“TASDIQLAYMAN”

Chirchiq davlat pedagogika universiteti

Aniq fanlar fakulteti dekani

I.G.Tursunov

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Aniq fanlar fakulteti Algebra va matematik analiz kafedrasi 2026-2027 o’quv yili Amaliy matematika yo‘nalishi 3-kurs (ingliz) talabalari uchun funksional analiz fanidan oraliq nazorat savollari ro‘yxati.

1. Elements of set theory.
2. Lebesgue measure and its properties.
3. Measurable functions and their properties.
4. Almost everywhere convergence and convergence in measure.
5. Lebesgue integral and its properties.
6. Metric spaces and convergence in them.
7. Complete metric spaces.
8. The contraction mapping principle and its applications.
9. Linear spaces.
10. Normed spaces and their properties.
11. Linear functionals.
12. Euclidean spaces.
13. The Hahn–Banach theorem in normed spaces.
14. Linear operators.
15. Compact sets and compact operators.

16. Prove the Cauchy–Bunyakovsky inequality. (Koshi-Bunyakovskiy tengsizligini isbotlang: $(\sum_{k=1}^{n} a_k b_k)^2 \le \sum_{k=1}^{n} a_k^2 \cdot \sum_{k=1}^{n} b_k^2$.

17. Prove the following equality: (Quyidagi tenglikni isbotlang) $C(CA \setminus B) = C(CB \setminus A)$.

18. $A = \{x \in R : x^2 - 5x + 6 \le 0\}$, $B = \{x \in R : 2x^2 - 5x < 0\}$, $A \cup B, A \cap B, A / B$

Perform the set operations.(to'plamlar ustida amallarni bajaring)

19. $A = \{x \in R : |x| + |x-1| \le 3\}$, $B = \{x \in R : x^2 - 5|x| + 6 < 0\}$, $A \cup B, A \cap B, A / B$

Perform the set operations.(to'plamlar ustida amallarni bajaring)

20. $A = \{(x,y) \in R \times R : |x| + |y| \le 1\}$, $B = \{(x,y) \in R \times R : x + y \ge 1\}$, $A \cup B, A \cap B, A / B$

Perform the set operations.(to'plamlar ustida amallarni bajaring)

21. $A = \{(x,y) \in R \times R : xy \le 0\}$, $B = \{(x,y) \in R \times R : y \ge x^2\}$, $A \cup B, A \cap B, A / B$

Perform the set operations.(to'plamlar ustida amallarni bajaring)

22. $A = \{x \in R : 1 < |x-3| \le 2\}$, $B = \{x \in R : 2|x| < 3\}$, $A \cup B, A \cap B, A / B$

Perform the set operations.(to'plamlar ustida amallarni bajaring)

23. Find the Lebesgue measure of each of the following sets. (Quyidagi to'plamlarning Lebeg o'lchovini hisoblang.) $A = [0,5] \setminus \left((1,2) \cup \left(3, \frac{9}{2}\right)\right)$

24. Find the Lebesgue measure of each of the following sets. (Quyidagi to'plamlarning Lebeg o'lchovini hisoblang) $A = \left([-2,1] \cap Q\right) \cup \left([1,4] \setminus Q\right)$

25. Prove that in the space of isolated points, the metric is introduced as the discrete metric. Diskret metrikali fazo esa yakkalangan nuqtalar fazosida metrika quyidagicha kiritilishini isbotlang: $d(x,y) = \begin{cases} 0, x = y \\ 1, x \ne y \end{cases} \quad \forall x, y \in X$.

26. Using the definition, show that the following functions are measurable on the given intervals. (Ta'rif yordamida quyidagi funksiyalarning berilgan oraliqlarda o'lchovli ekanligini ko'rsating) $f(x) = \{x\}, \quad x \in [0,2)$

27. Using the definition, show that the following functions are measurable on the given intervals. (Ta'rif yordamida quyidagi funksiyalarning berilgan oraliqlarda o'lchovli ekanligini ko'rsating) $f(x)=2x+3,\quad x\in[0,3]$

28. Using the definition, show that the following functions are measurable on the given intervals. (Ta'rif yordamida quyidagi funksiyalarning berilgan oraliqlarda o'lchovli ekanligini ko'rsating) $f(x)=x^2-5,\quad x\in[-2,3]$

29. Using the definition, show that the following functions are measurable on the given intervals. (Ta'rif yordamida quyidagi funksiyalarning berilgan oraliqlarda o'lchovli ekanligini ko'rsating) $f(x)=2^x-1,\quad x\in[0,2]$

30. Evaluate the Lebesgue integral of the given function over X. (Berilgan funksiyaning X to'plamdagi Lebeg integralini hisoblang) $f(x)=3e^{-3x}, X=[0,+\infty),\ \int_X f(x)d\mu$

31. Evaluate the Lebesgue integral of the given function over X. (Berilgan funksiyaning X to'plamdagi Lebeg integralini hisoblang) $f(x)=\frac{1}{1+x^2}, X=[0,+\infty),\ \int_X f(x)d\mu$

32. Evaluate the Lebesgue integral of the given function over X. (Berilgan funksiyaning X to'plamdagi Lebeg integralini hisoblang) $f(x)=\frac{1}{x^3},\ X=[1,+\infty),\ \int_X f(x)d\mu$

33. Evaluate the Lebesgue integral of the given function over X. (Berilgan funksiyaning X to'plamdagi Lebeg integralini hisoblang) $f(x)=\frac{1}{x(\ln x)^2},\ X=[e,+\infty),\ \int_X f(x)d\mu$

34. Let $x=(x_1,x_2),\ y=(y_1,y_2)$ be elements of R^2. Prove that $\rho_1(x,y)=|x_1-y_2|+|x_2-y_1|$ defines a metric on R^2. (Quyidagi funksiya metrika bo'ladimi)

35. Let $x=(x_1,x_2),\ y=(y_1,y_2)$ be elements of R^2. Prove that $\rho_1(x,y)=|x_1-y_1|+|x_2-y_2|$ defines a metric on R^2. (Quyidagi funksiya metrika bo'ladimi)

36. Let $x=(x_1,x_2),\ y=(y_1,y_2)$ be elements of R^2. Prove that $\rho_1(x,y)=|x_1-x_2|+|y_1-y_2|$ defines a metric on R^2. (Quyidagi funksiya metrika bo'ladimi)

37. Let $x=(x_1,x_2),\ y=(y_1,y_2)$ be elements of R^2. Prove that $\rho_1(x,y)=|x_1-y_1|+2|x_2-y_2|^2$ defines a metric on R^2. (Quyidagi funksiya metrika bo'ladimi)

38. Let $x=(x_1,x_2),\ y=(y_1,y_2)$ be elements of R^2. Prove that $\rho_1(x,y)=|x_1-y_2|+|y_1-x_2|$ defines a metric on R^2. (Quyidagi funksiya metrika bo'ladimi)

39. Determine whether the sequence (x_n) converges in the metric space $C[0,1]$, where $x_n(t)=t^n-t^{n+1}$.

40. Determine whether the sequence (x_n) converges in the metric space $C[0,1]$, where $y_n(t)=t^n-t^{2n}$.

41. Determine whether the sequence (x_n) converges in the metric space $C[0,1]$, where $z_n(t)=t^n-2t^{n+1}+t^{n+2}$.

42. Determine whether the sequence (x_n) converges in the metric space $C[0,1]$, where $u_n(t)=\frac{t^n}{n}-\frac{t^{n+1}}{n+1}$.

Oraliq nazorat savollari Algebra va matematik analiz kafedrasi 2026-yil ___-_____dagi ___-yig'ilishida muhokama qilingan ___-sonli bayonnoma

Kafedra mudiri **G'.X.Djumabayev**

Tuzuvchilar **O'.H.Bozorova**