lim_{\delta x\to0}\frac{f(x+\delta x)-f(x)}{\delta x}$ is equal to:	$f(0)$	$f'(a)$	$f'(x)$ ✓	$f'(0)$
277	$\lim_{x\to a}\frac{f(x)-f(a)}{x-a}$ is equal to:	$f'(x)$	$f'(a)$ ✓	$f'(2)$	None
278	$\lim_{h\to0}\frac{f(a+h)-f(a)}{h} = \cdots$:	$f(a)$	$f'(a+h)$	$f'(x)$	$f'(a)$ ✓
279	If $f(x)=x^{1/3}$ then $f'(8)$ =?:	1/2	2/3	1/12 ✓	1/3
280	If $f(x)=(1+x)^n$, then $f'(0)$ will be:	0	n ✓	1	n!
281	If $f(x)=\sqrt{a+x}$ then which option is correct?	$f'(0)=f'(1)$	$f'(0)<f'(1)$	$f'(0)>f'(1)$ ✓	$f'(0)=-f'(1)$
282	$\frac{d}{dx}(ax+b)^n$ is equal to:	$n(ax+b)^{n-1}$	$an(ax+b)^{n-1}$ ✓	$a(ax+b)^{n-1}$	$n(ax+b)^n$
283	$\frac{d}{dx}(c)$ =?, where c is a constant:	c	1	0 ✓	None
284	If $y=x^n$, then $\frac{dy}{dx}$ =?:	x^{n-1}	nx^{n-1} ✓	nx^n	$x^n\ln x$
286	If $y=1/x^2$, then dy/dx =?:	$-2/x^3$ ✓	$2/x^3$	$-3/x^2$	$3/x^2$
287	The derivative of $\frac{x-1}{x+1}$ w.r.t x is:	$-\frac{1}{(x+1)^2}$	$\frac{2}{(x+1)^2}$ ✓	$\frac{2x}{(x+1)^2}$	$\frac{-2x+1}{(x+1)^2}$

288	If $y = x - \frac{1}{x}$ then $\frac{dy}{dx}$ =?:	$1 + \frac{1}{x^2}$ ✓	$1 - \frac{1}{x^2}$	$1 + \frac{1}{x}$	$\frac{x^3 - x}{x + 1}$
290	The derivative of $\frac{x^3+2x^2}{x^3}$ equals:	$2/x^2$	$-2/x^2$ ✓	$1/2x^2$	$-1/2x^2$
291	$\frac{d}{dx}(ax^n + bx^m) = \cdots$:	$nax^{n-1} + mbx^{m-1}$ ✓	$nax^n + mbx^m$	$ax^{n-1} + bx^{m-1}$	None of these
292	$\frac{d}{dx}(\frac{x^2-4}{x-2})$ equals:	0	1 ✓	$x + 2$	$x - 2$
294	The magnitude of the vector $\vec{v} = a\hat{\imath} + b\hat{\jmath} + c\hat{k}$ is:	$a^2 + b^2 + c^2$	$a + b + c$	$\sqrt{a + b + c}$	$\sqrt{a^2 + b^2 + c^2}$ ✓
295	The position vector of any point in the xy-plane is:	$\vec{r} = x\hat{\imath} + y\hat{\jmath}$ ✓	$\vec{r} = y\hat{\imath} + z\hat{k}$	$\vec{r} = x\hat{\imath} + z\hat{k}$	None of these
296	Magnitude of the vector $\vec{v} = 3\hat{\jmath} + 4\hat{k}$ is:	$\sqrt{29}$	5 ✓	$\sqrt{28}$	28
297	Let $\overline{OA} = \vec{a}$ and $\overline{OB} = \vec{b}$ then $\overline{AB}$ is:	$\vec{a} - \vec{b}$	$\vec{a} + \vec{b}$	$\vec{b} - \vec{a}$ ✓	$\vec{b} + \vec{a}$
298	Length of the vector $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$ is:	2	4	3 ✓	5
299	Magnitude of the vector $\vec{v} = [3,4]$ is:	3	4	5 ✓	6
300	$\hat{\imath} \cdot \hat{\imath}$ is equal to:	0	1 ✓	2	3
302	$\hat{\imath} \cdot \hat{\jmath} = \cdots$:	0 ✓	1	2	$\hat{k}$
303	$\vec{a} \cdot \vec{b} = 0$ implies that $\vec{a}$ and $\vec{b}$ are:	Parallel	Perpendicular ✓	Coincident	None of these
304	Two vectors $\vec{a}$ and $\vec{b}$ are parallel if:	$\vec{a} \cdot \vec{b} = 0$	$\vec{a} \times \vec{b} = 0$ ✓	$\vec{a} \cdot \vec{b} = 1$	$\vec{a} \times \vec{b} = 1$
305	Cosine of the angle between $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{b} = \hat{\imath} + \hat{\jmath}$ is:	$2/\sqrt{6}$ ✓	$1/\sqrt{6}$	$3/\sqrt{6}$	$1/\sqrt{3}$
306	The angle between vectors $2\hat{\imath} - \hat{\jmath} + \hat{k}$ and $\hat{\imath} + 2\hat{\jmath} - \hat{k}$ is:	60°	30°	90° ✓	45°
307	For what value of p; $[2, p, 5]$ is perpendicular to $[3,1,p]$:	1	-1 ✓	-2	3
308	If $2\hat{\imath} + \alpha\hat{\jmath} + 5\hat{k}$ and $3\hat{\imath} + \hat{\jmath} + \alpha\hat{k}$ are perpendicular, then $\alpha = \cdots$:	0	1	-1	-2 ✓
309	The vectors $\vec{u}$ and $\vec{v}$ are parallel if the angle between them is:	$\pi/2$	π or 0 ✓	$\pi/4$	$\pi/3$
310	$\hat{\jmath} \times \hat{k} = \cdots$:	$\hat{\imath}$ ✓	$-\hat{\imath}$	1	0
311	Area of the triangle whose adjacent sides are $3\hat{\imath} + 4\hat{\jmath}$ and $-5\hat{\imath} + 7\hat{\jmath}$ is:	41	41/2 ✓	20	21
313	If $\vec{u} \times \vec{v} = 0$ then vectors are:	Parallel ✓	Perpendicular	Opposite	None
314	The sine of the angle between $\hat{\imath} + \hat{\jmath}$ and $\hat{\jmath} + \hat{k}$ is:	$1/\sqrt{3}$	$2/\sqrt{3}$	$\sqrt{2/3}$ ✓	1/2

315	The cross product of vectors is also known as:	Scalar product	Vector product ✓	Inner product	None
316	If $\vec{a} \times \vec{b} = 0$ and $\vec{a} \cdot \vec{b} = 0$, then:	$\vec{a}$ and $\vec{b}$ are parallel	$\vec{a}$ and $\vec{b}$ are perpendicula r	Either $\vec{a} = 0$ or $\vec{b} = 0$ ✓	None of these
317	If $\vec{a}$ and $\vec{b}$ are non-zero vectors then $\vec{a} \times \vec{b}$ =?:	ab	$\vec{a} \cdot \vec{b}$	$\vec{b} \times \vec{a}$	$-\vec{b} \times \vec{a}$ ✓
319	$\vec{u} \times (\vec{v} \cdot \vec{w})$ is:	Scalar product	Vector product	Cross product	Meaningless ✓
320	If any two vectors of a scalar triple product are equal, then its value is:	1	-1	2	0 ✓
321	Vector triple product of three non-zero vectors $\vec{a}, \vec{b}, \vec{c}$ is denoted by:	$\vec{a} \times (\vec{b} \times \vec{c})$ ✓	$\vec{a} \cdot (\vec{b} \times \vec{c})$	$\vec{a} \cdot (\vec{b} + \vec{c})$	None of these
322	$\hat{\imath} \cdot (\hat{\jmath} \times \hat{k})$ is equal to:	0	1 ✓	-1	2
323	$[\hat{k}\ \hat{\imath}\ \hat{\jmath}]$ is equal to:	0	1 ✓	-1	2
324	$(\vec{a} \times \vec{b}) \cdot \vec{c} = \cdots$:	$\vec{a} \cdot (\vec{b} \times \vec{c})$ ✓	$\vec{c} \cdot (\vec{b} \times \vec{a})$	$(\vec{c} \times \vec{b}) \cdot \vec{a}$	$\vec{a} \times (\vec{b} \cdot \vec{c})$
325	Volume of a tetrahedron with adjacent edges $\vec{a}, \vec{b}, \vec{c}$ is:	$\frac{1}{2}(\vec{a} \cdot \vec{b} \times \vec{c})$	$\frac{1}{3}(\vec{a} \cdot \vec{b} \times \vec{c})$	$\frac{1}{6}[\vec{a}\ \vec{b}\ \vec{c}]$ ✓	$[\vec{a}\ \vec{b}\ \vec{c}]$
326	Work done by a force $\vec{F} = 7\hat{\imath} + 4\hat{\jmath} + 3\hat{k}$ for displacement $\vec{d} = 3\hat{\imath} + \hat{\jmath}$ is:	24	25 ✓	26	27
327	$[2\hat{k}\ \hat{\jmath}\ \hat{\imath}]$:	1	-1	-2 ✓	2
328	$2\hat{\jmath} \cdot (2\hat{k} \times \hat{\imath})$:	4 ✓	3	2	1
329	The moment of a force $\vec{F}$ acting at P about C is:	$\vec{F} \times \overrightarrow{CP}$	$\overrightarrow{CP} \times \vec{F}$ ✓	$\overrightarrow{CP} \cdot \vec{F}$	$\overrightarrow{OP} \times \vec{F}$

Short Questions # NO.2

1. Find the multiplicative inverse of the following complex number: $(-4,7)$
2. Find the multiplicative inverse of the following complex number: $(\sqrt{2}, -\sqrt{5})$
3. Separate into real and imaginary parts (write as a simple complex number). $\frac{2-7i}{4+5i}$
4. Separate into real and imaginary parts (write as a simple complex number). $\frac{(-2+3i)^2}{1+i}$
5. Separate into real and imaginary parts (write as a simple complex number). $\frac{i}{1+i}$
6. Prove that $\overline{z} = z$ if z is real.
7. For $z \in C$, show that: $z\ ^{2} = z.\overline{z}$
8. If $z_1 = 2 + i, z_2 = 3 - 2i, z_3 = 1 + 3i$ then express $\frac{z_1 z_3}{z_2}$ in the form of $a + ib$.
9. If $z_1 = 2 + 7i$ and $z_2 = -5 + 3i$, then evaluate the following: $2z_1 - 4z_2$.
10. Show that $i^{n+1} + i^{n+2} + i^{n+3} + i^{n+4} = 0\ for\ aii\ n \in N$
11. Find the least positive value of n, if $(\frac{1+i}{1-i})^{2n} = 1$

12. If $z = \frac{(1+2i)^2}{2-i}$ then evaluate $\overline{z}$.
13. Find the real values of x and y in the following: $x + iy + 2 - 3i = i(5 - i)(3 + 4i)$
14. Find the real values of x and y in the following: $(x + iy)(1 - i) = (2 - 3i)(-5 + 5i)(-i\frac{3}{5})$ +1
15. Find the real values of x and y in the following: $\frac{x}{2+i} + \frac{y}{3-i} = 4 + 5i$
16. Find the real values of x and y if: $(x + iy)^2 = 25 + 60i$
17. Find the real values of x and y if: $(x + iy)^2 = \frac{2i-3}{3+i}$.
18. If $z_1 = 2 + 3i$ and $z_2 = 1 - \alpha$, find the value of a such that $Im(z_1 z_2) = 7$
19. Find the square root of the following complex number: $-7 - 24i$
20. Find the square root of complex number $5 + 12i$ and also represent the square root an Argand diagram. * Factorize the following: $a^2 + 4b^2$ +1
21. Factorize the following: $z^2 - 2iz - 1$
22. Factorize the following: $z^2 + 6z + 13$
23. Factorize the following polynomials into its linear factors: $z^3 + 8$
24. Factorize the following polynomials into its linear factors: $z^4 + 21z^2 - 100$
25. Equations & Roots of Unity Solve the following complex quadratic equation by completing square method: $2z^2 - 3z + 4 = 0$
26. Solve the following complex quadratic equation by completing square method: $z^2 + 4z + 13 = 0$
27. Solve the following equation: $2z^4 - 32 = 0$
28. Solve the following equation: $3z^5 - 243z = 0$
29. Solve the following equation: $z^3 - 5z^2 + z - 5 = 0$
30. Factorize the polynomial $P(z) = z^2 + (i - 3)z - 3i$
31. Factorize the polynomial $P(z) = z^3 + (1 + i)z^2 + iz$
32. Solve the equation $2z^2 - 12z + 50 = 0$ by completing square method and hence express it as a product of its linear factors.
33. Find the three cube roots of: 8
34. Find the three cube roots of: -27
35. Find the fourth roots of 16,81,625. Also show that their sum is zero in each case.
36. if $1, w, w^2$ are the cube roots of unity, show that $1 + \omega^n + \omega^{2n} = 3$ where n is a multiple of 3 respectively.
37. Prove that: $(x^3 + y^3) = (x + y)(x + \omega y)(x + \omega^2 y)$
38. Plot the following points: $(2, 75°)$.
39. Plot the following points: $(-3, 120°)$
40. Plot the following points: $(2, \frac{\pi}{6})$
41. Plot the following points: $(-\frac{5}{2}, \frac{\pi}{3})$
42. Plot the following points: $(-3, -\frac{2\pi}{3})$
43. Functions, Domains & Ranges Given that: (a) $f(x) = x^2 - 1$ (b) $f(x) = \sqrt{2x + 3}$, find (i) $f(-3)$, (ii) $f(0)$
44. Given that: (a) $f(x) = x^2 - 1$ (b) $f(x) = \sqrt{2x + 3}$ find (i) $f(x - 2)$ (ii) $f(x^2 + 3)$
45. Find $\frac{f(a+h)-f(a)}{h}$ and simplify where: $f(x) = 4x + 7$
46. Find $\frac{f(a+h)-f(a)}{h}$ and simplify where: $f(x) = sin\ x$ +2
47. Find $\frac{f(a+h)-f(a)}{h}$ and simplify where: $f(x) = x^3 + x^2 - 1$
48. Express the following: The area A of a of a square as a function of its perimeter P.
49. Express the following: The circumference C of a circle as a function of its area A.

50. Find the domain and the range of the function g defined below: $g(x) = 5 - x$
51. Find the domain and the range of the function g defined below: $g(x) = \sqrt{x+2}$
52. Find the domain and the range of the function g defined below: $g(x) = \{\begin{matrix} 6x+7, x \leq -2 \\ 4-3x, x > -2 \end{matrix}$
53. Find the domain and the range of the function g defined below: $g(x) = \frac{x+2}{3-x}$
54. Given $f(x) = x^3 - ax^2 + bx + 1$. If $f(2) = -3$ and $f(-1) = 0$, find the value of a and b.
55. Consider the function $f(x) = 3x - 5$. Determine the domain and range of $f(x)$
56. Consider the function $f(x) = 3x - 5$ is the function f one-to-one? justify your answer.
57. Let $f: R \to R$ be defined by $f(x) = \frac{2x-3}{x+1}$: Find the domain and range of $f(x)$.
58. Let $f: R \to R$ be defined by $f(x) = \frac{2x-3}{x+1}$: Prove that $f(x)$ is one-to-one.
59. Given $f(x) = x^3 - 2x^2 + 4x - 1$ find: $f(\frac{1}{x}), x \neq 0$
60. Find the domain and range of $f(x) = \frac{x}{x^2-4}$
61. Find the domain and range of $f(x) = \sqrt{x^2 - 9}$.
62. Show that the function $f(x) = x + 1$, where the domain and co-domain are all real numbers, is bijective.
63. Graphing & Intersections Find the point of intersection of the coordinate axes and the following linear function graphically: $y = -5x + 10$
64. Find the point (s) of intersection of the following function graphically: $f(x) = 2x + 5, g(x) = -x + 5$
65. Find the point (s) of intersection of the following function graphically: $f(x) = 3x - 2, g(x) = 10 - x$
66. Find the point (s) of intersection of the following function graphically: $f(x) = x - 1, g(x) = x^2 - 4x + 3$
67. Find the point (s) of intersection of the following function graphically: $f(x) = -2x - 1, g(x) = x^2 - 4x$
68. Graph the following function: $y = \sqrt{3x}$ * Graph the following function: $y = -\frac{1}{2}\sqrt{x}$ +1
69. Graph the following function: $y = \sqrt[3]{2x+1}$
70. Sketch and analyze: $y = -x^2 - 2x + 3$ * Find the maximum and minimum value of the $f(x) = -2x^2 + 4x + 3$ by completing square. +1
71. Find the point of intersection of $y = 3x + 2$ and $y = -x + 6$ graphically.
72. Radical & Rational Equations Solve: $x^2 - 4 = 5$
73. Solve the following: $\frac{x}{x+1} + \frac{x+1}{x} = \frac{5}{2}; x \neq -1,0$
74. Solve the following: $\frac{1}{x+1} + \frac{2}{x+2} = \frac{7}{x+5}; x \neq -1, -2, -5$
75. Solve the following: $\frac{a}{ax-1} + \frac{b}{bx-1} = a + b; x \neq \frac{1}{a}, \frac{1}{b}$
76. Solve the following: $3x^2 + 15x - 2\sqrt{x^2 + 5x + 1} = 2$
77. Solve the following: $\sqrt{2x+8} + \sqrt{x+5} = 7$
78. Solve the following: $\sqrt{3x+4} = 2 + \sqrt{2x-4}$
79. Solve the following: $\sqrt{x+7} + \sqrt{x+2} = \sqrt{6x+13}$
80. Matrices & Determinants If $A = a_{ij} \quad {}_{3\times4}$, then show that, $I_3 A = A$
81. If $A = \begin{bmatrix} 0 & -1 & 2 \\ 3 & 2 & 1, \\ -1 & 0 & 4 \end{bmatrix} B = \begin{bmatrix} 2 & 1 & -1 \\ 1 & 2 & 4 \, . \\ -1 & 2 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0 & -2 \\ -1 & 5 & 0 \\ 3 & 4 & -1 \end{bmatrix}$, then find: $A - B$
82. If $A = \begin{bmatrix} i & 2i \\ 1 & -i \end{bmatrix}, B = \begin{bmatrix} -i & 1 \\ 2i & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 2i & 1 \\ -i & i \end{bmatrix}$, then show that: $A(B + C) = AB + AC$ +1

83. If A and B are square matrices of the same order, then explain why in general; $(A+B)^2 \neq A^2 + 2AB + B^2$

84. If A and B are square matrices of the same order, then explain why in general; $(A-B)^2 \neq A^2 - 2AB + B^2$

85. If $A = \begin{bmatrix} -1 & 2 & 3 \\ 1 & 0 & 2, \\ -3 & 5 & 3 \end{bmatrix}$ then find $A + A^t$, $A - A^t$ AA^t A^tA and $(A^t)^t$.

86. Solve the matrix equation $A^2 - 5A + 4I - X = 0$ if $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$

87. If A and B are two matrices such that $AB = B$ and $BA = A$ show that $A^2 + B^2 = A + B$. +1

88. If $A = \begin{bmatrix} 1 & 0 & -1 & 2 \\ 3 & 1 & 2 & 5 \\ 0 & -2 & 1 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 & 3 & 1 \\ 1 & 3 & -1 & 4 \\ 3 & 1 & 2 & -1 \end{bmatrix}$, then show that $(A+B)^t = A^t + B^t$ +1

89. Find AB and BA if $A = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 4 & 2 \\ 3 & 0 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & -1 \\ 1 & -2 & 3 \end{bmatrix}$.

90. Evaluate the following determinant: $\begin{vmatrix} 1 & -2 & -4 \\ 3 & -1 & -3 \\ -2 & 3 & 2 \end{vmatrix}$

91. Evaluate the following determinant: $\begin{vmatrix} a+b & a-b & a \\ a & a+b & a-b \\ a-b & a & a+b \end{vmatrix}$

92. Without expansion show that: $\begin{vmatrix} 7 & 8 & 9 \\ 5 & 6 & 7 \\ 2 & 3 & 4 \end{vmatrix} = 0$

93. Without expansion show that: $\begin{vmatrix} 5 & 6 & -1 \\ 2 & 2 & 0 \\ 2 & -8 & 10 \end{vmatrix} = 0$

94. Without expansion show that: $\begin{vmatrix} -a & 0 & b \\ 0 & a & -c \\ c & -b & 0 \end{vmatrix} = 0$

95. Without expansion show that: $\begin{vmatrix} 2 & 1 & 3x \\ 2 & 3 & 9x \\ 3 & 5 & 15x \end{vmatrix} = 0$

96. Without expansion show that: $\begin{vmatrix} bc & a & a^2 \\ ca & b & b^2 \\ ab & c & c^2 \end{vmatrix} = \begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix}$

97. If $A = \begin{vmatrix} 1 & 2 & -3 \\ 0 & -5 & 0 \\ -2 & -2 & 7 \end{vmatrix}$. and $B = \begin{vmatrix} -5 & -2 & 5 \\ -3 & -1 & 4i \\ -2 & -1 & 2 \end{vmatrix}$ then find: $A_{13}, A_{23}, A_{33} and A$ +1

98. Find the value of x iff: $\begin{vmatrix} 1 & x-1 & 3 \\ -1 & x+1 & 2 \\ 2 & -3 & x \end{vmatrix} = 9$.

99. Find the value of x if: $\begin{vmatrix} 1 & 1 & 1 \\ 2 & x & 2 \\ 3 & 6 & x \end{vmatrix} = 0$

100. Find AA^t and A^tA: $A = \begin{bmatrix} -3 & 2 & -1 \\ 2 & 1 & 3 \end{bmatrix}$.

101. If A is a square matrix of order 3, then show that $KA = K^3A$

102. Verify that $(AB)^t = B^tA^t$ if: $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & -3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ -3 & -2 \\ 0 & 1 \end{bmatrix}$

103. Verify that $(AB)^t = B^tA^t$ if: $A = \begin{bmatrix} 1 & 2 \\ 1 & 4 \\ 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -3 \\ -2 & 1 \end{bmatrix}$

104. Evaluate the determinant if $A = \begin{vmatrix} 1 & -2 & 3 \\ -2 & 3 & 1. \\ 4 & -3 & 2 \end{vmatrix}$

105. Find the cofactor A_{12}, A_{22} and A_{32} of $A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 3 & 1 \\ 4 & -3 & 2 \end{bmatrix}$ and find A.

106. Partial Fractions Resolve $\frac{7x+25}{(x+3)(x+4)}$ into partial fractions.

107. Resolve $\frac{x^2+x-1}{(x+2)^3}$ into partial fraction.

Short Questions # NO.3

1. Find the next four terms of the following sequence: 12,16,20, . . .
2. Write down the first three terms of the following sequence: $a_{n+1} = 4a_n - 7$ and $a_1 = 3$
3. Write down the first three terms of the following sequence: $a_1 = 1$, $a_{n+1} = (3a_n + 2)^2$
4. Write down the nth term of the following sequence: 1,4,9, . . .
5. Find the common difference and write the next two terms of the following sequence: 9,16,23, . . .
6. Write the first three term of the following arithmetic sequence, with given information. $a_1 = 2$, $d = 13$
7. Find a_{n+1} and a_n if $a_n = 4 + 3n$.
8. Is 301 a term of the A.P 5,11,17, . . . ?
9. Which term of the A.P 3,8,13, . . . is 123?
10. The 7^{th} and 21^{st} terms of an A.P are 37 and 107 respectively. Find the A.P and its 100^{th} term.
11. How many numbers of three digits are divisible by 7?
12. Find the 8^{th} term form the end of the A.P 8,11,14, . . . ,185 .
13. If the 5^{th} term of an A.P is 13 and 17^{th} term is 49, find a_n and a_{13} .
14. Find A.M between the given number: $2 + \sqrt{3}$, $2 - \sqrt{3}$
15. If 6,11,16 are three A.Ms between a and b, find a and b.
16. The A.M of two numbers is 7 and their product is 45. Find the number.
17. Sum the series: $3 + 6 + 9 + \ldots a_{20}$.
18. Find S_n for the following arithmetic series: $a_1 = 40$, $n = 20$, $d = -3$
19. How many items of series: $96 + 93 + 90 + \ldots$ amount to 1071.
20. Find the 6th term of the G.P: $-6, -3, \frac{-3}{2}, \ldots$
21. Find the 12^{th} term of $1 + i + 2i, -2 + 2i, \ldots$
22. Find the eight term of a geometric sequence for which $a_1 = -3$ and $r = -2$
23. Find a_n if $a_4 = \frac{8}{27}$ $a_7 = \frac{-64}{729}$
24. Find G.M. between: $-2i$ and $8i$
25. Insert three G.Ms. between 2 and $\frac{1}{2}$
26. Sum of n terms the series: $0.2 + 0.22 + 0.222 + \ldots$
27. Find the 9^{th} term of the following harmonic sequence: $\frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \ldots$
28. If 5 is the harmonic mean between 2 and b, find b.

29. If a^2 b^2 and c^2 are in A.P., show that $a+b+c$ and $b+c$ are in H.P.

30. Evaluate the following: $\frac{10!}{0!8!}$

31. Write the following in factorial form: $n^3 - n$

32. Write the following in factorial form: $n(n-1)(n-2)\ldots(n-r+1)$

33. Evaluate the following: ${}^{10}p_5$

34. Find the value of n when: ${}^{n}p_3 = 504$

35. How many 4 digit number can be formed, with distinct digits, with each digit odd?

36. How many 5-digits multiples of 5 can be formed from the digits 2,3,5,7,9, when no digit is repeated.

37. In how may ways can 8 different books including 2 on English be arranged on a shelf in such a way that the English books are never together?

38. How many different 4-digit number can be formed out from the digits 1,2,3,4,5,6, when no digit is repeated?

39. How many arrangements of the letters of the following word, taken all together can be made? PAKISTAN.

40. How many permutations of the letters of the word "BANANA" can be made. If B must be the first letter in each arrangement?

41. In how many different ways can the following persons sit around a round table? (a) 8 persons (b) 7 persons (c) 6 persons.

42. How many necklaces can be made from 10 beads of different colours?

43. If ${}^{3n}C_2 : {}^{n}C_2 = 15:1$, find n.

44. Find the value of n and r, when: ${}^{n}C_r = 56$, ${}^{n}P_r = 336$

45. How many diagonals and triangles can be formed by joining the vertices of the polygon having 15 sides.

46. In how many ways can a cricket team of 11 players be selected out of 17 players? How many of them will include a particular player?

47. Find remainder and quotient by simplifying the following: $(5x^4 - 3x^3 + 2x^2 - 1) \div (x^2 + 4)$

48. Use the remainder theorem to find the remainder when the first polynomial is divided by the second polynomial: $x^2 + 5 + 6$, $x - 2$

49. Use the factor theorem to determine the first polynomial is a factor of the second polynomial: $x - 3$, $x^4 - 3x^3 + x^2 - x + 1$

50. Use synthetic division to show that x is the zero of the polynomial and use the result to factorize the polynomial completely: $x^3 - 7x + 6$, $x = 2$

51. Use synthetic division to find the quotient and the remainder when the polynomial $x^4 - 10x^2 - 2x + 4$ is divided by $x + 3$.

52. If $x + 1$ and $x - 2$ are factors of $x^3 - px^2 + qx + 2$ Using synthetic division, find the values of p and q.

53. When the polynomial $4x^4 + 2x^3 + kx^2 + 13$ is divided by $x + 1$, the remainder is 16. Find the value of k.

54. Use factor theorem to find the values of p and q is $x + 1$ and $x - 2$ are the factors of the polynomial $x^3 + px^2 + qx + 3$

55. Divide the cube polynomial $3x^3 - 10x^2 + 13x - 6$ by the linear polynomial $x - 2$. Also find the quotient and remainder.

56. Find the value of k if the polynomial $x^3 + kx^2 - 7x + 6$ has a remainder -4, when divided by $x + 2$.

57. Show that $x-2$ is a factor of $f(x)=x^3-7x+6$ without factorizing.

58. If $(x-2)$ and $(x+2)$ are factors of x^4-13x^2+36 . Using synthetic division, find the other two factors.

59. A digital processing system has a transfer function with a numerator $B(z)=z^2-z-2$ Use the factor theorem to find the zeros of the system.

60. Prove the following: $\sin(180^\circ+\alpha)\sin(90^\circ-\alpha)=-\sin\alpha\cos\alpha$

61. Prove the following: $\sin(810^\circ)\sin(630^\circ)+\cos(135^\circ)\sin(225^\circ)=-\frac{1}{2}$

62. Prove the following: $\tan(150^\circ)\cot(330^\circ)-2\sec(135^\circ)\csc(225^\circ)=-3$

63. Prove the following: $\sin(210^\circ)+\cos(240^\circ)+\tan(225^\circ)+\cot(225^\circ)=1$

64. If α,β,γ are the angles of a triangle ABC, then prove that: $\sin(\alpha+\beta)=\sin\gamma$.

65. If α,β,γ are the angles of a triangle ABC, then prove that: $\sec\left(\frac{\alpha+\beta}{2}\right)=\csc\frac{V}{2}$

66. If α,β,γ are the angles of a triangle ABC, then prove that: $\tan(\alpha+\beta)+\tan\gamma=0$

67. Find distance between the following point: $P(\cos x,\cos y)$, $Q(\sin x,\sin y)$

68. Prove that: $\sin(45^\circ+\alpha)=\frac{1}{\sqrt{2}}(\sin\alpha+\cos\alpha)$

69. Prove that: $\sin(\alpha+\beta)\sin(\alpha-\beta)=\sin^2\alpha-\sin^2\beta\cos^2\beta-\cos^2\alpha$

70. Without using tables, find the values of all trigonometric functions of 105°

71. Prove that: $\frac{\cos(11^\circ)+\sin(11^\circ)}{\cos(11^\circ)-\sin(11^\circ)}=\tan(56^\circ)$

72. Find the values of $\sin(2\alpha)$, $\cos(2\alpha)$ and $\tan(2\alpha)$, when: $\sin\alpha=\frac{3}{5}$ where $0<\alpha<\frac{\pi}{2}$

73. Prove that: $\frac{\sin\theta+\sin(2\theta)}{1+\cos\theta+\cos(2\theta)}=\tan\theta$

74. Show that: $\sin(2\theta)=\frac{2\tan\theta}{1+\tan^2\theta}$

75. Show that: $\cos(2\theta)=\frac{1-\tan^2\theta}{1+\tan^2\theta}$

76. Express the following product as sums or differences: $\cos(x+y)\sin(x-y)$

77. Express the following product as sums or differences: $\sin(12^\circ)\sin(46^\circ)$

78. Express the following sums and differences a s products: $\cos(12^\circ)+\cos(48^\circ)$

79. Express the following sums and differences a s products: $\sin(x+30^\circ)+\sin(x-30^\circ)$

80. Prove without using table / calculator, that $\sin(19^\circ)\cos(11^\circ)+\sin(71^\circ)\sin(11^\circ)=\frac{1}{2}$

81. Express $\sin(5x)+\sin(7x)$ as a product.

82. Express $\cos\theta+\cos(3\theta)+\cos(5\theta)+\cos(7\theta)$ as a product.

Short Questions # NO.4

1. Determine whether the following functions are even, odd or neither odd nor even: $\sin^2 x$
2. Determine whether the following functions are even, odd or neither odd nor even: $\tan x+\sec x$
3. Determine whether the following functions are even, odd or neither odd nor even: $\frac{1}{\csc^3 x}$
4. Determine whether the following functions are even, odd or neither odd nor even: $\frac{\sin x+\sin 3x}{\cos x+\cos 3x}$
5. Find the periods of the following function: $\sin 5x$
6. Find the periods of the following function: $\cot\frac{x}{2}$
7. Find the periods of the following function: $\csc(\frac{2x}{5})$

8. Find the periods of the following function: $\frac{1}{2}\sin(\frac{3x}{2}-\frac{\pi}{2})$

9. Find the maximum and minimum values of the following function: $\frac{1}{2}+\sin(5x+\pi)$

10. Find the maximum and minimum values of the following function: $\frac{3}{2}+\cos(x-\frac{\pi}{4})$

11. Find the maximum and minimum values of the following function: $\frac{1}{10-2\sin 3x}$

12. A giant Ferris wheel has a diameter of 60 feet. The lowest point of the wheel is located 6 feet above the ground. The wheel completes one full revolution every 80 seconds. Find the maximum height of the rider.

13. Find the limit of the following sequence if exists: $a_n=\frac{2n+3}{n+1}$

14. Find the limit of the following sequence if exists: $b_n=\frac{2n+3}{n^2+1}$

15. Evaluate the following limit by using theorems of limits: $\lim_{x\to 3}(2x+4)$

16. Evaluate the following limit by using theorems of limits: $\lim_{x\to 1}(3x^2-2x+4)$

17. Evaluate the following limit by using algebraic techniques: $\lim_{x\to -1}\frac{x^3-x}{x+1}$

18. Evaluate the following limit by using algebraic techniques: $\lim_{x\to 3}(\frac{x^2-5x+6}{x^2-2x-3})$

19. Evaluate the following limit using algebraic techniques: $\lim_{x\to 1}\frac{x^3-3x^2+3x-1}{x^3-x}$

20. Evaluate the following limit by using algebraic techniques: $\lim_{h\to 0}\frac{\sqrt{x+h}-\sqrt{x}}{h}$

21. Evaluate: $\lim_{x\to 3}\frac{x-3}{\sqrt{x}-\sqrt{3}}$

22. limit by using algebraic techniques: $\lim_{x\to 2}(\sqrt{x+2}-\sqrt{6-x})$

23. Evaluate the following limit by using algebraic techniques: $\lim_{x\to a}\frac{x^n-a^n}{x^m-a^m}$

24. Evaluate: $\lim_{x\to 1}\frac{x^2-1}{x^2-x}$

25. Evaluate: $\lim_{x\to 3}\frac{x-3}{\sqrt{x}-\sqrt{3}}$

26. $\lim_{x\to +\infty}\frac{5x^4-10x^2+1}{-3x^3+10x^2+50}$

27. Evaluate: $\lim_{x\to +\infty}\frac{5x^4-10x^2+1}{-3x^3+10x^2+50}$.

28. Evaluate: $\lim_{x\to -\infty}\frac{2-3x}{\sqrt{3+4x^2}}$

29. Express the following limit in terms of e. $\lim_{n\to 0}(1+2n)^{\frac{1}{n}}$

30. Evaluate: $\lim_{\theta\to 0}\frac{\sin 7\theta}{\theta}$

31. Evaluate: $\lim_{\theta\to 0}\frac{1-\cos\theta}{\theta}$

32. Determine the left hand limit and the right hand limit and then, find limit of the following function when $x\to c$. $f(x)=2x^2+x-5, c=1$

33. Discuss the continuity of $f(x)$ at $x=c$: $f(x)=\begin{cases}2x+5 & \text{if } x\le 2\\ 4x+1 & \text{if } x>2\end{cases}$

34. Discuss continuity of $f(x)$ at $x=3$, when $f(x)=\begin{cases}x-1 & ,x<3\\ 2x+1 & ,x\ge 3\end{cases}$

35. Find by definition, the derivatives w.r.t 'x' of the following function defined as: $2-\sqrt{x}$

36. Find by definition, the derivatives w.r.t 'x' of the following function defined as: $\frac{1}{\sqrt{x}}$

37. Find $\frac{dy}{dx}$ from the first principle and final gradient of the curve at the given point: $\sqrt{x+2}$ at $x = 6$.

38. Find from principle, the derivatives of the following expressions w.r.t their respective independent variables: $(3x-2)^{-2}$

39. Find the gradient and equation of the tangent line to $y = 3x^2 - 4x + 1$ at $x = 2$.

40. Find the gradient of the curve $f(x) = 3x^2 + 2x$ at $x = 1$.

41. The position of a car after t hours is given by: $s(t) = 2t^3 - 3t^2 + t$ (in kilometres). Find the instantaneous velocity at $t = 2$

42. A stone is thrown upwards and its height after t seconds is given by: $s(t) = -16t^2 + 32t + 10$ (in feet). Find the instantaneous velocity at $t = 1$.

43. Find the gradient and an equation of tangent line to the graph of $f(x) = x^2 - 2$ at the point $P(-1,1)$

44. Find the derivative of the following function by definition: $f(x) = c$

45. Calculate $\frac{d}{dx}(3x^{\frac{4}{3}}) = 3\frac{d}{dx}(x^{\frac{4}{3}})$.

46. Find the derivative of $y = \frac{3}{4}x^4 + \frac{2}{3}x^3 + \frac{1}{2}x^2 + 2x + 5$ w.r.t. x.

47. Find the derivative of $y = (x^2+5)(x^3+7)$ with respect to x.

48. Find derivative of $y = (2\sqrt{x}+2)(x-\sqrt{x})$ with respect to x.

49. Differentiate $\frac{2x^3-3x^2+5}{x^2+1}$ with respect to x.

50. Let $\underline{u} = 3\underline{i} + 2\underline{j} - 5\underline{k}$, $\underline{v} = \underline{i} - 5\underline{j} - \underline{k}$ and $\underline{w} = -4\underline{i} - \underline{j} + 7\underline{k}$. Find the following: $\underline{u} + 2\underline{v} + \underline{w}$

51. Let $\underline{u} = 3\underline{i} + 2\underline{j} - 5\underline{k}$, $\underline{v} = \underline{i} - 5\underline{j} - \underline{k}$ and $\underline{w} = -4\underline{i} - \underline{j} + 7\underline{k}$. Find the following: $|3\underline{v} + \underline{w}|$.

52. Find the magnitude of the vector $\underline{v}$ and write the direction cosines of $\underline{v}$. $\underline{v} = 3\underline{i} - 2\underline{j} + 6\underline{k}$

53. Find t so that $|2\underline{i} + (t-1)\underline{j} + t\underline{k}| = \sqrt{13}$

54. Find a unit vector in the direction of $\underline{v} = -\underline{i} + 4\underline{j} - 8\underline{k}$

55. Find the vector whose magnitude is 5 and is parallel to $3\underline{i} + 4\underline{j} - \underline{k}$

56. If $\underline{u} = x\underline{i} + 2\underline{j} + 3\underline{k}$, $\underline{v} = \underline{i} + y\underline{j} - 3\underline{k}$ and $\underline{w} = 2\underline{i} - 3\underline{j}$ represent the sides of a triangle. Find the values of x and y.

57. The position vectors of the points A,B,C and D are $\underline{u} = \underline{i} + 2\underline{j} + \underline{k}$, $\underline{v} = 7\underline{i} + 8\underline{j} + 4\underline{k}$, $\underline{w} = -\underline{i} + \underline{k}$ and $\underline{z} = \underline{i} + 2\underline{j} + 2\underline{k}$ respectively. Show that $\overrightarrow{AB}$ is parallel to $\overrightarrow{CD}$.

58. Is the following triple can be the direction angles of a single vector? 45°, 45°, 60°

59. For the vectors, $\underline{u} = [1,-2,3]$, $\underline{v} = [2,1,3]$ and $\underline{w} = [-1,4,0]$, find the following: $\underline{v} + \underline{w}$

60. Find the unit vectors of $\underline{u} = 2\underline{i} + 5\underline{j} - \underline{k}$

61. If $\underline{u} = 2\underline{i} + 3\underline{j} + \underline{k}$, $\underline{v} = 4\underline{i} + 6\underline{j} + 2\underline{k}$ and $\underline{w} = -6\underline{i} - 9\underline{j} - 3\underline{k}$ then show that $\underline{u}$, $\underline{v}$ and $\underline{w}$ are parallel to each other.

62. Find the cosines of the angle between $\underline{u}$ and $\underline{v}$. $\underline{u} = 2\underline{i} + 3\underline{j} + \underline{k}$, $\underline{v} = -\underline{i} + 2\underline{j} + 2\underline{k}$

63. If $\underline{a} + \underline{b} + \underline{c} = \underline{0}$ and $|\underline{a}| = 3$, $|\underline{b}| = 5$ and $|\underline{c}| = 7$. Find the angle between $\underline{a}$ and $\underline{b}$.

64. Calculate the projection of $\underline{a}$ along $\underline{b}$ and projection of $\underline{b}$ along $\underline{a}$ when: $\underline{a} = 2\underline{i} + 3\underline{j} - \underline{k}$, $\underline{b} = \underline{i} - 2\underline{j} + 4\underline{k}$

65. Find a real number a so that the vectors $\underline{u}$ and $\underline{v}$ are perpendicular: $\underline{u} = a\underline{i} + 3\underline{j} + \underline{k}$, $\underline{v} = \underline{i} - 2\underline{j} + a\underline{k}$

66. Find the number z so that the triangle with vertices $A(3,0,-2)$, $B(0,3,1)$ and $C(1,1,z)$ is a right triangle with right angle at C.

67. If $\underline{u} = 3\underline{i} - \underline{j} - 2\underline{k}$ and $\underline{v} = \underline{i} + 2\underline{j} - \underline{k}$ then find $\underline{u} \cdot \underline{v}$.

68. Find a scalar a so the the vectors $2\underline{i} + a\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + a\underline{k}$ are orthogonal.

69. Find the angle between the vectors: $\underline{u} = 2\underline{i} - \underline{j} + \underline{k}$ and $\underline{v} = -\underline{i} + \underline{j}$

70. The constant forces $2\underline{i} + 5\underline{j} + 6\underline{k}$ and $-\underline{i} - 2\underline{j} - \underline{k}$ act on a body displaced from the position $P(4,-3,-2)$ to $Q(6,1,-3)$. Find the total work done.

71. Compute the cross product $\underline{a} \times \underline{b}$ and $\underline{b} \times \underline{a}$. Check your answer by showing that each $\underline{a}$ and $\underline{b}$ are perpendicular to $\underline{a} \times \underline{b}$ and $\underline{b} \times \underline{a}$. $\underline{a} = 2\underline{i} + \underline{j} - \underline{k}$, $\underline{b} = \underline{i} - \underline{j} + \underline{k}$

72. Find a unit vector perpendicular to the plane containing $\underline{a}$ and $\underline{b}$. Also find sine of the angle between them. $\underline{a} = \underline{i} + 6\underline{j} - 3\underline{k}$, $\underline{b} = 2\underline{i} + \underline{j} + 3\underline{k}$

73. Find the area of the triangle, formed by the points P,Q and R. $P(2,3,5)$; $Q(1,2,3)$; $R(4,1,2)$

74. Find the area of the parallelogram, whose vertices are: $A(1,1,1)$; $B(4,2,3)$; $C(5,6,7)$; $D(2,5,5)$

75. Which vectors, if any, are perpendicular or parallel $\underline{u} = 5\underline{i} - \underline{j} + \underline{k}$; $\underline{v} = \underline{j} - 5\underline{k}$; $\underline{w} = -15\underline{i} + 3\underline{j} - 3\underline{k}$

76. Use the definition of cross product, for any vectors $\underline{u}, \underline{v}, \underline{w}$ and scalar k, prove that: $\underline{u} \times (\underline{v} + \underline{w}) = (\underline{u} \times \underline{v}) + (\underline{u} \times \underline{w})$

77. $\underline{u} = 2\underline{i} - \underline{j} + \underline{k}$ and $\underline{v} = 4\underline{i} + 2\underline{j} - \underline{k}$ find by determinant formula: $\underline{u} \times \underline{u}$

78. Find the area of the parallelogram whose vertices are: $P(0,0,0)$, $Q(-1,2,4)$, $R(2,-1,4)$ and $S(1,1,8)$.

79. Find the moment about the point $M(-2,4,6)$ of the force represented by $\overrightarrow{AB}$, where coordinates of points A and B are (1,2,-3) and (3,-4,2) respectively.

Long Questions

Question NO. 5

1. Find the square root of $13 - 20\sqrt{3}i$ and represent it on an Argand diagram.
2. Find the real values of u and v if $\frac{u-2}{2+i} + \frac{v-3}{2-i} = 4i$
3. If $z_1 = 4 + 5i$ and $z_2 = \alpha - 2i$ find the real values of a such that $Re(z_1 z_2) = 20$.
4. Find the roots of $z^4 + 7z^2 - 144 = 0$ and hence express it as a product if linear factors.
5. Find a polynomial $P(z)$ of degree 4 with zeros $2i, -2i, 1, -1$ and satisfying $P(2) = 240$
6. Factorize the polynomial $P(z) = z^3 - 3z^3 + z + 5$
7. Evaluate: $(\frac{-1+\sqrt{-3}}{2})^7 + (\frac{-1-\sqrt{-3}}{2})^7$
8. Show that: $(1 - \omega + \omega^2)(1 - \omega^2 + \omega^4)(1 - \omega^4 + \omega^8)(1 - \omega^8 + \omega^{16})$. ... to 2n factors = 2^{2n}
9. Prove that: $(\frac{i+\sqrt{3}}{2})^8 + (\frac{i-\sqrt{3}}{2})^8 = -1$
10. If ω is an imaginary cube root of unity, prove that $\frac{a+b\omega^2+c\omega}{a\omega^2+b\omega+c} = \omega$

11. If ω is a cube root of unity, prove that $\frac{aw^{12}+bw^{17}+cw^{19}}{aw^{14}+bw^{22}+cw^{30}} = \omega$.

12. If z_1 and z_2 are different complex numbers with $|z_2| = 1$, find $|\frac{z_2-z_1}{1-z_1z_2}|$.

13. An AC source supplies a voltage of $V = 120(cos\frac{\pi}{4} + i\ sin\frac{\pi}{4})$ volts to a circuit with impedance $Z = \frac{1+i\sqrt{3}}{2}$ ohms. Calculate the current in polar form.

14. An AC circuit has an impedance of $z = 3 - 6\ i$ ohms and is connected to a voltage source of $V = 90 + 30i$ volts. Find the current in both rectangular and polar form.

15. Encrypt the word "Class" by adding the complex number encryption key $k = -3 + 4i$. Then decrypt it back to the original word.

16. A stone falls from a height of 60m on the ground, the height h after x seconds is approximately given by $h(x) = 40 - 10x^2$ what is the height of stone when: (a) $x = 1$ sec? (b) 1.5 sec (c) $x = 1.7$ sec.

17. Graph the square root function $y = 2\sqrt{x} + 1$

18. Find the maximum and minimum value of the following quadratic function by completing squares: $f(x) = x^2 + 6x + 13$

19. Find the maximum and minimum value of the following quadratic function by completing squares: $f(x) = -x^2 + 8x + 13$

20. Find the maximum and minimum value of the following quadratic function by completing squares: $f(x) = -2x^2 - x + 21$

21. Find the maximum and minimum point by sketching the following quadratic function. Also find their domain and range: $f(x) = -x^2 + 2x - 8$

22. Find the maximum and minimum point by sketching the following quadratic function. Also find their domain and range: $f(x) = x^2 + 2x - 8.3$

23. Find the inverse of the following quadratic function. Also find their domain and range: $f(x) = x^2 - 3$, $x \le 0$

24. Find the inverse of the following quadratic function. Also find their domain and range: $f(x) = 2x^2 - 8x + 11, x \ge 2$

25. Find the inverse of the following quadratic function. Also find their domain and range: $f(x) = 3x^2 - 2x + 6, x \ge 5$

26. Find the inverse of the following quadratic function. Also find their domain and range: $f(x) = -3(x + 4)^2 - 5, x < -4$

27. Solve the following absolute value quadratic equation and inequalities: $|x^2 + 5x + 4| = 0$

28. Solve the following absolute value quadratic equation and inequalities: $|3x^2 - 7x + 2| = x^2 - x + 1$

29. Solve the following absolute value quadratic equation and inequalities: $|x^2 - 5x + 6| \le x + 2$

30. Solve: $|x^2 - 6x - 4| < 3$

Question NO. 6

1. Using properties of determinants, show that: $\begin{vmatrix} a+x & a & a & a \\ a & a+x & a & a \\ a & a & & a+x \end{vmatrix} = x^2(3\ a + x)$

2. Using properties of determinants, show that: $\begin{vmatrix} 1 & 1 & 1 \\ a+1 & b+1 & c+1 \\ (a+1)^2 & (b+1)^2 & (c+1)^2 \end{vmatrix} = (a-b)(b-c)(c-a)$

3. Using properties of determinants, show that: $\begin{vmatrix} a & b & & c \\ b+c & c+a & & a+b \\ a+b & b & b+c & c+a \end{vmatrix} = a^3+b^3+c^3-3\,abc.$

4. Using properties of determinants, show that: $\begin{vmatrix} a+t & a & a \\ b & b+t & b \\ c & c & c+t \end{vmatrix} = t^2(a+b+c+t).$

5. Using properties of determinants, show that: $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

6. Using properties of determinants, show that: $\begin{vmatrix} y+z & z+x & x+y \\ x & y & z \\ x^2 & y^2 & z^2 \end{vmatrix} = (x+y+z)(x-y)(y-z)(z-x).$

7. Using properties of determinants, show that: $\begin{vmatrix} 1 & 1 & 1 \\ a^2+1 & b^2+1 & c^2+1 \\ a^3+a & b^3+b & c^3+c \end{vmatrix} = (a-b)(b-c)(c-a)(ab+bc+ca-1).$

8. Using properties of determinants, show that: $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc+ab+bc+ca.$

9. Find the inverse of $A = \begin{bmatrix} 1 & 2 & 1 \\ -5 & 0 & 4 \\ 5 & 4 & 0 \end{bmatrix}$; and show that $A^{-1}A = I_3$

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

11. Solve the following systems of linear equation by Cramer's rule: $\left.\begin{array}{c} 2x+y-z=1 \\ x-y+2z=3 \\ 3x+2y+z=4 \end{array}\right\}$

12. Solve the following systems of linear equation by Cramer's rule: $\left.\begin{array}{c} x_1+2x_2-3x_3=0 \\ 4x_1-x_2+x_3=5 \\ 2x_1+3x_2+2x_3=3 \end{array}\right\}$.

13. Solve the following system of linear equation by matrix inversion method: $\left.\begin{array}{c} x-2y+z=1 \\ 3x+y-2x=4 \\ y-z=1 \end{array}\right\}$

14. Solve the following system of linear equation by matrix inversion method: $\left.\begin{array}{c} x+y=2 \\ 2x-z=1 \\ y-3z=-1 \end{array}\right\}$

15. Use matrix inversion method to solve the system: $x_1-2x_2+x_3=-4$, $2x_1-3x_2+2x_3=-6$, $2x_1+2x_2+x_3=5$

16. Resolve the following into partial fraction: $\frac{2x+3}{(x+1)(x+2)(x+3)}$

17. Resolve the following into partial fraction: $\frac{x^2+4x+5}{(x+1)(x^2+5x+6)}$

18. Resolve the following into partial fraction: $\frac{x+1}{(x-1)^2}$

19. Resolve the following into partial fraction: $\frac{x^2+x}{(x^2-1)^2}$

20. Resolve the following into partial fraction: $\frac{3x^2+4x-5}{(x-1)^3}$

21. Resolve the following into partial fraction: $\frac{1}{x(x+1)^3}$

22. Resolve $\frac{1}{(x+1)^2(x^2-1)}$ into partial fraction.

23. Resolve into partial fractions: $\frac{2x^2+3x+3}{(x+1)(x^2+1)}$

24. Resolve into partial fractions: $\frac{3x^2+3}{x^3+1}$

25. A signal process system has a transfer function $H(z)=\frac{z^2+3z+2}{z^2-0.2z+0.9}$ zero(s) of the transfer function by using factor theorem.

26. A signal process system has a transfer function $H(z)=\frac{z^2-0.5z-0.5}{z^3+1}$ zero(s) of the transfer function by using factor theorem.

27. The denominator of signal processing system's transfer function equal to $A(z)=z^2+1.2z+0.35$ Use factor theorem to determine the location of the corresponding poles and assess the stability of the system.

Question NO. 7

1. If $\frac{1}{a-c},\frac{1}{b-c},\frac{1}{b-a}$ are in A.P, the show that $\frac{a-b}{a-c}=\frac{a-c}{b-a}$.
2. If $\frac{1}{a},\frac{1}{b}$ and $\frac{1}{c}$ are in A.P, show that $b=\frac{2\,ac}{a+c}$
3. If $\frac{1}{a},\frac{1}{b}$ and $\frac{1}{c}$ are A.P., show that the common difference is (equation).
4. If a_k and a_m, denotes two different terms of an A.P., show that its nth term is $a_\epsilon+(n-k)(\frac{a_k+a_m}{k-m})$.
5. Insert five A.Ms. between $\sqrt{2}$ and $\frac{15}{\sqrt{2}}$
6. For what value of n, $\frac{a^{n+1}+b^{n+1}}{a^n+b^n}$ is the A.M between a and b, where $a\neq b$.
7. If $\frac{1}{a+b},\frac{1}{c+a},\frac{1}{b+c}$ are in A.P then show that a^2,b^2,c^2 in A.P
8. If $\frac{1}{a},\frac{1}{b}$ and $\frac{1}{c}$ are in G.P. Show that the common ration is $\pm\sqrt{\frac{a}{c}}$.
9. For what value of $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ is the positive geometric mean between a and b?
10. The A.M of two positive integral numbers exceeds their (positive) G.M. by 2 and their sum is 20, find the numbers.
11. If the numbers $\frac{1}{k},\frac{1}{2k+1}$ and $\frac{1}{4k-1}$ are in harmonic sequence, find k.
12. Find n so that $\frac{a^{n+1}+b^{n+1}}{a^n+b^n}$ may be H.M between a and b.
13. If $\frac{b+c-a}{a},\frac{c+a-b}{b},\frac{a+b-c}{c}$ are in A.P., show that a, b, c are in H.P.
14. If between any two numbers there are inserted two A.Ms A_1,A_2, two G.Ms. G_1,G_2 and two H.Ms. H_1,H_2: show that $\frac{A_1+A_2}{G_1G_2}=\frac{H_1+H_2}{H_1H_2}$.
15. If the 4th and 7^{th} term of the H.P are $\frac{2}{13}$ and $\frac{2}{25}$ respectively, find the sequence.
16. Sum the following series upto n terms: $1\times3\times5+2\times4\times6+3\times5\times7+\ldots$
17. Sum the following series upto n terms: $2^2+4^2+6^2+\ldots.$
18. Sum the series: $1^2-2^2+3^2-4^2+\ldots+(2n-1)^2-(2n)^2$.

19. Sum the series: $\frac{1^2}{1}+\frac{1^2+2^2}{2}+\frac{1^2+2^2+3^2}{3}+\ldots$ to n term.

20. Find the sum to n term of the series whose n^{th} term are given: n^2+2n-3

21. Given n^{th} terms of the series, find the sum to 2n terms: $3n^2+5n+2$

22. Express as a single fraction: $\frac{(n+2)!}{(r+2)!}+\frac{(n+1)!}{(r+1)!}$

23. Prove from the first principle that: $n_p=n.^{n-1}p_{r-1}$

24. Prove from the first principle that: $n_p=^{n-1}p_r+r.^{n-1}p_{r-1}$

25. From a standard deck of 52 playing cards, there are 26 black cards and 26 red cards. How many different ways can eight cards be selected if 3 are black and the remaining 5 are red?

Question NO. 8

1. Prove that: $\frac{\sin\theta-\cos\theta\tan\frac{\theta}{2}}{\cos\theta+\sin\theta\tan\frac{\theta}{2}}=\tan\frac{\theta}{2}$
2. Prove that: $\frac{1-\tan\theta\tan\phi}{1+\tan\theta\tan\phi}=\frac{\cos(\theta+\phi)}{\cos(\theta-\phi)}$
3. Show that $\cos(\alpha+\beta)\cos(\alpha-\beta)=\cos^2\alpha-\sin^2\beta=\cos^2\beta-\sin^2\alpha$
4. Show that $\frac{\tan\alpha+\tan\beta}{\tan\alpha-\tan\beta}=\frac{\sin(\alpha+\beta)}{\sin(\alpha-\beta)}$
5. Show that: $\sin(\alpha+\beta)=\frac{1+\cot\alpha\tan\beta}{\cos ec\,\alpha\sec\beta}$
6. Show that: $\cot(\alpha+\beta)=\frac{\cot\alpha\cot\beta-1}{\cot\alpha+\cot\beta}$
7. If $\sin\alpha=\frac{24}{25}$ and $\cos\beta=\frac{20}{29}$ where $0<\alpha<\frac{\pi}{2}$ and $0<\beta<\frac{\pi}{2}$ show that $\sin(\alpha-\beta)=\frac{333}{725}$
8. Prove that: $\frac{\cos 19^\circ+\sin 19^\circ}{\cos 19^\circ-\sin 19^\circ}=\tan 64^\circ$.
9. Prove that: $\cos(60^\circ+\theta)\cos(60^\circ-\theta)+\sin(60^\circ+\theta)\sin(60^\circ-\theta)=\cos 2\theta$.
10. If α,β,γ are the angles of a triangle ABC, show that: $\cot\frac{\alpha}{2}+\cot\frac{\beta}{2}+\cot\frac{\gamma}{2}=\cot\frac{\alpha}{2}\cot\frac{\beta}{2}\cot\frac{\gamma}{2}$.
11. If $\alpha+\beta+\gamma=180$, show that $\cot\alpha\cot\beta+\cot\beta\cot\gamma+\cot\gamma\cot\alpha=1$.
12. If α,β,γ are the angles of $\triangle ABC$ Prove that: $\tan\alpha+\tan\beta+\tan\gamma=\tan\alpha\tan\beta\tan\gamma$.
13. If α,β,γ are the angles of $\triangle ABC$, Prove that: $\tan\frac{\alpha}{2}\tan\frac{\beta}{2}+\tan\frac{\beta}{2}\tan\frac{\gamma}{2}+\tan\frac{\gamma}{2}\tan\frac{\alpha}{2}=1$.
14. Prove the following: $\cot\alpha-\tan\alpha=2\cot 2\alpha$.
15. Prove the following: $\frac{1-\cos\alpha}{\sin\alpha}=\tan\frac{\alpha}{2}$
16. Prove the following: $\frac{\cos\alpha-\sin\alpha}{\cos\alpha+\sin\alpha}=\sec 2\alpha-\tan 2\alpha$
17. Prove the following: $\sqrt{\frac{1+\sin\alpha}{1-\sin\alpha}}=\frac{\sin\frac{\alpha}{2}+\cos\frac{\alpha}{2}}{\sin\frac{\alpha}{2}-\cos\frac{\alpha}{2}}$
18. Prove the following: $\frac{\operatorname{cosec}\theta+2\cos ec\,2\theta}{\sec\theta}=\cot\frac{\theta}{2}$
19. Prove the following: $\frac{3+\cos 4\theta}{1-\cos 4\theta}=\frac{1}{2}(\tan^2\theta+\cot^2\theta)$
20. Prove the following: $\frac{1+\sin 2\theta}{1-\sin 2\theta}=\tan^2(\frac{\pi}{4}+\theta)$
21. Prove the following: $\cos^2\frac{\pi}{8}+\cos^2\frac{3\pi}{8}+\cos^2\frac{5\pi}{8}+\cos^2\frac{7\pi}{8}=2$
22. Show that: $2\cos\theta=\sqrt{2+\sqrt{2+2\cos 4\theta}}$ [: 299]

23. Prove the following identity: $\frac{\sin 8x-\sin 2x}{\cos 8x+\cos 2x}=\tan 5x$

24. Prove the following identity: $\frac{\sin 80^\circ+\sin 40^\circ}{\cos 80^\circ+\cos 40^\circ}=\sqrt{3}$

25. Prove that: $\sin\frac{\pi}{9}\sin\frac{2\pi}{9}\sin\frac{\pi}{3}\sin\frac{4\pi}{9}=\frac{3}{16}$

26. Prove that: $\sin 10^\circ\sin 30^\circ\sin 50^\circ\sin 70^\circ=\frac{1}{16}$

27. Show that $\cos 20^\circ\cos 40^\circ\cos 80^\circ=\frac{1}{8}$ [: 311]

28. Evaluate the following limit: $lim_{x\to\frac{\pi}{4}}\frac{\sin x-\cos x}{x-\frac{\pi}{4}}$

29. Evaluate the following limit: $Lim_{x\to 0}\frac{\cos ax-\cos bx}{x^2}$

30. Evaluate the following limit: $lim_{x\to 0}\frac{\cos ax-\cos bx}{\cos cx-\cos dx}$

31. Express the following limit in term of e: $Lim_{n\to\infty}(1+\frac{1}{3n})^n$

32. Express the following limit in term of e: $lim_{x\to\infty}(\frac{x}{1+x})^x$

33. Express the following limit in term of e: $lim_{x\to 0}\frac{e^{\frac{1}{x}}-1}{e^{\frac{1}{x}}+1}, x<0$

34. If $f(x)=\begin{cases}3x & if\ x\le -2\\ x^2-1 & if -2<x<2\\ 3 & if\ x\ge 2\end{cases}$ discuss continuity at $x=2$ and $x=-2$.

35. Find the values of m and n, so that given function f is continuous at $x=3$. $f(x)=\begin{cases}mx & if\ x<3\\ n & if\ x=3\\ -2x+9 & if\ x>3\end{cases}$

36. Determine whether $Lim_{x\to 2}f(x)$ and $Lim_{x\to 4}f(x)$ exist, when $f(x)=\begin{cases}2x+1 & if\ 0\le x\le 2\\ 7-x & if\ 2<x<4\\ x & if\ 4\le x\le 6\end{cases}$

37. $f(x)=\begin{cases}\frac{\sqrt{2x+5}-\sqrt{x+7}}{x-2} & , x\ne 2\\ k & , x=2\end{cases}$ find value of k so that f is continuous at $x=2$.

38. Discuss the continuity of the function $f(x)$ and $g(x)$ at $x=3$. $f(x)=\begin{cases}\frac{x^2-9}{x-3} & if\ x\ne 3\\ 6 & if\ x=3\end{cases}$

Question NO. 9

1. A particle moves along a line such that its position after t hours is given by $s(t)=4t^2+2t+1$ (in miles). Find the instantaneous velocity at $t=3$.
2. Find the derivative of $\sqrt{x}$ at $x=a$ from first principle.
3. If $y=\frac{1}{x^2}$ then find $\frac{dy}{dx}$ at $x=-1$ by ab-initio method.
4. Differentiate w.r.t 'x': $x^{-3}+2x^{-\frac{3}{2}}+3$
5. Differentiate w.r.t 'x': $\frac{(1+\sqrt{x})(x-x^{\frac{3}{2}})}{\sqrt{x}}$

6. Differentiate $v.r.t'x'$: $(\sqrt{x}-\frac{1}{\sqrt{x}})^2$

7. Differentiate w.r.t 'x': $\frac{(x^2+1)^2}{x^2-1}$

8. Differentiate $w.r.t'x'$: $\frac{2x-1}{\sqrt{x^2+1}}$

9. Find $\frac{dy}{dx}$ if $y=\frac{(\sqrt{x}+1)(x^{\frac{3}{2}}-1)}{x^{\frac{1}{2}}}.(x\neq 1)$.

10. Differentiate $\frac{(\sqrt{x}+1)(x^{\frac{3}{2}}-1)}{x^{\frac{3}{2}}-x^{\frac{1}{2}}}$ with respect to x.

11. If $y=\sqrt{x}-\frac{1}{\sqrt{x}}$. show that $2x\frac{dy}{dx}+y=2\sqrt{x}$

12. If $y=x^4+2x^2+2$, prove that $\frac{dy}{dx}=4x\sqrt{y-1}$.

13. Find the direction cosines for the given vector: $\underline{v}=4\underline{i}+2\underline{j}-5\underline{k}$

14. Find the direction cosines for the given vector: $\overrightarrow{PQ}$ where $P(9,3,13)$ and $Q(11,6,19)$

15. Find the work done, if the point at which the constant force $\underline{F}=2\underline{i}+5\underline{j}+3\underline{k}$ is applied to an object, moves it from $P_1(2,-3)$ to $P_2(7,5,3)$.

16. A force of magnitude 6 units acting parallel to $4\underline{i}+3\underline{j}-\underline{k}$ displace the point of application from $A(2,-1,3)$ to $B(7,3,2)$. Find the work done.

17. Show that the vectors $\overrightarrow{AB}=2\underline{i}-\underline{j}+\underline{k}$, $\overrightarrow{BC}=\underline{i}-3\underline{j}-5\underline{k}$ and $\overrightarrow{AC}=3\underline{i}-4\underline{j}-5\underline{k}$ are the sides of a right triangle.

18. Prove that: $\underline{a}\times(\underline{b}+\underline{c})+\underline{b}\times(\underline{c}+\underline{a})+\underline{c}\times(\underline{a}+\underline{b})=\underline{0}$

19. If $\underline{a}+\underline{b}+\underline{c}=\underline{0}$ then prove that $\underline{a}\times\underline{b}=\underline{b}\times\underline{c}=\underline{c}\times\underline{a}$

20. Find the moment about the point $M(1,-3,3)$ of the force represented by $\overrightarrow{AB}$. where the coordinates of points $A(4,3,-1)$ and $B(-1,3,7)$ are given.

21. A force $\vec{F}=6\underline{i}+4\underline{j}-4\underline{k}$ is applied at the point $A(1,-1,2)$. Find the moment of the force about the point $B(3,-2,3)$.

22. Give a force $\underline{F}=2\underline{i}+\underline{j}-3\underline{k}$ acting at a point $A(1,-2,1)$ Find the moment of $\vec{F}$ about the point $B(2,0,2)$.

23. A force $\underline{F}=-2\underline{i}+\underline{k}-3\underline{k}$ is applied at $P(-1,-3,2)$. Find its moment about the point $Q(4,2,2)$.

24. If $\underline{a}=4\underline{i}+3\underline{j}+\underline{k}$ and $\underline{b}=2\underline{i}-\underline{j}+2\underline{k}$ Find a unit vector perpendicular to both a and b. Also find the sine of the angle between the vectors a and b.

25. In any triangle ABC, prove that $\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$