① About a sequence the correct fact is
a) A sequence is convergent, if all its sub-sequences are convergent
b) A sequence is convergent, if it has a convergent subsequence
c) A divergent sequence has a convergent subsequence
d) A sequence is convergent, if it has an oscillatory sequence

② The sequence $S_n = \left(1+\frac{1}{n}\right)^n$ is convergent, whose limit lies
a) between 0 & 1 b) between 1 & 2
c) between 2 & 3 d) between 3 & 4

③ Limit of convergence of the sequence $S_n = \frac{n^2+5}{n^2+3}$ is
a) 0 b) 1 c) ∞ d) $-\infty$

④ The value of $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$ lies between
a) 1 & 2 b) 3 & 4 c) 2 & 3 d) 0 & 1

⑤ A sequence is
a) Convergent, if the limit superior is equal to the limit inferior
b) divergent, if it has a convergent subsequence
c) monotonic, then bounded
d) Convergent, if it has a convergent subsequence

⑥ Let $\langle U_n \rangle$ be monotonic increasing bounded sequence, then
a) the sequence is divergent sequence
b) the sequence is convergent sequence
c) the sequence is not absolutely convergent
d) None of the above

⑦ The series $\frac{1}{2} + \frac{2}{3}x + \left(\frac{3}{4}\right)^2 x^2 + \cdots \infty$ term is
a) convergent for $x \le 1$
b) convergent for $x < 1$
c) divergent for $x > 1$
d) convergent for $x = 1$

8) Let n be a natural number, then series $\sum 1/n^p$, where $p>1$ is
a) convergent series b) divergent series
c) Conditionally convergent d) alternating series

9) Series $\sum_{n=0}^{\infty} 1/5^n$ is
a) convergent b) divergent
c) oscillatory d) None of these

10) A series $\sum U_n$ is absolutely convergent if
a) $\lim_{n\to\infty} \sum U_n$ = finite b) $\lim_{n\to\infty} \sum |U_n| = 0$
c) $\lim_{n\to\infty} \sum |U_n|$ = finite d) $\lim_{n\to\infty} \sum |U_n| = \infty$

11) The series $\sum \frac{1}{n^{a+\frac{b}{n}}}$ is divergent, if
a) $a>1$ b) $a\leq 1$ c) $a=\infty$ d) $a=e$

13) Series $1-\frac{1}{2}+\frac{1}{3^2}$ ---- ∞ terms is
a) absolutely convergent b) conditionally convergent
c) no convergent d) divergent

13) The Series $\sum (-1)^n \frac{1}{\sqrt{n}}$ is
a) divergent b) convergent
c) oscillatory d) not cauchy sequence

14) The correct fact about convergent of series is
a) every absolutely convergent series is convergent series
b) every convergent series is absolutely convergent
c) there exist a series which is both convergent and divergent
d) there exists a series which is neither convergent nor divergent not oscillatory

15) According to D'Alembert ratio Test of the series $\sum U_n(x)$ is
a) convergent, if $\lim_{n\to\infty} \frac{U_{n+1}}{U_n} < 0$ b) divergent if $\lim_{n\to\infty} \frac{U_{n+1}}{U_n} > 1$
c) divergent, if $\lim_{n\to\infty} \frac{U_{n+1}}{U_n} > 0$ d) divergent if $\lim_{n\to\infty} \frac{U_{n+1}}{U_n} = 0$

16) The series whose general term is $\{(n^3-1)^{1/3} - n\}$ is
a) divergent b) stationary
c) oscillatory d) convergent

17) The series whose general term is $\frac{n+1}{n^3} x^n$ at $x=1$ is
a) Convergent b) divergent c) oscillatory d) static

18) According to Raabe test the series ΣU_n is convergent, if
a) $\lim_{n\to\infty} n\left[\frac{U_n}{U_{n+1}} - 1\right] > 0$ b) $\lim_{n\to\infty} n\left(\frac{U_n}{U_{n+1}} - 1\right) > 1$
c) $\lim_{n\to\infty} n\left(\frac{U_n}{U_{n+1}} - 1\right) < 1$ d) $\lim_{n\to\infty} n\left[\frac{U_n}{U_{n+1}} - 1\right] < 0$

19) Series $1 + \frac{2x}{2!} + \frac{3^2x^2}{3!} + \cdots \infty$ terms is
a) Convergent, if $x < \frac{1}{e}$ b) divergent if $x \geq 1/e$
c) Convergent, if $x \leq 1/e$ d) divergent, $x = 1/e$

20) The series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$ is
a) semi - convergent b) absolutely convergent
c) divergent d) semi - divergent

21) The series $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots + (-1)^n \frac{1}{n} + \cdots$ is
a) alternating series but not convergent
b) Convergent series but not absolutely convergent
c) absolutely convergent
d) divergent series

22) An infinite series in which the terms are alternately positive and negative and each other is numerically less than the preceding term is
a) convergent b) divergent c) alternating series d) oscillatory

23) The series $1 + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \cdots \frac{1}{\sqrt{n}}$ is
a) convergent b) divergent c) oscillatory d) static

24) The series $\sum x^n \cos n\theta$ is absolutely convergent, if
a) $|x| < 1$ b) $|x| > 1$ c) $|x| = \pi$ d) $|x| = \pi/2$

25) A relation in the set of natural numbers N is defined as follows $a < b$, if $a + x = b$ has a solution in N, then the relation '<' is
a) reflexive b) symmetric c) transitive d) an equivalence relation

26) If $a \equiv b \pmod n$ and m/n, then which is true?
a) $a \equiv b \pmod m$ b) $ab = mn$
c) $am = bn$ d) $a \equiv b \pmod{m^n}$

27) Let N be the set of natural numbers Z be the set of integers, then which of the following is a group?
a) $(N, +)$ b) $(N, \cdot)$ c) $(Z, \cdot)$ d) $(Z, +)$

28) On a non-empty set G, the binary operation is
a) a map from G to G b) a map from G to the set of real numbers
c) a map from $G \times G$ to G d) a map from G to $G \times G$

29) Let G has two elements, then number of binary operation on G is
a) 2 b) 4 c) 8 d) 16

30) The centre of an abelian group G is equal to
a) $\{e\}$ b) the whole group of G
c) proper subgroup of G d) All of these

31) Let M_n^2 is a collection of all n square matrices with real entries, then
a) this set is abelian group with respect to addition of matrices
b) this collection is non-abelian group with respect to addition of matrices
c) the collection is abelian group w.r.t. matrix multiplication
d) non-abelian group w.r.t. matrix multiplication

32) The permutation group S_3 on 3 symbols is
a) ~~abelian~~ abelian group of order 6
b) non abelian group of order 3
c) non-abelian group of order 6
d) abelian group of order 9

33) The centre of the symmetric group of permutation on 3 symbols $S = \{a, b, c\}$ is
a) 1 b) $\{1, (a, b)\}$ c) $\{1, (a, b), (b, c)\}$ d) $\{1, (abc)(acb)\}$

34) Correct fact about alternating group is,
a) it is normal subgroup of symmetric group of permutations
b) it contains half odd permutations and half of them are even permutations
c) it contains all odd permutations
d) it contains no even permutations

35) Let G be a group of order 10 and H be a subgroup of G, then order H can be,
a) 4 b) 5 c) 6 d) 7

36) If the order of an element $a \in G$ is n, then the order of a^p is
a) less than n b) equal to n c) less than or equal to n d) none of these

37) Lagrange theorem for finite group is that
a) order of elements of the group divides the order of the group
b) Order of each subgroup divides order of the group
c) a group G can have subgroups of all possible orders less than or equal to the order of the group
d) only abelian group has subgroups

38) A group of order 6 cannot have a subgroup of order
a) 1 b) 2 c) 3 d) 4

39) The number of elements of order 11 in a group of order 33 is
a) 20 b) 30 c) 1 d) 10

40) Let $o(G) = 24$ and G be the cyclic. if $a \in G$ such that $a^8 \neq e$ $a^{12} \neq e$, then the order of a is
a) 3 b) 4 c) 6 d) 24

41) In an abelian group, the order of an element a is 4 and order of element b is 3, then $(a^2 b^{14})$ is
a) $a^2 b^{-1}$ b) $(ab)^{-2}$ c) a^2 d) b

42) Let G be a group of order 49, then
a) G is abelian b) G is cyclic
c) G is non-abelian d) centre of G has order 7

42) Let S be a set and P(S) be the power set of S, then $\{P(S), \cup\}$ is not a group because
a) P(S) is not closed with $\cup$ b) $\cup$ is not associative
c) inverse does not exist d) Identity element does not exist

43) If in a group $a^5 = e$, $aba^{-1} = b^2$ for $a, b \in G$, then $o(b)$ is
a) 30 b) 31 c) 32 d) 33

44) If H and K are two subgroup of a group G, then
a) $H \cup K$ is a subgroup of G b) $H \cap K$ is a subgroup of G
c) $H - K$ is a subgroup of G d) $H \times K$ is a subgroup of G

45) Number of possible subgroups of additive group of integers is
a) one b) two c) only finitely many d) infinitely many

46) If a cyclic group has only 3 subgroups (e) a subgroup of order 7 and group itself, then the order of the group is
a) 14 b) 7 c) 49 d) cannot be determined

47) If G is a group and H be a subgroup of G, such that $xyx^{-1}y^{-1} \in H$ $x, y \in G$ then
a) H must be abelian b) must be non-abelian
c) H must be cyclic d) H must be normal subgroup of G

48) The centre of S_3 on $S = \{a, b, c\}$ is
a) $\{I\}$ b) A_3 c) $\{(ab)(bc)\}$ d) $\{(abc)(acb)\}$

49) If $o(G) = 27$ and G is non abelian, then the order of; the centre of G is
a) 1 b) 3 c) 9 d) 27

50) Let G be a cyclic group of order 7 the number of generators
a) 1 b) 2 c) 6 d) 7

51) Klein's four group is not
a) an abelian group (b) cyclic group
c) a group having each element its own inverse
d) the order of each element ≠ e is 2 except identity

52) If a group has only one generator, then the number of element in the group is
a) an odd prime b) any prime c) even integer (d) at most two

53) If G is a group of 9th root of unity w.r.t. multiplication of roots, then the number of elements of order 9 in G is
(a) 6 b) 9 c) 2 d) 3

54) A cyclic group has at least
(a) one generator b) two generators
c) three generator d) four generators

55) A group of order 7 is
(a) always cyclic group b) non-abelian group
c) generated by identity element d) All of these

56) The correct answer is
a) Every abelian group is cyclic (b) every cyclic group is abelian
c) no cyclic group is abelian d) no abelian group is cyclic

57) Which of the following groups is not cyclic group?
a) Group of integers with respect to operation addition
b) Group $(Z_5, +_5)$ integer modulo addition 5
(c) Symmetric group of permutations S_3
d) Alternating group A_3

58) A group of order 4 is
a) always cyclic group
b) always Klein's four group
(c) either cyclic or Klein's four group
d) neither (a) nor (b)

59) Let $f: G_1 \to G_2$ is an onto homomorphism with Kernel K, then G_2 is isomorphic to
a) G_1 b) G_1/K c) $\{e\}$ d) $G_2 - \{e\}$

60) Let $f: G_1 \to G_2$ is an onto homomorphism, then f is an isomorphism iff
a) $\ker f = \{e\}$ b) $\ker f = \phi$ c) $\ker f = G_1$ d) $\ker f \neq \{e\}$

61) Let $f: G_1 \to G_2$ is a homomorphism and $a \in G_1$ such that order of 'a' is n then order of f(a) is
a) Equal to order of 'a' b) divisor of order 'a'
c) multiple of order of 'a' d) independent of order of 'a'

62) Which of the following is normal subgroup in the symmetric group of permutations S_3 on $S = \{a, b, c\}$?
a) Alternating group A_3 b) $\{I, (ab)\}$
c) $\{I, (ab)(bc)\}$ d) $\{I, (bc)(ca)\}$

63) Let R be finite ring, then its characteristic is
a) finite b) non zero c) zero d) none of these

64) The characteristic of an infinite ring is always
a) finite b) zero c) infinite d) prime

65) Let $(\mathbb{Z}, +, \cdot)$ be a set of integers equipped with addition and scalar multiplication is
a) not ring b) ring without unity c) ring with unity d) non abelian ring

66) The smallest ring is
a) $R = \{0, +, \cdot\}$ b) $R = \{0, 1, +_2, \times_2\}$
c) $(\mathbb{Z}, +, \cdot)$ d) $(N, +, \cdot)$

67) The set of all matrices of the form $\begin{bmatrix} 0 & x \\ 0 & y \end{bmatrix}$, $x, y \in \mathbb{R}$ Under the two operation matrix addition and matrix multiplication, is
a) ring with unity b) commutative ring
c) non-commutative ring without zero divisor
d) ring without zero divisor unity

68) Which of the following is not subring of ring of integers?
a) $(N,+,\cdot)$ b) $(2Z,+,\cdot)$ c) $(3Z,+,\cdot)$ d) $(mZ,+,\cdot)$

69) Which of the following is not an integral domain?
a) $(N,+,\cdot)$ b) $(Q,+,\cdot)$ c) $(R,+,\cdot)$ d) $(C,+,\cdot)$

70) A Ring R is integral domain, if
a) R is ring without zero divisors
b) R is commutative ring without zero divisors
c) R is commutative ring with unity and without zero divisors
d) every ring is integral domain

71) If N be a set of natural numbers, then
a) $(N,+,\cdot)$ is a ring b) $(N,+,\cdot)$ is an integral domain
c) $(N,+,\cdot)$ is skew-field d) $(N,+,\cdot)$ is not a ring

72) The correct fact about ring is
a) A ring is an integral domain b) Every field is a ring
c) Every skew-field is field d) Every integral domain is field

73) $(Z,+_6,\times_6)$ is
a) integral domain b) not integral domain
c) field d) division ring

74) Set of even integers is
a) a ring with respect to addition and multiplication
b) field with respect to addition and scalar multiplication
c) not integral domain
d) non-abelian ring

75) A field has
a) at least one element c) at least two elements
b) at least three element d) at least infinitely many elements

76) Let R be a collection of all non-singular matrices with real entries equipped with addition and multiplication of matrices then
a) $(R,+,\cdot)$ is a field b) $(R,+,\cdot)$ is skew field c) Both a and b are true d) Neither a nor b is true

77) The correct fact about an ideal is
a) Every subring is an ideal ✗ b) Every ideal is a subring
c) Both a and b are correct d) Neither a nor b is correct

78) Let $f:(R_1,+,\cdot) \to (R_2,+,\cdot)$ is a ring homomorphism, then
✗ a) Kernel of f is subring of R_1 b) Kernel is subring of R_2
c) Kernel is not subring of R_1 d) None of these

79) $f(z) = e^z$ is
a) Periodic function of period 2π ✓ b) periodic function of period $2\pi i$
c) not a periodic function d) periodic function, if z is a real number

80) The real part of $\exp(e^{i\theta})$ is
✓ a) $e^{\cos\theta}\cos(\sin\theta)$ b) $e^{\sin\theta}\cos(\sin\theta)$
c) $e^{\cos\theta}\sin(\sin\theta)$ d) $e^{\cos\theta}\cos(\cos\theta)$

81) The value of $\sin(iz)$ is
a) $\sinh z$ ✓ b) $i\sinh z$ c) $i\sin z$ d) $\cos z$

82) The expression of $\sinh z$ is
a) $z - \frac{z^3}{3!} + \frac{z^5}{5!} +$ ✓ b) $z + \frac{z^3}{3!} + \frac{z^5}{5!} + \cdots$
c) $1 + z^2 + \frac{z^4}{4!} + \cdots \infty$ term d) $1 - z^2 + \frac{z^4}{4!} + \cdots$

83) The correct relation is
a) $\cosh^2 z = 1 - \sinh^2 z$ ✓ b) $\cosh^2 z - \sinh^2 z = 1$
c) $\cosh^2 z = 1 + \sinh^2 z$ d) $\sinh^2 z = 1 + \cosh^2 z$

84) The real part of $\sin^2(x+iy)$ is
a) $\frac{1}{2}\sin 2x \cdot \sinh 2y$ ✓ b) $\frac{1}{2}(1 - \cos 2x \cdot \cosh 2y)$
c) $\frac{1}{2}\cos 2x \cdot \sinh 2y$ d) $\frac{1}{2}(1 - \sin 2x \cdot \sinh 2y)$

85) $\sin(\theta + i\phi) = \tan\alpha + i\sec\alpha$ then $\cos 2\theta \cosh 2\phi$ is equal to
✓ a) 3 b) 4 c) 2 d) 0

86) The hyperbolic function have ____ period
a) real b) complex ✓ c) imaginary d) infinite

87) The value of $\log i$ is
a) $i\pi(2n+\frac{1}{2})$ b) $i\pi(2n-\frac{1}{2})$ c) $2\pi ni$ d) $i\pi(2n+1)$

88) The value of $\log_i i$ is
a) i b) 1 c) $\frac{2m+1}{2n+1}$ d) $\frac{4m+1}{4n+1}$

89) The principal value of $\log_2(-5)$ is
a) $\frac{\log 5 + \pi i}{\log 2}$ b) $\frac{\log 2 + \pi i}{\log 5}$ c) $\frac{\log 3 - \pi i}{\log 2}$ d) none of these

Answer: a

90) $i \log\left(\frac{x-i}{x+i}\right)$ is equal to
a) $2\pi - \tan^{-1}x$ b) $\pi - 2\tan^{-1}x$ c) $\pi - 2\tan x$ d) $\pi + 2\tan^{-1}x$

91) The value of $(-i)^{-i}$ is
a) $e^{2\pi i}$ b) 1 c) $e^{\frac{\pi}{2}(4n-1)}$ $e^{\frac{\pi}{2(4n-1)}}$ d) $e^{\pi(4n-1)}$

92) The value of $\sin(\log i)^i$ is
a) 0 b) $-i$ c) 1 d) i

Answer: b

93) The correct expression is
a) $\tanh^{-1}z = \frac{1}{2}\log\left(\frac{1+z}{1-z}\right)$ b) $\tanh^{-1}z = \frac{1}{2}\log\left(\frac{1-z}{1+z}\right)$
c) $\tanh^{-1}z = \frac{1}{2}\log\left(\frac{z-1}{z+1}\right)$ d) $\tanh^{-1}z = \frac{1}{2}\log\left(\frac{z+1}{z-1}\right)$

94) The correct relation is
a) $\sinh^{-1}x = -\sin ix$ b) $\sinh^{-1}x = -i\sin^{-1}(ix)$
c) $\sinh^{-1}(ix) = \sin^{-1}x$ d) $\sinh^{-1}x = i\sin^{-1}x$

95) The value of the series $1 - \frac{1}{3\cdot 3} + \frac{1}{5\cdot 3^2} - \frac{1}{7\cdot 3^2} + \cdots$ is
a) $\frac{\pi}{2\sqrt{3}}$ b) $\pi/\sqrt{3}$ c) $\frac{2\pi}{3}$ d) $\frac{\pi}{3}$

Answer: a

96) The correct expression is
a) $\tan^{-1}z = z - \frac{1}{3!}z^2 + \frac{1}{5!}z^5 - \cdots$
b) $\tan^{-1}z = z + \frac{1}{3}z^3 + \frac{1}{5}z^5 \cdots$
c) $\tan^{-1}z = 1 - \frac{1}{3}z^3 + \frac{1}{5}z^5 \cdots$
d) $\tan^{-1}z = 1 - \frac{z^2}{2} + \frac{z^4}{4!} - \cdots$

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97) The value of n when $\frac{-5\pi}{4} \le \theta \le -\frac{3\pi}{4}$ for general trigonometric series

a) $n=\pm 1$ b) $n=\pi$ c) $n=-1$ d) $n=0$

98) The value of $\frac{1}{3\cdot5} + \frac{1}{7\cdot9} + \frac{1}{11\cdot13} \cdots \infty$ term is

a) $\frac{1}{4} - \frac{\pi}{4}$ b) $\frac{1}{4} - \frac{\pi}{8}$ c) $\frac{1}{2} - \frac{\pi}{8}$ d) $\frac{1}{2} - \frac{\pi}{4}$

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99) C+iS method is applicable for

a) sine series b) cosine series c) Both a and b d) neither a nor b

100) If β is exterior angle of a regular polygon of n sides and α is any constant, then the value of $\sin\alpha + \sin(\alpha+\beta) + \sin(\alpha+2\beta) + \cdots$ to n term is

a) 0 b) 1 c) $\pi/2$ d) π

101) The value of the series $\cos\frac{\pi}{11} + \cos\frac{3\pi}{11} + \cos\frac{5\pi}{11} + \cos\frac{7\pi}{11} + \cos\frac{9\pi}{11}$ is

a) 2/3 b) 1 c) 1/2 d) 1/4

102) The sum of the series $\tan^{-1}\frac{1}{3+3\cdot1+1^2} + \tan^{-1}\frac{1}{3+3\cdot2+2^2} + \cdots \tan^{-1}\frac{1}{3+3\cdot n+n^2}$ is

a) $\frac{\pi}{2} - \cot^{-1}\frac{1}{\sqrt{n+1}}$ Ayadav b) $\frac{\pi}{2} + \cot^{-1}\frac{1}{\sqrt{n+1}}$

c) $\frac{\pi}{3} - \cos^{-1}\frac{1}{\sqrt{n+1}}$ d) $\frac{\pi}{2} + \cos^{-1}\frac{1}{\sqrt{n+1}}$

a) $\tan^{-1}\left(\frac{n}{n+5}\right)$ b) $\tan^{-1}\left(\frac{n}{2n+5}\right)$

c) $\tan^{-1}\left(\frac{n}{5n+2}\right)$ d) $\tan^{-1}\left(\frac{n}{2n+2}\right)$

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