

Matematika ta'lim yo'nalishi **1-kurs(kechki)** talabalari uchun “**matematik analiz**”
fanidan yakuniy nazorat savollari.

(2024-2025-o'y. 1-semestr)

Nazariy savollar.

1. Sonli ketma-ketlik va uning limiti.
2. Funksiyani monotonlikga tekshirish.
3. Yaqinlashuvchi ketma-ketliklarning va ularning xossalari.
4. Differensiyal hisobning asosiy teoremlarining biri, Koshi teoremasi.
5. Differensiyal hisobning asosiy teoremlarining biri, Roll, Ferma va Logranj teoremasi.
6. Monoton ketma-ketliklar va ularning limiti.
7. Funksiya grafigining asimptotalari.
8. Fundamental ketma-ketliklar va Koshi teoremasi.
9. Cheksiz katta va cheksiz kichik funksiyalar. Funksiyalarni taqqoslash.
10. Qisman ketma-ketliklar. Ketma-ketlikning quyi va yuqori limitlari.
11. Differensiyal yordamida funksiyaning taqribiy qiymatin hisoblash.
12. Funksiya tu'shinchasi. Juft va toq funksiyalar.
13. Funksiyaning aniqlanish sohasi va qiymatlar sohasin topish.
14. Tekari va murakkab funksiyalar.
15. Funksiya limitining Koshi, Geyne ta'riflari va ularning ekvivalentligi.
16. Funksiyaning bir tamonlama limitlari.
17. Limitga ega bo'lgan funksiyalarning xossalari.
18. Murakkab funksiyaning xosilasi.
19. Funksiyaning u'zilish nuqtasi va tu'rlari.
20. Teskari funksiyaning xosilasi.
21. Funksiyaning u'zluksizligi.
22. Parametrli funksiyaning xosilasi.
23. Kesmada u'zluksiz funksiyalarning xossalari.
24. Bir tamonlama xosilalar.
25. Funksiyaning tekis u'zluksizligi haqidagi Kantor teoremasi.
26. Urinma va normal tenglamalari.
27. Funksiya xosilasi va differensiyali.

28. Xosilaning geometrik va fizik manosi.
29. Bir o'zgaruvchili funktsiyani to'liq tekshirish.
30. Matematik induksiya usuli.
31. To'plamlar va ular u'stida a'mallar.
32. Haqiqiy sonlar to'plami va uning xossalari.
33. Davriy funktsiya. Elementar funktsiyalar va ularning xossalari.
34. Funktsiya limitining ta'riflari.
35. A'joyib limitlar. Asosiy limitlar.
36. U'zluksiz funktsiyalarning lokal va global xossalari.
37. Murakkab va elementar funktsiyalarning u'zluksizligi.
38. Xosilani hisoblash qoidalari va formulalari.
39. Teylor va Makloren formulalari.
40. Xosila yordamida funktsiyani monotonliqqa tekshirish.

A'maliy savollar

41. $x_n = n^{(-1)^n}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
42. $x_n = \left(\frac{n+1}{n}\right)^n (-1)^n + \sin \frac{\pi n}{2}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
43. $x_n = \frac{n+2}{n+1} \sin \frac{\pi n}{3}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
44. $x_n = \frac{n-1}{n+1} \cdot \cos \frac{2n\pi}{3}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
45. $x_n = 1 + \frac{n}{n+1} \cdot \cos^2 \frac{n\pi}{2}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
46. $x_n = \sqrt[n]{1 + 2^{n(-1)^n}}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
47. $x_n = \frac{(-1)^n}{n} + \frac{1 + (-1)^n}{2}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
48. $x_n = 1 + 2 \cdot (-1)^{n+1} + 3 \cdot (-1)^{\frac{n(n-1)}{2}}$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$
49. $x_n = -n \cdot \left[2 + (-1)^n\right]$, $\overline{\lim}_{n \rightarrow \infty} x_n = ?$, $\underline{\lim}_{n \rightarrow \infty} x_n = ?$

50. $x_n = \left(1 + \frac{1}{n}\right)^n (-1)^n + \sin \frac{n\pi}{4}$, $\overline{\lim} x_n = ?$, $\underline{\lim} x_n = ?$
51. $x_n = \cos^n \frac{2n\pi}{3}$, $\overline{\lim} x_n = ?$, $\underline{\lim} x_n = ?$
52. $\lim_{x \rightarrow 1} \frac{\sqrt[m]{x} - 1}{\sqrt[n]{x} - 1}$ ($n, m \in \mathbb{R}$) limitni hisoblang.
53. $y = (\arcsin 3x)^{e^{2x}}$, $y' = ?$
54. $x_n = \left(\frac{n^3 + 1}{n^3 - 1}\right)^{2n - n^3}$ ketma-ketlik limitini hisoblang.
55. $x_n = \frac{\sqrt[3]{n} + 5 - \sqrt{3n^4 + 2}}{1 + 3 + 5 + \dots + (2n - 1)}$ ketma-ketlik limitini hisoblang.
56. $x_n = \frac{a^n + 3b^n}{5a^n + 7b^n}$, ($a > 0$, $b > 0$) ketma-ketlik limitini hisoblang.
57. $y = \ln(\ln^2(\ln^3 x))$ murakkab funksiyaning xosilasin toping.
58. $f(x) = \frac{\sqrt{1 - \cos 2x}}{x}$ funksiyaning $a = 0$ nuqtadagi ong va chap limitlarin toping.
59. $f(x) = \left(\frac{a}{b}\right)^x \left(\frac{b}{x}\right)^a \left(\frac{x}{a}\right)^b$ ($a > 0$, $b > 0$) murakkab funksiyaning xosilasin toping.
60. $y = -\frac{\cos x}{2\sin^2 x} + \ln \sqrt{\frac{1 + \cos x}{\sin x}}$ murakkab funksiyaning xosilasin toping.
61. $\lim_{x \rightarrow \infty} \frac{\sqrt[3]{1 + \frac{4}{x}} - \sqrt[4]{1 + \frac{3}{x}}}{1 - \sqrt[5]{1 - \frac{5}{x}}}$ limitni hisoblang.
62. Xosila ta'rifidan foydalanib, $f(x) = \arccos 3x$ funksiyaning xosilasin toping.
63. $f(x) = x^{x^a} + x^{ax} + a^{x^x}$ ($a > 0$, $x > 0$) murakkab funksiyaning xosilasin toping.
64. $y = e^x + e^{e^x} + e^{ee^x}$ murakkab funksiyaning xosilasin toping.
65. $\lim_{x \rightarrow 1} \frac{x + x^2 + \dots + x^n - n}{x - 1}$, $n \in \mathbb{N}$ limitni hisoblang.

66. $\lim_{x \rightarrow \frac{\pi}{2}} (\sin x)^{\operatorname{tg}^2 x}$ limitni hisoblang.
67. Ta'rif yordamida $a = \frac{4}{3}$ soni $x_n = \frac{4n^2 + 1}{3n^2 + 2}$ ketma-ketlikning limiti ekenligin isbotlang.
68. $y = \sin \left[\cos^2 (\operatorname{tg}^3 x) \right]$ murakkab funksiyaning xosilasin toping.
69. $x_n = \frac{5}{6} + \frac{13}{36} + \dots + \frac{3^n + 2^n}{6^n}$ ketma-ketlik limitini hisoblang.
70. $\lim_{x \rightarrow \pi} \frac{\sin x}{\pi^2 - x^2}$ limitni hisoblang.
71. $x_n = \left(\frac{2n^2 + 21n - 7}{2n^2 + 18n + 9} \right)^{2n+1}$ ketma-ketlik limitini hisoblang.
72. $y = (\sin x)^{\cos x} + (\cos x)^{\sin x}$ murakkab funksiyaning xosilasin toping.
73. Sonli ketma-ketlik ta'rifi yordamida $a = -6$ soni $x_n = -\frac{6n}{n+2}$ ketma-ketlikning limiti ekenligin isbotlang.
74. Sonli ketma-ketlik ta'rifi yordamida $a = \frac{1}{2}$ soni $x_n = \frac{2n^2 + 3n + 4}{4n^2 - 5n + 6}$ ketma-ketlikning limiti ekenligin isbotlang.
75. Sonli ketma-ketlik ta'rifi yordamida $a = 0$ soni $x_n = \frac{1}{n} \sin \frac{\pi n}{2}$ ketma-ketlikning limiti ekenligin isbotlang.
76. $x_n = \left(\frac{2n^2 + 2}{2n^2 + 1} \right)^{n^2}$ ketma-ketlik limitini hisoblang.
77. $x_n = \frac{3}{4} + \frac{5}{16} + \dots + \frac{9}{64} + \dots + \frac{1+2^n}{4^n}$ ketma-ketlik limitini hisoblang.
78. $x_n = \frac{(3n-1)! + (3n+1)!}{(3n)! \cdot (n-1)}$ ketma-ketlik limitini hisoblang.
79. $x_n = \left(n - \sqrt[3]{n^3 - 5} \right) \cdot n\sqrt{n}$ ketma-ketlik limitini hisoblang.
80. $\lim_{x \rightarrow 1} \left(\frac{n}{1-x^n} - \frac{m}{1-x^m} \right), (n, m \in \mathbb{N})$ limitni hisoblang.

81. $\lim_{x \rightarrow 0} \frac{x}{\sqrt[n]{1+ax} \cdot \sqrt[m]{1+bx} - 1}$, $(n, m \in \mathbb{N})$ limitni hisoblang.
82. $\lim_{x \rightarrow 0} \frac{(\sqrt{1+x^2} + x)^n - (\sqrt{1+x^2} - x)^n}{x}$, $n \in \mathbb{N}$ limitni hisoblang.
83. $\lim_{x \rightarrow +0} \left(\frac{1 + \sin x - \cos x}{1 + \sin 4x - \cos 4x} \right)^{\frac{1}{x}}$ limitni hisoblang.
84. Xosila ta'rifidan foydalanib, $f(x) = \frac{1}{1+x^2}$ funksiyaning xosilasin toping.
85. Xosila ta'rifidan foydalanib, $f(x) = x\sqrt[3]{x}$ funksiyaning xosilasin toping.
86. $f(x) = x^{a^a} + a^{x^a} + a^{a^x}$ ($a > 0$) murakkab funksiyaning xosilasin toping.
87. $\lim_{x \rightarrow +\infty} \frac{x^{\ln x}}{(\ln x)^x}$ limitni hisoblang.
88. $\lim_{x \rightarrow +\infty} (3x^2 + 3^x)^{\frac{1}{x}}$ limitni hisoblang.
89. $\lim_{x \rightarrow 0} \left(\frac{2}{\pi} \cdot \arccos x \right)^{\frac{1}{x}}$ limitni hisoblang.
90. $\lim_{x \rightarrow 0} (ctgx)^{\frac{1}{\ln x}}$ limitni hisoblang.
91. $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right)^{\frac{1}{x^2}}$ limitni hisoblang.
92. $\lim_{x \rightarrow \infty} \frac{e^{-ax}}{e^{-x}(2 - \sin x - \cos x)}$ ($a \neq 1$) limitni hisoblang.
93. $\lim_{x \rightarrow 0} \frac{x^3 \cdot \sin \frac{1}{x}}{\sin^2 x}$ limitni hisoblang.
94. $\lim_{x \rightarrow \infty} \frac{x - \sin x}{x + \sin x}$ limitni hisoblang.
95. $\lim_{x \rightarrow a} \left(2 - \frac{x}{a} \right)^{tg \frac{\pi x}{2a}}$ limitni hisoblang.

$$96. \quad \lim_{x \rightarrow 0} \frac{x \cdot \sin(\sin x) - \sin^2 x}{x^6} \text{ limitni hisoblang.}$$

$$97. \quad 1 + 2 + 3 + 5 + \dots + (2n - 1) = n^2 \text{ tenglikni isbotlang.}$$

$$98. \quad 1^2 + 2^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6} \text{ tenglikni isbotlang.}$$

$$99. \quad 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3} \text{ tenglikni isbotlang.}$$

$$100. \quad \frac{1}{1 \cdot 5} + \frac{1}{5 \cdot 9} + \frac{1}{9 \cdot 13} + \dots + \frac{1}{(4n-3)(4n+1)} = \frac{n}{4n+1} \text{ tenglikni isbotlang.}$$

$$101. \quad 1^2 + 3^2 + 5^2 + \dots + (2n-1) \cdot 2 = \frac{n(2n-1)(2n+1)}{3} \text{ tenglikni isbotlang.}$$

$$102. \quad 1 - 2^2 + 3^2 - 4^2 + \dots + (-1)^n \cdot n^2 = (-1)^{n-1} \cdot \frac{n(n+1)}{2} \text{ tenglikni isbotlang.}$$

$$103. \quad 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots - \frac{1}{2n} = \frac{1}{n+1} + \frac{1}{n+2} + \dots + \frac{1}{2n} \text{ tenglikni isbotlang.}$$

$$104. \quad 1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + 3 \cdot 4 \cdot 5 + \dots + n(n+1)(n+2) = \frac{n}{4}(n+1)(n+2)(n+3) \text{ tenglikni isbotlang.}$$

$$105. \quad \frac{1^2}{1 \cdot 3} + \frac{2^2}{3 \cdot 5} + \dots + \frac{n^2}{(2n-1)(2n+1)} = \frac{n(n+1)}{2(2n+1)} \text{ tenglikni isbotlang.}$$

$$106. \quad \left(1 - \frac{1}{4}\right) \left(1 - \frac{1}{9}\right) \dots \left(1 - \frac{1}{(n+1)^2}\right) = \frac{n+2}{2n+2} \text{ tenglikni isbotlang.}$$

$$107. \quad \frac{1}{2} + \cos x + \cos 2x + \dots + \cos nx = \frac{\sin \frac{2n+1}{2} x}{2 \sin \frac{x}{2}} \text{ tenglikni isbotlang.}$$

$$108. \quad \cos \frac{\alpha}{2} \cdot \cos \frac{\alpha}{4} \cdot \cos \frac{\alpha}{8} \dots \cos \frac{\alpha}{2^n} = \frac{\sin \alpha}{2^n \sin \frac{\alpha}{2^n}} \text{ tenglikni isbotlang.}$$

$$109. \quad \cos \alpha \cdot \cos 2\alpha \cdot \cos 2^2 \alpha \cdot \dots \cdot \cos 2^n \alpha = \frac{\sin 2^{n+1} \alpha}{2^{n+1} \sin \alpha} \text{ tenglikni isbotlang.}$$

$$110. \quad \sin x + \sin 2x + \dots + \sin nx = \frac{\sin \frac{n+1}{2} x}{\sin \frac{x}{2}} \sin \frac{nx}{2} \text{ tenglikni isbotlang.}$$

111. $\operatorname{tg} \alpha \cdot \operatorname{tg} 2 \alpha + \operatorname{tg} 2 \alpha \cdot \operatorname{tg} 3 \alpha + \dots + \operatorname{tg} (n-1) \alpha \cdot \operatorname{tg} n \alpha = \frac{\operatorname{tg} n \alpha}{\operatorname{tg} \alpha} - n$ tenglikni isbotlang.
112. $\frac{1}{2} \operatorname{tg} \frac{x}{2} + \frac{1}{2^2} \operatorname{tg} \frac{x}{2^2} + \dots + \frac{1}{2^n} \operatorname{tg} \frac{x}{2^n} = \frac{1}{2^n} \operatorname{ctg} \frac{x}{2^n} - \operatorname{ctg} x$ tenglikni isbotlang.
113. $y = \log_2 \log_3 \log_4 x$ funksiyaning aniqlanish sohasin toping.
114. $y = \frac{\sqrt{x}}{\sin \pi x}$ funksiyaning aniqlanish sohasin toping.
115. $y = \sqrt{\arcsin(\log_2 x)}$ funksiyaning aniqlanish sohasin toping.
116. $y = \arccos \frac{2x}{1+x^2}$ funksiyaning aniqlanish sohasin toping.
117. $y = \sqrt{9-x^2} + \log \frac{x+1}{x-2}$ funksiyaning aniqlanish sohasin toping.
118. $y = \lg(1-2 \cos x)$ funksiyaning aniqlanish sohasin toping.
119. $y = \frac{x^2+x+2}{x^2-x+2}$ funksiyaning aniqlanish sohasin toping.
120. $y = ||x|-1|-x$ funksiyaning aniqlanish sohasin toping.
121. $y = \sqrt{\frac{\sin x - \cos x}{\sin x + \cos x}}$ funksiyaning aniqlanish sohasin toping.
122. $y = \sqrt{\frac{1+\operatorname{ctg}^2 x}{1-\cos^2 x}}$ funksiyaning aniqlanish sohasin toping.
123. Agar $\phi(x) = x^2, \psi(x) = \sqrt{x}$ bolsa, $\phi(\phi(x)), \phi(\psi(x)), \psi(\psi(x)), \psi(\phi(x))$ lar topilsin.
124. Agar $\phi(x) = \operatorname{sign} x, \psi(x) = \frac{1}{x}$ bolsa, $\phi(\phi(x)), \psi(\psi(x)), \phi(\psi(x)), \psi(\phi(x))$ lar topilsin.
125. Agar $\phi(x) = \operatorname{sign} x, \psi(x) = 1+x^2$ bolsa, $\phi(\psi(x)), \psi(\phi(x))$ lar topilsin.
126. Agar $f(x) = \sqrt{1-x^2}, x = 1 + \sin^2 \pi t = \phi(t)$ bolsa, $f(\phi(t))$ funksiyaning aniqlanish sohasi topilsin.
127. Agar $\phi(x) = \ln x^2, \psi(x) = \sin x$ bolsa, $\phi(\psi(x)), \psi(\phi(x))$ funksiyalar va ularning aniqlanish sohasi topilsin.

128. Agar $f\left(\frac{1}{x}\right) = x^2 + 1$ bolsa, $f(x)$ topilsin.
129. Agar $f\left(\frac{x-1}{x+1}\right) = x$ bolsa, $f(x)$ topilsin.
130. Agar $f\left(\frac{x}{x+1}\right) = x^2$ bolsa, $f(x)$ topilsin.
131. Agar $f(x) = \frac{x}{\sqrt{1+x^2}}$ bolsa, $f_n(x) = \underbrace{f(f(\dots f(x)))}_{n \text{ ta}}$ funksiya topilsin.
132. Agar $f(x) = \frac{1}{1-x}$ bolsa, $f(f(f(x))) = x$ tenglik x ting qanday qiymatlarida orinli
133. $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$ tenglikni isbotlang.
134. $A \setminus (B \cup C) = (A \setminus B) \setminus C$ tenglikni isbotlang.
135. $(A \setminus B) \cap C = (A \cap C) \setminus (B \cap C)$ tenglikni isbotlang.
136. $(A \cup B) \cup C = A \cup (B \cup C)$ tenglikni isbotlang.
137. $(A \cap B) \cap C = A \cap (B \cap C)$ tenglikni isbotlang.
138. $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$ tenglikni isbotlang.
139. $(A \setminus B) \setminus C = (A \setminus C) \setminus (B \setminus C)$ tenglikni isbotlang.
140. $(A \setminus B) \cup (B \setminus C) \cup (C \setminus A) \cup (A \cap B \cap C) = A \cup B \cup C$ tenglikni isbotlang.
141. $(A \cap C) \cup (B \cap D) \subset (A \cup B) \cap (C \cup D)$ tenglikni isbotlang.
142. $A \cap (A \cup B) = A$ tenglikni isbotlang.
143. $f(x) = \arccos 3x$ funksiyaning xosilasin toping.
144. $f(x) = 7 \arctg(x+1)$ funksiyaning xosilasin toping.
145. $f(x) = x \cdot |x|$ funksiyaning xosilasin toping.
146. $y = a \cdot \ln \frac{a^2}{a^2 - x^2}$ funksiyaning xosilasin toping.
147. $y = \arcsin e^x$ funksiyaning xosilasin toping.
148. $y = x \cdot \sqrt{\frac{x}{a}}$ funksiyaning xosilasin toping.
149. $y^2 = x(3-x)^2$ funksiyaning xosilasin toping.
150. $y = \sqrt{1-x^2} + \arcsin x$ funksiyaning xosilasin toping.

