“TASDIQLAYMAN”
Chirchiq davlat pedagogika universiteti
Aniq fanlar fakulteti dekani
I.G.Tursunov
“__” _____ 2026-yil

Aniq fanlar fakulteti Algebra va matematik analiz kafedrasi 2026-2027 o‘quv yili Amaliy matematika yo’nalishi(ingliz) 2-kurs talabalari uchun Matematik analiz fanidan 3-semestr uchun yakuniy nazorat savollari

1. Multivariable functions. Rm space and its important sets
2. Sequences in Rm space and their limits
3. Limits of multivariable functions
4. Continuity of multivariable functions
5. Properties of continuous functions
6. Uniform continuity of multivariable continuous functions
7. Differentiation of multivariable functions
8. Applications of multivariable function differentials to approximate calculations
9. Higher-order derivatives and differentials of multivariable functions
10. Differentiation of implicit functions
11. Extrema of multivariable functions
12. Maximum and minimum values of multivariable functions
13. Directional derivatives
14. Definitions of double integrals
15. Existence of double integrals
16. Properties of double integrals
17. Change of variables in double integrals
18. Approximate calculation of double integrals
19. Applications of double integrals

Practical session questions

1. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{1}{n^2}+\frac{2}{n^2}+...+\frac{n-1}{n^2};\left(\frac{2n^2+2}{2n^2+1}\right)^{n^2}\right)$

   ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

2. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{2n+1\,!+\,2n+2\,!}{2n+3\,!};\left(\frac{n-1}{n+3}\right)^{n+2}\right)$

   ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

3. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{2^{n+1}+3^{n+1}}{2^n+3^n};\left(\frac{n^2-1}{n^2}\right)^{n^4}\right)$

   ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

4. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{1+2+...+n}{\sqrt{9n^4+1}};\left(\frac{2n+3}{2n+1}\right)^{n+1}\right)$

   ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

5. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{1+4+7+...+\,3n-2}{\sqrt{5n^4+n+1}};\left(\frac{n+1}{n-1}\right)^{n}\right)$

   ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

6. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{n+4\,!-\,n+2\,!}{n+3\,!};\left(\frac{n+3}{n+5}\right)^{n+4}\right)$

   ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

7. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{\sqrt[3]{n^3+5}-\sqrt{3n^4+2}}{1+3+5+...+\,2n-1};\left(\frac{n^3+1}{n^3-1}\right)^{2n-n^3}\right)$

   ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

8. Find the limit of the sequence in $\mathbb{R}^2$

   $x^n = \left(\frac{3}{4}+\frac{5}{16}+\frac{9}{64}...+\frac{1+2^n}{4^n};n\sqrt[3]{5+8n^3}-2n\right)$ ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

9. Find the limit of the sequence in $\mathbb{R}^2$

$x^n = \left(\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+...+\frac{1}{n\ n+1};\sqrt{2}\cdot\sqrt[4]{2}\cdot\sqrt[8]{2}\cdot....\cdot\sqrt[2^n]{2}\right)$ ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

10. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{1}{n^2}+\frac{2}{n^2}+...+\frac{n-1}{n^2};\left(\frac{2n^3+1}{2n^3+2}\right)^{n^3}\right)$

($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

11. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{1}{n^2}+\frac{2}{n^2}+...+\frac{n-1}{n^2};\left(\frac{4n^2-3}{4n^2-2}\right)^{n^2}\right)$

($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

12. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{4^{n+1}+3^{n+1}}{4^n+3^n};\left(\frac{2n^2-1}{2n^2}\right)^{n^4}\right)$

($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

13. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{n+3\ !-\ n+1\ !}{n+2\ !};\left(\frac{3n+3}{3n+5}\right)^{n+4}\right)$

($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

14. Find the limit of the sequence in $\mathbb{R}^2$ fazoda

$x^n = \left(\frac{3}{4}+\frac{5}{16}+\frac{9}{64}...+\frac{1+2^n}{4^n};n\sqrt[3]{3+27n^3}-3n\right)$ ($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

15. Find the limit of the sequence in $\mathbb{R}^2$ $x^n = \left(\frac{1+2+...+n}{\sqrt{5n^4+1}};\left(\frac{3n+3}{3n+1}\right)^{n+4}\right)$

($\mathbb{R}^2$ fazoda ketma-ketlikning limitini toping.)

16. $u = \arccos\frac{x}{x+y}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

17. $u = \ln xyz$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

18. $u = \ln\ -x-y$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

19. $u = \arcsin\frac{y}{x}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

20. $u = \sqrt{\sin\ x^2+y^2}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

21. $u = \sqrt{1-\ x^2+y^{\ 2}}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

22. $u = \sqrt{\frac{x^2+y^2-x}{2x-x^2-y^2}}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

23. $u = \sqrt{x^2+y^2-1\ \ 4-x^2-y^2}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

24. $u = \sqrt{1-x^2}+\sqrt{y^2-1}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

25. $u = \sqrt{\frac{x^2+2x+y^2}{x^2-2x+y^2}}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

26. $u = \arccos\frac{z}{\sqrt{x^2+y^2}}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

27. $u = \frac{\sqrt{4x-y^2}}{\ln\ 1-x^2-y^2}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

28. $u = \operatorname{arc}tg\frac{x-y}{1+x^2y^2}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

29. $u=\sqrt{x-\sqrt{y}}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

30. $u=\sqrt{x\cos y}$ Find and sketch the domain of the function. (funksiyaning aniqlanish sohasini toping va uni tasvirlang)

31. $\lim\limits_{\substack{x\to 0\\ y\to 0}} \dfrac{\sin xy}{\sqrt{x^2+y^2}}$ Calculate. (ni hisoblang)

32. $\lim\limits_{\substack{x\to\infty\\ y\to\infty}} \dfrac{x+y}{x^2-xy+y^2}$ Calculate. (ni hisoblang)

33. $\lim\limits_{\substack{x\to\infty\\ y\to 3}} \left(1+\dfrac{1}{x}\right)^{\frac{x^2}{x+y}}$ Calculate. (ni hisoblang)

34. $\lim\limits_{\substack{x\to+\infty\\ y\to+\infty}} \left(\dfrac{xy}{x^2+y^2}\right)^{x^2}$ Calculate. (ni hisoblang)

35. $\lim\limits_{\substack{x\to\infty\\ y\to\infty}} \dfrac{x^2+y^2}{x^4+y^4}$ Calculate. (ni hisoblang)

36. $\lim\limits_{\substack{x\to 0\\ y\to 0}} x^2+y^2\ ^{x^2y^2}$ Calculate. (ni hisoblang)

37. $\lim\limits_{\substack{x\to\infty\\ y\to 0}} \left(1+\dfrac{2}{x}\right)^{\frac{x^2}{x+y}}$ Calculate. (ni hisoblang)

38. $\lim\limits_{\substack{x\to+\infty\\ y\to+\infty}} x^2+y^2\ e^{-x+y}$ Calculate. (ni hisoblang)

39. $\lim\limits_{\substack{x\to 1\\ y\to 0}} \dfrac{\ln x+e^y}{\sqrt{x^2+y^2}}$ Calculate. (ni hisoblang)

40. $\lim\limits_{\substack{x\to 0\\ y\to 0}} \dfrac{\sin x^4y^2}{x^2+y^2\ ^2}$ Calculate. (ni hisoblang)

41. $\lim\limits_{\substack{x\to 0\\ y\to 0}} \dfrac{e^{-\frac{1}{x^4+y^4}}}{x^4+y^4}$ Calculate. (ni hisoblang)

42. $\lim\limits_{\substack{x\to 0\\ y\to 0}} 1+x^2y^2\ ^{\frac{1}{x^2+y^2}}$ Calculate. (ni hisoblang)

43. $\lim\limits_{\substack{x\to 0\\ y\to 0}} 1+x^2+y^2\ ^{\frac{1}{x^2+y^2}}$ Calculate. (ni hisoblang)

44. $\lim\limits_{\substack{x\to 0\\ y\to 0}} \dfrac{\sqrt[3]{x^4y^2}}{x^2+y^2}$ Calculate. (ni hisoblang)

45. $\lim\limits_{\substack{x\to \infty\\ y\to \infty}} x^2+y^2\ \sin\dfrac{1}{x^2+y^2}$ Calculate. (ni hisoblang)

46. $f\ x,y = \begin{cases} \dfrac{x^2y^2}{x^4+y^4},\ x^4+y^4\neq 0, \\ 0,\ x^4+y^4=0 \end{cases}$ Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

47. $f\ x,y = \begin{cases} \dfrac{x^3y^2}{x^4+y^4},\ x^4+y^4\neq 0, \\ 0,\ x^4+y^4=0 \end{cases}$ Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

$f\ x,y = \begin{cases} \dfrac{x^2+y^2}{x+y},\ x+y\neq 0, \\ 0,\ x+y=0 \end{cases}$ Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

48. $f\ x,y = \begin{cases} \dfrac{x^2-y^2}{x^2+y^2},\ x^2+y^2\neq 0, \\ 1,\ x^2+y^2=0 \end{cases}$ Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

49. $f\ x,y = \begin{cases} \dfrac{\sin x+\sin y}{x+y}, & x+y\neq 0, \\ 1, & x+y=0 \end{cases}$ Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

50. $f\ x,y = \begin{cases} \dfrac{\cos x-\cos y}{x-y}, & x-y\neq 0, \\ 1, & x-y=0 \end{cases}$ Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

51. $f\ x,y = \begin{cases} \dfrac{1}{x^2+y^2}, & x,y \neq 0,0 \\ 0, & x,y = 0,0 \end{cases}$, Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

52. $f\ x,y = \begin{cases} \dfrac{x^2y}{x^4+y^2}, & x^2+y^2\neq 0, \\ 0, & x^2+y^2=0 \end{cases}$ Investigate the continuity of the function at $O\ 0,0$ with respect to each variable separately and with respect to both variables jointly. (funksiyani $O\ 0,0$ nuqtada har bir o'zgaruvchi bo'yicha xususiy va ikkala o'zgaruvchi bo'yicha birgalikda uzluksizlikka tekshiring)

53. $u\ x,y = \sqrt{x^2+y^2}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

54. $u\ x,y = \sqrt[3]{xy}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

55. $u\ x,y = \sqrt[3]{x^4+y^4}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

56. $u\ x,y = \sqrt[3]{x}\sin y$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

57. $u\ x,y = \sqrt[4]{x^4+y^4}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

58. $u\ x,y = \sqrt{x^4+y^4}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

59. $u\ x,y = \sqrt[3]{x^2y^2}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

60. $u\ x,y = \sqrt[3]{x^3+y^3}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

61. $u\ x,y = \sqrt[3]{xy^2}\sin x$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

62. $u\ x,y = \sqrt[4]{x^3+y^3}$ Does the function have partial derivatives at $O\ 0,0$, and is it differentiable at this point? (funksiya $O\ 0,0$ nuqtada xususiy hosilalarga egami va bu nuqtada differensiallanuvchi bo'ladimi)

63. $z = x \cdot \ln(x^2+y^2)$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

64. $z = y \cdot e^{x \cdot y}$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

65. $z = \ln(\sin(x+y))$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

66. $z = \arcsin\frac{x+y}{x}$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

67. $z = \sqrt{x^2+2 \cdot x \cdot y}$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

68. $z = \operatorname{arctg}\frac{x}{y}$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

69. $z = y\ln(x+y^2)$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

70. $z = tg(xy)$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

71. $z = e^{\sqrt{x^2+y^2}}$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

72. $z = y\sin(x+y)$ Find the second-order partial derivatives and the second-order total differential of the following function. (Quyida berilgan funksiyaning ikkinchi tartibli xususiy hosilalari va differensialini toping)

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

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