Seat No.	

ENT - 43

Total No. of Pages : 20

P. G. Re-Entrance Examination, 2024
M.Sc. (MATHEMATICS)
Subject Code : 58716

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Day and Date : Friday, 28-06-2024 **Total Marks : 100**

Time : 12.30 p.m. to 02.00 p.m.

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Instructions :

1) All questions are compulsory.
2) Each question carries 1 mark.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Follow the instructions given on OMR sheet.
5) Rough work shall be done on the sheet provided at the end of question paper.

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1. Which of the following statement is **not** correct for the group $G = \{1, -1\}$ under multiplication.
   A) 1 is the identity element of G.
   B) 1 is the inverse of -1.
   C) G is abelian.
   D) 1 is the inverse of 1.

2. Consider the following statements for the elements in the group S_3:
   I) $(1\ 2\ 3) = (2\ 3\ 1)$.
   II) $(1\ 2)(1\ 3) = (1\ 3\ 2)$.
   Then
   A) Only I) is true
   B) Only II) is true
   C) Both I) and II) are true
   D) Both I) and II) are false

3. Consider the following statements for the group G:
   I) G is abelian.
   II) $G' = \{e\}$.
   Then
   A) Only I) $\Rightarrow$ II)
   B) Only II) $\Rightarrow$ I)
   C) Neither I) $\Rightarrow$ II) nor II) $\Rightarrow$ I)
   D) I) $\Leftrightarrow$ II)

4. Consider the ring $Z_7 = \{0, 1, 2, 3, 4, 5, 6\}$ under addition and multiplication modulo 7. Then
   $4 \odot_7 3 =$ _____.
   A) 5
   B) 6
   C) 1
   D) 0

5. If D is any integral domain. Then characteristic of D is _____ .
   A) either 0 or a prime number
   B) 1
   C) even integer
   D) odd integer

6. An element e in a ring R is called _____ if $e^2 = e$.
   A) generator
   B) zero divisor
   C) idempotent
   D) nilpotent

7. Let $< R, +, \cdot >$ be a ring and let I be an ideal of R. Consider the following statements:
   I) $< R, + >$ is abelian.
   II) I is a normal subgroup of R.
   Then
   A) Only I) is true
   B) Only II) is true
   C) Both I) and II) are true
   D) Both I) and II) are false

8. Let R and R' be rings. A one-one homomorphism from R to R' is called ____.
   A) endomorphism B) imbedding C) automorphism D) isomorphism

9. $o(A_3) =$ _____.
   A) 1
   B) 2
   C) 3
   D) 6

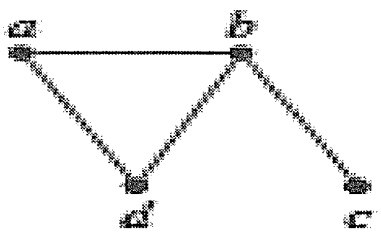
10. Let R and R' be rings and let $f: R \to R'$ be a homomorphism. Consider the following statements:
   I) f is one-one.
   II) $Ker\ f = \{0\}$. Then
   A) Only I) $\Longrightarrow$ II)
   B) Only II) $\Longrightarrow$ I)
   C) Neither I) $\Longrightarrow$ II) nor II) $\Longrightarrow$ I)
   D) I) $\Longleftrightarrow$ II)

11. Let $G = (V, E)$ be a graph, where $V = \{w_1, w_2, w_3, w_4, w_5\}$ and $E = \{(w_1, w_2), (w_2, w_3), (w_3, w_1), (w_4, w_2), (w_5, w_4), (w_5, w_3)\}$ then the degree of the vertex w_3 is
   A) 3 B) 4 C) 5 D) 2

12. Adjacency matrix of a graph G is always
   A) Symmetric B) Triangular C) Invertible D) Singular

13. Consider the following two statements:
   I: Every graph has a spanning tree.
   II : Any two spanning trees for a graph have the same number of edges.
   Then
   A) Only I is true B) Only II is true
   C) Both I and II are true D) Both I and II are false

14. The number of spanning trees for the following graph are



   A) 3 B) 4 C) 2 D) 1

15. Let G be a simple connected graph with n vertices and n edges $(n > 2)$. Then which of the following statement is true?
    A) G has no circuit.
    B) G has at least one circuit.
    C) The graph obtained by removing any edge from G is not connected
    D) None of these.

16. $\sim (p \leftrightarrow q)$ is logically equivalent to _____
    A) $q \leftrightarrow p$ B) $p \leftrightarrow \sim q$ C) $\sim p \leftrightarrow \sim q$ D) $\sim q \leftrightarrow \sim p$

17. Propositions that supports the conclusion of an argument are called
    A) Inferences B) Concepts C) Premises D) None of these

18. The octal equivalent of hexa decimal number B35 is
    A) 6454 B) 4564 C) 5465 D) 5645

19. Subtraction of the binary numbers 101101 and 10011 is
    A) 11010 B) 11011 C) 10110 D) 11001

20. Let P(x) denote the statement $x > 7$: Which of these have truth value true?
    A) P(0) B) P(- 4) C) P(6) D) P(8)

21. For the function $f(x) = x$ in [0, 3], let $P = \{0, 1, 2, 3\}$ be the partition of [of $L(f, P)$ is _____.
    (A) 0
    (B) 3
    (C) 6
    (D) 9

22. The integral $\int_0^{\infty} \frac{4a}{(x^2 + 4a^2)} dx$ is _____.
    (A) Convergent
    (B) divergent
    (C) oscillatory
    (D) proper integral

23. If $g(x) = \int_1^x \frac{1}{t^3+1}\, dt$, then $g'(x) =$ _____.

(A) $1/x$

(B) $\frac{1}{x^3+1}$

(C) $\frac{1}{x^3+1} - \frac{1}{2}$

(D) 0

24. If $f: [0,1] \to \mathbb{R}$ such that $f(x) = \begin{cases} 1 & \text{if } x \text{ is rational} \\ 0 & \text{if } x \text{ is irrational} \end{cases}$, then _____

(A) $U(f)$ and $L(f)$ do not exist

(B) f is integrable

(C) f is not integrable

(D) None of these

25. If f is integrable on $[a, b]$, then

(A) $|f|$ is integrable but converse is not true

(B) $|f|$ is not integrable

(C) $|f|$ is integrable and converse is true

(D) None of these

26. $\int_{-\infty}^{0} e^x\, dx$ is _____.

A) Converges to 1

B) Converges to 0

C) Converges to -1

D) divergent

27. The Cauchy Principal Value of $\int_{-1}^{1} \frac{1}{x} dx$ is

A) –3

B) 0

C) $^{5}/_{72}$

D) Does not exist

28. In the Fourier series expansion of $f(x) = x^2$ in $[-\pi, \pi]$, the value of a_0 is _

(A) $\frac{\pi^2}{3}$

(B) $\frac{2\pi^2}{3}$

(C) $\frac{4\pi^2}{3}$

(D) 0

29. In the Fourier series expansion of $f(x) = |x|$ in $[-\pi, \pi]$, the value of b_n is _____.

(A) π

(B) $\frac{2}{\pi n^2}((-1)^n - 1)$

(C) 0

(D) –1

30. In the Fourier series $f(x) = \frac{1}{2}a_0 + \sum_{n=1}^{\infty}(a_n \cos nx + b_n \sin nx)$ the value of the Fourier coefficient a_n is _____.

(A) $\frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\ dx$

(B) $\frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos nx\ dx$

(C) $\frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\sin nx\ dx$

(D) $\frac{2}{\pi}\int_{0}^{\pi} f(x)\sin nx\ dx$

31. The method used to solve LPP without artificial variables is called the _____ method.

(A) Dual Simplex method
(B) Simplex method
(C) artificial variable method.
(D) none of the above

32. The IBFS to the following transportation problem

		Destination					
		W_1	W_2	W_3	W_4	W_5	*Supply*
	F_1	2	11	10	3	7	4
Origin	F_2	1	4	7	2	1	8
	F_3	3	9	4	8	12	9
Demand:		3	3	4	5	6	

by using North-West Corner method is .....

A) 128 B) 153 C) 104 D) 199

33. Graphical optimal value for Z can be obtained from _____.

A) Corner points of feasible region
B) Both a and c
C) Corner points of the solution region
D) none of the above

34. When the sum of gains of one player is equal to the sum of losses to another player in a game, this situation is known as _____

A) two-person game B) two-person zero-sum game

C) zero-sum game D) non-zero-sum game

35. In game theory, the outcome or consequence of a strategy is referred to as the ....

A) payoff B) penalty C) reward D) end-game strategy.

36. The main objective of LPP is to maximize or minimize the .....

A) numerical value B) optimization C) cost D) None of the above

37. ..... or ..... are used to "balance" an assignment or transportation problem.

A) Destinations; sources

B) Units supplied; units demanded

C) Dummy rows; dummy columns

D) Large cost coefficients; small cost coefficients

38. There are five jobs, each of which must go through the two machines A and B in the order AB. Processing times (hours) are given below:

Job	1	2	3	4	5
Time for A	5	1	9	3	10
Time for B	2	6	7	8	4

the total ideal time for machine B is .....

A) 2 B) 3 C) 4 D) 5

39. For the following game

Player B

The value of game is .....

A) 51/7 B) 52/7 C) 53/7 D) 54/7

40. There are five jobs, each of which must go through the two machines A and B in the order AB. Processing times (hours) are given below:

Job	1	2	3	4	5
Time for A	10	2	18	6	20
Time for B	4	12	14	16	8

A sequence for the five jobs that will minimize the total elapsed time is .....

A) 1-2-3-4-5 B) 2-3-4-5-1 C) 2-4-3-5-1 D)1-3-4-2-5

41. $L\left\{t^{\frac{5}{2}}\right\} =$ _____.

A) $\frac{1}{8s^3}\sqrt{\frac{\pi}{s}}$ B) $\frac{3}{4s^2}\sqrt{\frac{\pi}{s}}$ C) $\frac{15}{8s^3}\sqrt{\frac{\pi}{s}}$ D) $\frac{3}{4s^3}\sqrt{\frac{\pi}{s}}$

42. $L\{\cos^2 2t\} =$ _____.

A) $\frac{s}{s^2+16}$ B) $\frac{s^2+8}{s(s^2+16)}$ C) $\frac{4}{s^2+16}$ D) $\left(\frac{s}{s^2+16}\right)^2$

43. If $L\{F(t)\} = \frac{1}{s^2-4}$, then $L\{e^{2t}F(t)\} =$ _____

A) $\frac{1}{s^2-2s}$ B) $\frac{1}{s^2+2s}$ C) $\frac{1}{s^2-2s-8}$ D) $\frac{1}{s^2+2s-8}$

44. $L\{t \sin 2t\} =$ _____.

A) e^{-2s} B) $\frac{e^{2s}}{s}$ C) e^{-s} D) $-\frac{4s}{(s^2+4)}$

45. If $L^{-1}\{f(s)\} = \cosh 3t$ then $L^{-1}\left\{\frac{d^2}{ds^2} f(s)\right\} =$ ____

A) $\cosh 3t$ B) $t \cosh 3t$ C) $t^2 \cosh 3t$ D) $t^2 \sinh 3t$

46. $L^{-1}\left\{\frac{1}{(s-1)(s-2)}\right\} =$ _____

A) $e^{2t} - e^t$ B) $e^t - e^{2t}$ C) $e^t + e^{2t}$ D) $-e^t - e^{2t}$

47. $L^{-1}\left\{\frac{1}{s^2+9}\right\} =$ _____

A) $\frac{1}{3}\cosh 3t$ B) $\frac{1}{3}\sin 3t$ C) $\frac{1}{3}\sinh 3t$ D) $\frac{1}{3}\cos 3t$

48. The inversion formula for the infinite Fourier cosine transform is _____

A) $F(x) = \frac{2}{\pi}\int_0^\infty F_c(F(x)) \cos x\, ds$ B) $F(x) = \frac{1}{\pi}\int_0^\infty F_c(F(x)) \cos sx\, ds$

C) $F(x) = \frac{1}{\pi}\int_0^\infty F_c(F(x)) \cos x\, ds$ D) $F(x) = \frac{2}{\pi}\int_0^\infty F_c(F(x)) \cos sx\, ds$

49. If $f(s)$ is Fourier transform of $F(X)$ then the Fourier transform of $F'(X)$ is _____,

where $F\{F(x)\} = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} F(x)e^{isx}\, dx$

A) $-is\, f(s)$ B) $s\, f(s)$ C) $is\, f(s)$ D) $-s\, f(s)$

50. If $f(s)$ is Fourier transform of $F(x)$ then Fourier transform of $F(x) \cos ax$ is_____

A) $\frac{1}{2}[f(s-a) - f(s+a)]$ B) $\frac{-1}{2}[f(s-a) + f(s+a)]$

C) $\frac{1}{2}[f(s+a) - f(s-a)]$ D) $\frac{1}{2}[f(s-a) + f(s+a)]$

51. A sequence of points in any metric space converges to ----------.

A) more than two limits B) only one limit

C) two distinct limits D) none of these

52. Which of the following is a closed subset of an absolute metric space R?

A) {a} B) (a, ∞) C) (a,b] D) none of these

53. In any metric space arbitrary intersection of closed sets ----------.

A) need not be closed set B) is open set

C) is closed set D) can't say

54. If a is any point in discrete metric space R_d, then is the interval ----------.

A) {a} B) R_d C) {1.1} D) [0, 1]

55. In any metric space image of open set ----------.

A) need not be open set B) is open set

C) is closed set D) neither open nor closed

56. A subset A of discrete metric space R_d is totally bounded if and only if --------

A) set A contains infinite number of points B) set A is connected

C) set A contains only a finite number of points D) set A is bounded

57. Let A be any subset of discrete metric spcae with at least two elements, then diameter of set A is ----------.

A) ∞ B) 1 C) 0 D) $-\infty$

58. In an absolute metric space R^1, the set A = (0, 1] U [1, 2] is ----------.

A) an open set in R^1 B) a closed set in R^1
C) a compact set in R^1 D) a connected set in R^1

59. A subset D = {1, 2, . . . , 500} in discrete metric space is----------.

A) connected B) open C) need not be open D) compact

60. Let $< M, \rho >$ be a metric space. If $T: M \to M$ is a contraction on M then which of the following is true?

A) $\rho(Tx, Ty) \leq 2\ \rho(x, y)$ B) $\rho(Tx, Ty) \leq \frac{1}{2}\rho(x, y)$

C) $\rho(Tx, Ty) > \frac{3}{-}\rho(x, y)$ D) $\rho(Tx, Ty) \geq 5\ \rho(x, y)$

61. The number of vectors in any basis of a vector space V is called ..... of V.
A) rank B) nullity C) order D) dimension

62. If $T: R^2 \to R^2$ and $S: R^2 \to R^2$ defined by $T(x,y) = (y,x)$ and $S(x,y) = (x-y, x+y)$ th

A) $(y+x, y-x)$ B) $(y+2x, y-x)$

C) $(x-y, y+x)$ D) $(y-x, x+y)$

63. If V is an inner product space and $u, v \in V$ such that u is orthogonal to v then
A) $\| u+v \|^2 = 0$ B) $\| u+v \|^2 = \| u \|^2 + \| v \|^2$
C) $\| u+v \|^2 \leq \| u \|^2 - \| v \|^2$ D) $\| u+v \|^2 \geq \| u \|^2 + \| v \|^2$

64. If $\lambda = 3$ is an eigen value of an invertible operator T then eigen value of T^{-1} is
A) -3 B) 3 C) $\frac{1}{3}$ D) $-1/3$

65. If T is a linear operator on R^3 defined by $T(x_1, x_2, x_3) = (0,0,0)$ then rank of $T =$
A) 3 B) 0 C) 2 D) 1

66. Which of the following set is a linearly independent subset of $\mathbb{R}^3(\mathbb{R})$?

A) $\{(1,1,0), (3,3,0), (1,1,0)\}$ B) $\{(1,0,0), (1,1,1), (0,0,0)\}$
C) $\{(1,0,0), (0,2,0), (0,0,3)\}$ D) $\{(1,0,0), (2,1,0), (4,2,0)\}$

67. Let T be a linear operator on $\mathbb{R}^3$, defined by $T(x,y,z) = (x+z, x+y+2z, 2x+y+3z)$

Then

A) $(1,1,-1) \in$ Ker T B) $(1,2,3) \in$ Ker T
C) Ker T is the empty set D) Ker $T = \{0\}$

68. Two matrices A, B are said to be similar matrices if there exists a non-singular matrix C such

that

A) $B = C^{-1}AC$ B) $B = C^{-1}CA$
C) $A = B$ D) $AB = CA$

69. Which of the following is incorrect?
   A) A basis of a vector space is a maximal linearly independent set.
   B) A minimal generating subset of a vector space V is a basis for V.
   C) Any two bases of a F. D. V. S. have same number of vectors.
   D) If dim $V = n$, then any $n + 1$ vectors in V are linearly independent.

70. The characteristic polynomial of the matrix $\begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix}$ is
   A) $x^2 - 3x + 2$ B) $x^2 + 3x - 10$
   C) $x^2 - 3x$ D) $x^2 - 3x - 10$

71. The polar form of complex number $-5 + 5i$ is.....

   A) $5\sqrt{2}e^{i\pi/4}$ B) $5\sqrt{2}e^{-i3\pi/4}$ C) $5\sqrt{2}e^{i3\pi/4}$ D) None of these

72. C.R. equation in the polar form are .....

   A) $\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{1}{r}\frac{\partial u}{\partial \theta} = -\frac{\partial v}{\partial r}$ B) $\frac{\partial u}{\partial r} = r\frac{\partial v}{\partial \theta}$, $r\frac{\partial u}{\partial \theta} = -\frac{\partial u}{\partial r}$

   C) $\frac{\partial u}{\partial r} = -\frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{1}{r}\frac{\partial u}{\partial \theta} = \frac{\partial u}{\partial r}$ D) $\frac{\partial u}{\partial r} = -r\frac{\partial v}{\partial \theta}$, $r\frac{\partial u}{\partial \theta} = \frac{\partial u}{\partial r}$

73. Which of the following function is not analytic?

   A) $\sin z$
   B) $\cos z$
   C) $az^2 + bz + c$
   D) $\frac{1}{z-1}$

74. If $f(z) = xy + iy$ is .....

   A) Everywhere continuous and analytic
   B) Everywhere continuous but not analytic
   C) discontinuous but analytic every where
   D) neither continuous nor analytic-

75. When $z_1 = -1$ *and* $z_2 = \mathrm{i}$ then $\arg(z_1 . z_2) = \ldots$

A) $-\frac{\pi}{2}$ B) $\frac{\pi}{2}$ C) $-\frac{3\pi}{2}$ D) $\frac{3\pi}{2}$

76. A continuous function $f(z)$ over a continuous rectifiable curve C is.....

A) Differentiable
B) Integrable
C) Meromorphic
D) None of these

77. The value of integral $\oint_{|z|=3} \frac{e^z}{(z-2)^2} dz$ is .....

A) 0
B) $2\pi ie^3$
C) $2\pi ie^2$
D) $2\pi i$

78. If in the principal part of $f(z)$ are infinite number of terms then $z = a$

A) Removable singularity
B) Essential singularity
C) Pole
D) None of these

79. If $u(x,y) = e^x \cos y$ then corresponding harmonic conjugate is _____

A) $e^y \sin x$ B) $e^y \cos x$ C) $e^y \sin x + e^x \sin y$ D)

80. 3. If $f(z) = \sqrt{|xy|}$ then

A) f is differentiable at $z = 0$ B) C-R equations are not satisfie

C) f is not differentiable at $z = 0$ D) f is nowhere continuous

1. The function f(x)=$\sin\frac{1}{x}$ at x=0 has a_____.

A)Discontinuity of first kind
B)Removable discontinuity
C)Discontinuity of second kind
D)Infinite discontinuity

82. $\lim_{x\to 0}\frac{a^x-b^x}{x}$ is

A)$\log\frac{b}{a}$ B)$\log\frac{a}{b}$

C)$\log(ab)$ D)$\log(a-b)$

83. If the function $f(x)=e^x$ satisfies all the conditions of LMVT in [0,1] then value of

$c=$ _____.

A) e B) $log(e-1)$

C)$e-1$ D)$e-2$

84. If y=$\sin(ax+b)$ then $y_{5=}$

A)$a^4\cdot\sin(ax+b)$ B)$-a^5\cdot\cos(ax+b)$

C)$a^5\cdot\cos(ax+b)$ D)$-a^5\cdot\sin(ax+b)$

85. If $u=log\left(\frac{x^5+y^5}{x+y}\right)$ then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=$_____

A)2 B)4 C)6 D)-2

86. A function $f(x,y)$ has an extreme value at (a,b) then _____.

A)$AC-B^2>0$ B) $AC-B^2<0$ C) $AC-B^2=0$ D) $AB-C^2>0$

87. The complementary function (C.F.) of the equation

$x^2\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+y=\frac{1}{(1-x)^2}$ is _____.

A) $y=(c_1+c_2\log x)x^{-1}$ B) $y=(c_1+c_2x)\log x$

C) $y=(c_1\log x+c_2x)$ D) $y=(c_1+c_2x)x^{-1}$

88. $\frac{1}{D^2+4}cosx =$ _____.

A) $\frac{1}{3}\sin x$ B) $\frac{1}{5}\sin x$ C) $\frac{1}{3}\cos x$ D) $\frac{1}{5}\cos x$

89. If the equation $Mdx + Ndy = 0$ is not exact but is of the form $yf_1(xy)dx + xf_2(xy)dy = 0$ then it's I.F. is_____.

A) $\frac{1}{Mx+Ny}(Mx + Ny \neq 0)$ B) $\frac{1}{Mx-Ny}(Mx - Ny \neq 0)$

C) $e^{\int Mdx}$ D) $e^{\int Ndy}$

90. In the differential equation, $\frac{d^2y}{dx^2} + P\frac{dy}{dx} + Qy = R$ if $m^2 + mP + Q = 0$,

then the known solution

of C.F. of the given equation is _____.

A) $y = e^{mx}$ B) $y = e^{x}$ C) $y = e^{-x}$ D) $y = x^{m}$

91. If A is skew – Hermitian matrix then iA is …

A) Symmetric matrix B) Skew-Hermitian matrix

C) Hermitian matrix D) Skew Symmetric matrix

92. Let A={1,2,3,4} and R be a relation in A given by R={(1,1),(2,2),

(3,3),(4,4),(1,2),(3,1),(1,3)}

then R is :

A) An equivalence relation
B) Transitive and symmetric only
C) Reflexive and transitive only
D) None of the above

93. If a is a generator of cyclic group G then…

A)$O(a) < O(G)$ B) $O(a) = O(G)$

C) $O(a) > O(G)$ D) $O(a) \neq O(G)$

94. If 2^{100} is divided by 7 then the remainder is …

A) 1 B) 5 C) 2 D) 4

95. Quotient group of abelian group is…

A) cyclic B) abelian C) neither abelian nor cyclic D) none of these

96. Consider the two statements,
I: Every ideal is a subring.
II: Every subring is an ideal.
A) only I is true B)only II is true
C) both I & II are true D) Both I & II are false

97. The set of irrational numbers is…
A) countable B) uncountable C) finite D) none of these

98. The least upper bound of the set $\left\{\frac{3n+2}{2n+1} \ /n \in N\right\}$ is …
A) 5/3 B) 3/5 C) 1/5 D) 1/3

99. If $\{S_n\} = \{10^{100},\ 1, -1,\ 1, -1,\ 1, -1, \ldots\}$ $\lim_{n \to \infty} \inf S_n = \cdots$

A) 0 B) 1 C) -1 D) 2

100. The positive p- series $\sum \frac{1}{n^p}$ is divergent for …

A) $p < 1$ B) $p \leq 1$ C) $p \geq 1$ D) $p > 1$

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