

1.14. Logarifm.

1.14.1. Logarifmik funksiya va uning xossalari.

1(96-6-52) $y = \log_3(2 - x)$;

$2 - x > 0$; $x < 2$; $x \in (-\infty; -2)$ (A)

2(97-1-63) $y = \log_x(3 - x)$;

$\begin{cases} 3 - x > 0 \\ x > 0 \\ x \neq 1 \end{cases}$; $\begin{cases} x < 3 \\ x > 0 \\ x \neq 1 \end{cases}$; $x \in (0; 1) \cup (1; 3)$ (C)

3(97-6-64) $f(x) = \log_x(6 - x)$;

$\begin{cases} 6 - x > 0 \\ x > 0 \\ x \neq 1 \end{cases}$; $\begin{cases} x < 6 \\ x > 0 \\ x \neq 1 \end{cases}$; $x \in (0; 1) \cup (1; 6)$ (D)

4(97-8-52) $y = \log_{x-1}(x - \frac{1}{4})$;

$\begin{cases} x - \frac{1}{4} > 0 \\ x - 1 > 0 \\ x - 1 \neq 1 \end{cases}$; $\begin{cases} x > \frac{1}{4} \\ x > 1 \\ x \neq 2 \end{cases}$; $x \in (1; 2) \cup (2; \infty)$ (B)

5(97-9-75) $y = \lg(nx^2 - 5x + 1)$ funksiya berilgan

oraliqda aniqlangan bo'lishi uchun $\frac{1}{4}$ va 1

$nx^2 - 5x + 1 = 0$ tenglamaning ildizlari bo'lishi

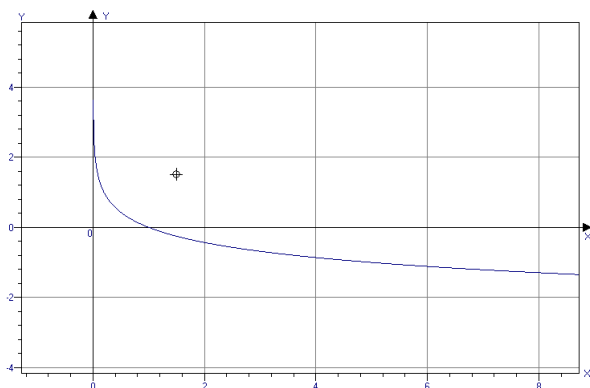
kerak. $\frac{1}{4}$ va funksiyaning aniqlanish sohasiga

kiritilgan. Bunday bo'lishi mumkin emas. (D)

6(97-12-52) $y = \log_{x^3}(6 - x)$;

$\begin{cases} 6 - x > 0 \\ x^3 > 0 \\ x^3 \neq 1 \end{cases}$; $\begin{cases} x < 6 \\ x > 0 \\ x \neq 1 \end{cases}$; $x \in (0; 1) \cup (1; 6)$ (E)

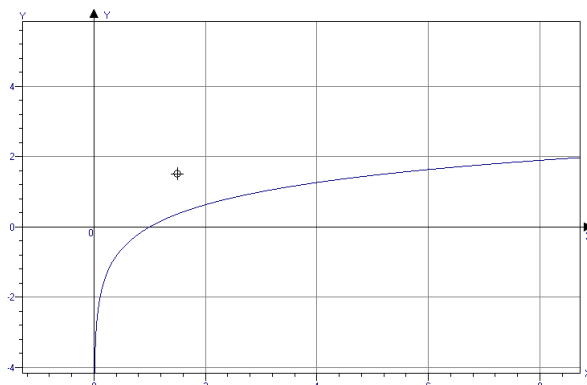
7(98-7-42) $y = -\log_5 x = \log_{\frac{1}{5}} x$



I va IV choraklardan o'tadi. (D)

8(98-5-15) y_1 ; y_3 ; y_5 juft funksiya. (D)

9(98-12-42) $y = \log_3 x$;



I va IV choraklardan o'tadi. (A)

10(99-2-36) $f(x) = \frac{\sqrt{8-x}}{\lg(x-1)}$;

$\begin{cases} 8-x \geq 0 \\ x-1 > 0 \\ \lg(x-1) \neq 0 \end{cases}$; $\begin{cases} x \leq 8 \\ x > 1 \\ x \neq 2 \end{cases}$; $x \in (1; 2) \cup (2; 8]$. Bu oraliqqa tegishli 6 ta butun son bor. (D)

11(99-3-26) $y = \frac{1}{\ln(1-x)} + \sqrt{x+2}$;

$\begin{cases} 1-x > 0 \\ \ln(1-x) \neq 0 \\ x+2 \geq 0 \end{cases}$; $\begin{cases} x < 1 \\ x \neq 0 \\ x \geq -2 \end{cases}$; $x \in [-2; 0) \cup (0; 1)$ (D)

12(99-5-39) $f(x) = \log_2(64^{-x} - 8^{1-x})$;

$64^{-x} - 8^{1-x} > 0$; $64^{-x} > 8^{1-x}$; $8^{-2x} > 8^{1-x}$;

$-2x > 1-x$; $x < -1$; $x \in (-\infty; -1)$ (B)

13(99-6-29) $\log_3(x(x-3)) - \log_3 x$;

$\begin{cases} x(x-3) > 0 \\ x > 0 \end{cases}$; $x \in (3; \infty)$ (A)

14(97-7-15) $y = \lg(kx^2 - 2x + 1)$ funksiya faqat $x=1$

nuqtada aniqlanmagan bo'lishi uchun

$kx^2 - 2x + 1 = (x-1)^2$ bo'lishi yoki $k=1$ bo'lishi

kerak. (E)

15(99-8-34) $y = \sqrt{\frac{1}{1-x}} + \log_2 x$;

$\begin{cases} \frac{1}{1-x} > 0 \\ 1-x > 0 \\ x > 0 \end{cases}$; $\begin{cases} 1-x > 0 \\ x > 0 \\ x < 1 \\ x > 0 \end{cases}$; $x \in (0; 1)$ (A)

16(99-8-36)

$$f(x) = \log_3(x^2 - 6x + 36) = \log_3((x-3)^2 + 27);$$

$$f(x)_{\min} = \log_3 27 = 3 \quad (\mathbf{D})$$

17(99-9-50) $y = \ln\left(\frac{x^2}{4} - 2x\right) + \sqrt{9-x}$;

$$\begin{cases} \frac{x^2}{4} - 2x > 0 \\ 9-x \geq 0 \end{cases}; \begin{cases} x(x-8) > 0 \\ x \leq 9 \end{cases}; x \in (-\infty; 0) \cup (8; 9];$$

(E)

18(00-9-44) $f(x) = \log_5(81^{-x} - 3^{x^2+3})$;

$$81^{-x} - 3^{x^2+3} > 0; 81^{-x} > 3^{x^2+3}; 3^{-4x} > 3^{x^2+3};$$

$$-4x > x^2 + 3; x^2 + 4x + 3 < 0; (x+3)(x+1) < 0;$$

$$x \in (-3; -1) \quad (\mathbf{D})$$

19(96-3-90) $a = \log_{\frac{1}{2}} 5; b = \log_{\frac{1}{4}} 3 = \log_{\frac{1}{2}} \sqrt{3}$;

$$c = \log_{\frac{1}{2}} 3; 5 > 3 > \sqrt{3}; a < c < b \quad (\mathbf{E})$$

20(96-9-25) $a = \log_{\frac{1}{3}} 3 = -1; b = \log_{\frac{1}{4}} 3 > -1$;

$$c = \log_{\frac{1}{2}} 3 < -1; c < a < b \quad (\mathbf{A})$$

21(96-12-90) $a = \log_{\frac{1}{8}} 4 = -\frac{2}{3}; b = \log_{\frac{1}{8}} 6 < -\frac{2}{3}$

$$\log_{\frac{1}{8}} 6 < c = \log_{\frac{1}{6}} 4 < -\frac{2}{3}; b < c < a \quad (\mathbf{B})$$

22(96-13-31) $a = \log_{\frac{1}{5}} 4; b = \log_{\frac{1}{5}} 6 < a$;

$$c = \log_{\frac{1}{6}} 4 > a; b < a < c \quad (\mathbf{E})$$

23(98-9-32) q va l musbat. (C)

24(02-2-20) $\log_{\frac{1}{2}} 2 = -1 \quad (\mathbf{A})$

25(99-9-47) $0 < p < 1$ va $1 < n < m$ bo'lsa,

$$\log_p n < 0; \log_p m < 0 \text{ yoki } \log_p n \cdot \log_p m > 0$$

bo'ladi. (B)

26(0-3-43) d va l musbat (E)

27(99-2-30) Hech qaysisi to'g'ri emas. (E)

28(01-1-29) $y = \frac{\ln(6x - x^2 - 5)}{5^{2-x} - 1}$;

$$\begin{cases} 6x - x^2 - 5 < 0 \\ 5^{2-x} - 1 \neq 0 \end{cases}; \begin{cases} x^2 - 6x + 5 > 0 \\ 5^{2-x} \neq 1 \end{cases}$$

$$\begin{cases} (x-5)(x-1) < 0 \\ x \neq 2 \end{cases}; x \in (1; 2) \cup (2; 5) \quad (\mathbf{B})$$

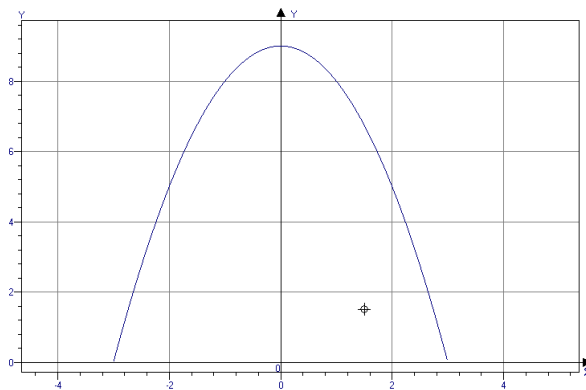
29(01-3-21) $y = \log_{\sqrt{10}}(6 + x - x^2)$;

$$6 + x - x^2 > 0; x^2 - x - 6 < 0; (x-3)(x+2) < 0;$$

$$-2 < x < 3. -1, 0, 1, 2 \text{ butun sonlar ularning yig'indisi}$$

2 ga teng. (C)

30(01-6-19) $y = 10^{\lg(9-x^2)} = 9 - x^2; 9 - x^2 > 0$;



I va II chorakdan o'tadi.

31(01-6-40) $f(x) = \frac{\log_{x^2+1}(6-x)}{\sqrt{x+2}}$;

$$\begin{cases} 6-x > 0 \\ x+2 > 0 \\ x^2+1 \neq 1 \end{cases}; \begin{cases} x < 6 \\ x > -2 \\ x \neq 0 \end{cases}; x \in (-2; 0) \cup (0; 6) \quad (\mathbf{C})$$

32(01-7-44) $f(x) = \sqrt{9-x^2} + \lg(x-1) - \sqrt{x}$;

$$\begin{cases} 9-x^2 \geq 0 \\ x-1 > 0 \\ x \geq 0 \end{cases}; \begin{cases} (x-3)(x+3) = 0 \\ x = 1 \\ x = 0 \end{cases}; x \in (1; 3] \quad (\mathbf{E})$$

33(01-9-46) $y = \log_{\pi} \frac{x^2 - 13x - 30}{25 - 9x^2}$;

$$\frac{x^2 - 13x - 30}{25 - 9x^2} > 0; (x^2 - 13x - 30) \left(x^2 - \frac{25}{9}\right) < 0;$$

$$(x+2)(x-15) \left(x - \frac{5}{3}\right) \left(x + \frac{5}{3}\right) < 0;$$

$$x \in \left(-2; -\frac{5}{3}\right) \cup \left(\frac{5}{3}; 15\right). \text{ Bu oraliqqa 13 ta natural}$$

son tegishli (A)

34(01-9-47) $y = \log_{15} \frac{x^2 - 2x - 15}{2x + 3}$;

$$\frac{x^2 - 2x - 15}{2x + 3} > 0; (x^2 - 2x - 15)(x+1.5) > 0;$$

$$(x+3)(x-5)(x+1.5) > 0; x \in (-3; -1.5) \cup (5; \infty).$$

Bu oraliqqa tegishli eng karra butun son -2.

$$f(-2) = \log_{15} 7 \quad (\mathbf{E})$$

$$35(98-7-21) \lg(x-3) - \lg(x+9) = \lg(x-2);$$

$$\begin{cases} x-3 \geq 0 \\ x+9 \geq 0 \\ x-2 \geq 0 \end{cases}; \begin{cases} x \geq 3 \\ x \geq -9 \\ x \geq 2 \end{cases}; x \in (3; \infty) \quad (\mathbf{D})$$

$$36(02-3-42) y = 5 \lg \frac{x}{3}; \quad \frac{y}{5} = \lg \frac{x}{3}; \quad \frac{x}{3} = 10^{\frac{y}{5}};$$

$$x = 3 \cdot 10^{\frac{y}{5}}; \quad y = 3 \cdot 10^{\frac{x}{5}} \quad (\mathbf{A})$$

$$37(02-3-43) y = \lg(3x-1) + \frac{1}{\sqrt{6+x-x^2}};$$

$$\begin{cases} 3x-1 > 0 \\ 6+x-x^2 > 0 \end{cases}; \begin{cases} 3x > 1 \\ x^2-x-6 < 0 \end{cases}; \begin{cases} x > \frac{1}{3} \\ (x-3)(x+2) < 0 \end{cases};$$

$$x \in \left(\frac{1}{3}; 3 \right) \quad (\mathbf{A})$$

38(02-4-39) Funksiyaning OY o'qi bilan kesishish nuqtasida $x=0$ bo'ladi.

$$y(0) = \sqrt{10^{\lg(0+4)}} = \sqrt{4} = 2 \quad (\mathbf{E})$$

$$39(02-7-20) y = \lg \left(\frac{3x+1}{x+2} - 1 \right);$$

$$\begin{cases} \frac{3x+1}{x+2} - 1 > 0 \\ x+2 \neq 0 \end{cases}; \begin{cases} \frac{2x-1}{x+2} > 0 \\ x \neq -2 \end{cases};$$

$$\begin{cases} \left(x - \frac{1}{2} \right) (x+2) > 0 \\ x \neq -2 \end{cases}; x \in (-\infty; -2) \cup \left(\frac{1}{2}; \infty \right) \quad (\mathbf{A})$$

$$40(02-9-29) y = \sqrt{2 + \log_{\frac{1}{2}}(3-x)};$$

$$\begin{cases} 2 + \log_{\frac{1}{2}}(3-x) \geq 0 \\ 3-x > 0 \end{cases}; \begin{cases} \log_{\frac{1}{2}}(3-x) \geq -2 \\ x < 3 \end{cases};$$

$$\begin{cases} 3-x \leq 4 \\ x < 3 \end{cases}; \begin{cases} x \geq -1 \\ x < 3 \end{cases}; x \in [-1; 3) \quad (\mathbf{B})$$

$$41(02-12-51) f(x) = \sqrt{x+4} + \log_2(x^2-4);$$

$$\begin{cases} x^2-4 > 0 \\ x+4 \geq 0 \end{cases}; \begin{cases} (x-2)(x+2) > 0 \\ x \geq -4 \end{cases};$$

$$x \in [-4; -2) \cup (2; \infty) \quad (\mathbf{E})$$

$$42(03-4-40) f(x) = \log_{x^2}(x-1) + \sqrt{2-x};$$

$$\begin{cases} x-1 > 0 \\ x^2 > 0 \\ 2-x \geq 0 \end{cases}; \begin{cases} x > 1 \\ x \neq 0 \\ x \leq 2 \end{cases}; x \in (1; 2] \quad (\mathbf{D})$$

$$43(03-4-41)$$

$$f(x) = \log_2(x^2-2x+5) = \log_2((x-1)^2+4);$$

$$f(x)_{\min} = \log_2 4 = 2; \quad f(x) \in [2; \infty) \quad (\mathbf{E})$$

$$44(03-5-63) a = 2 \log_2 5 = \log_2 25;$$

$$b = 3 \log_{\frac{1}{8}} \frac{1}{23} = \log_2 23; \quad c = 4 \log_{\frac{1}{4}} \frac{5}{26} = \log_2 27,04;$$

$$b < a < c \quad (\mathbf{A})$$

$$4503-6-43) y = \sqrt{\frac{8}{|x|}} - 1 + \lg(x^2-1);$$

$$\begin{cases} \frac{8}{|x|} - 1 \geq 0 \\ |x| \geq 0 \\ x^2 - 1 > 0 \end{cases}; \begin{cases} 8 - |x| \geq 0 \\ |x| \leq 8 \\ |x| \neq 0 \\ (x-1)(x+1) > 0 \\ (x-1)(x+1) > 0 \end{cases};$$

$$\begin{cases} -8 \leq x \leq 8 \\ x \neq 0 \\ (x-1)(x+1) > 0 \end{cases}; x \in [-8; -1) \cup (1; 8] \quad (\mathbf{D})$$

$$46(03-10-38) y = \frac{\ln(7-x^2)}{x+1};$$

$$\begin{cases} 7-x^2 > 0 \\ x+1 \neq 0 \end{cases}; \begin{cases} (x-\sqrt{7})(x+\sqrt{7}) < 0 \\ x \neq -1 \end{cases};$$

$x \in (-\sqrt{7}; -1) \cup (1; \sqrt{7})$; Bu oraliqqa tegishli butun sonlar -2,0,1,2. Bularning yig'indisi 1 (B)

$$Q = \log_4 16 + \log_4 \frac{1}{8} = \log_4 2 = -\frac{1}{2} < 2; \text{ (D)}$$

$$3(96-9-31) \left(\sqrt[3]{7}\right)_{\log_9 7}^3 = 7^{\frac{1}{3} \cdot \frac{3}{\log_9 7}} = 7^{\log_7 9} = 9 \text{ (B)}$$

$$4(96-12-89) \left(\sqrt{3}\right)_{\log_4 3}^2 = 3^{\frac{1}{2} \cdot \frac{2}{\log_4 3}} = 3^{\log_3 4} = 4 \text{ (C)}$$

$$5(96-13-30) \left(\sqrt[3]{5}\right)_{\log_4 5}^3 = 5^{\frac{1}{3} \cdot \frac{3}{\log_4 5}} = 5^{\log_5 4} = 4 \text{ (D)}$$

$$6(97-2-53) m = 2 \log_2 8 - \log_2 4 = 6 - 2 = 4;$$

$$n = \log_2 400 - 2 \log_2 5 = \log_2 400 - \log_2 25 = \\ = \log_2 16 = 4;$$

$$p = \log_5 125 + \log_5 5 = 3 + 1 = 4;$$

$$q = \ln 12e - \ln 12 = \ln e = 1; \quad n = m = p \neq q \text{ (D)}$$

$$7(975-37) \log_2 \lg 100 = \log_2 2 = 1; \text{ (A)}$$

$$8(97-8-53)$$

$$2 \log_2 5 - \log_2 25 = \log_2 25 - \log_2 25 = 0 < 2 \text{ (C)}$$

$$9(97-9-37) \log_5 \ln e^5 = \log_5 5 = 1 \text{ (E)}$$

$$10(97-12-52) 2 \log_2 5 - \log_2 30 =$$

$$= \log_2 25 - \log_2 30 = \log_2 \frac{25}{30} < 1; \text{ (D)}$$

$$11(98-4-15) \frac{5^{\lg 20}}{20^{\lg 5+1}} = \frac{5^{\lg 20}}{20 \cdot 20^{\lg 5}} = \frac{1}{20} = 0,05 \text{ (D)}$$

$$12(98-9-73) \frac{\log_2 729}{\log_2 9} = \log_9 729 = 3 \text{ (B)}$$

$$13(98-11-46) \log_{2\sqrt{2}} 128 = 2 \log_8 128$$

$$= 2 \log_{2^3} 2^7 = \frac{14}{3} = 4 \frac{2}{3}; \text{ (A)}$$

$$14(98-12-74) \frac{\log_3 12}{\log_{36} 3} - \frac{\log_3 4}{\log_{108} 3} =$$

$$= \log_3 12 \cdot \log_3 36 - \log_3 4 \cdot \log_3 108 =$$

$$= \log_3 (4 \cdot 3) \cdot \log_3 (9 \cdot 4) - \log_3 4 \cdot \log_3 (27 \cdot 4) =$$

$$= (\log_3 4 + 1) \cdot (2 + \log_3 4) - \log_3 4 \cdot (3 + \log_3 4) =$$

$$= 2 \log_3 4 + \log_3^2 4 + 2 + \log_3 4 - 3 \log_3 4 - \log_3^2 4 =$$

$$= 2 \text{ (B)}$$

$$15(99-2-31) 100^{\frac{1}{2} \lg 27 - \lg 3} \cdot 10 = 10^{\lg 27 - 2 \lg 3} \cdot 10 =$$

$$= 10^{\lg 27 - \lg 9} \cdot 10 = 10^{\lg 3} \cdot 10 = 3 \cdot 10 = 30 \text{ (C)}$$

1.14.2. Logarifmik ifodalarni shakl almashtirish.

$$1(96-3-89)$$

$$\left[2^{\frac{1}{\log_3 16}}\right]^4 = \left[2^{\log_{16} 3}\right]^4 = \left[2^{\frac{1}{4} \log_2 3}\right]^4 = 2^{\log_2 3} = 3 \text{ (E)}$$

$$2(96-6-53)$$

16(99-3-15)

$$\frac{5^{-\log_{\sqrt{5}}(\sqrt[4]{3})}}{9^{1+\log_{0,5} 2^{+1}}} = \frac{5^{-\frac{1}{4} \cdot 2 \log_5 3}}{9^{1-1}} = (5^{\log_5 3})^{-\frac{1}{2}} = 3^{-\frac{1}{2}} = \frac{\sqrt{3}}{3} \quad (\text{B})$$

$$17(99-6-13) \log_9 17 \cdot \log_{17} 7 \cdot \log_7 3 = \frac{\log_3 17}{\log_3 9} \times$$

$$\times \frac{\log_3 7}{\log_3 17} \cdot \frac{\log_3 3}{\log_3 7} = \frac{\log_3 3}{\log_3 9} = \frac{1}{2} = \frac{7}{14} \quad (\text{A})$$

$$18(99-8-30) \lfloor \lg 28 \rfloor + \lfloor \lg 0,026 \rfloor = 1 - 2 = -1 \quad (\text{C})$$

$$19(00-1-35) 100^{2 \lg 5 - \lg 15} = \left(10^{\lg \frac{25}{15}}\right)^2 = \frac{25}{9} = 2\frac{7}{9} \quad (\text{D})$$

20(00-1-39)

$$\text{A) } \log_2 18 - \log_2 9 = \log_2 2 = 1;$$

$$\text{B) } 3 \log_3 6 = 3(\log_3 2 + 1) = 3 \log_3 2 + 3 \approx 4,8;$$

$$\text{C) } \lg 25 + \lg 4 = \lg 100 = 2;$$

$$\text{D) } \log_{13} 169^2 = \log_{13} 13^4 = 4;$$

$$\text{E) } \frac{\log_8 4}{\log_8 64} = \log_{64} 4 = \frac{1}{3}; \quad \text{Javob: (B)}$$

$$21(00-3-34) 343^{\log_{49} 4} = (7^{\log_7 4})^{\frac{3}{2}} = 4^{\frac{3}{2}} = 8 \quad (\text{A})$$

$$22(00-7-32) n = \log_{\frac{1}{2}} 4 + \log_{\frac{1}{2}} 2 = -2 - 1 = -3;$$

$$m = \log_{\frac{1}{3}} 15 - \log_{\frac{1}{3}} 3 = \log_{\frac{1}{3}} 3 = -1; \quad p =$$

$$\ln e^{-2} = -2;$$

$$-3 < -2 < -1; \quad n < m < p \quad (\text{A})$$

$$23(00-10-42) \log_{2\sqrt{2}} 512 = 2 \log_8 512 =$$

$$= 2 \log_{2^3} 2^9 = \frac{18}{3} = 6; \quad (\text{B})$$

24(96-9-84)

$$\log_3 4 \cdot \log_4 5 \cdot \log_5 6 \cdot \log_6 7 \cdot \log_7 8 \cdot \log_8 9 =$$

$$\frac{\log_3 4}{\log_3 3} \cdot \frac{\log_3 5}{\log_3 4} \cdot \frac{\log_3 6}{\log_3 5} \cdot \frac{\log_3 7}{\log_3 6} \cdot \frac{\log_3 8}{\log_3 7} \cdot \frac{\log_3 9}{\log_3 8} =$$

$$= \frac{\log_3 9}{\log_3 3} = 2 \quad (\text{D})$$

25(00-5-66)

$$\log_3 2 \cdot \log_4 3 \cdot \log_5 4 \cdot \log_6 5 \cdot \log_7 6 \cdot \log_8 7 =$$

$$= \frac{\log_2 2}{\log_2 3} \cdot \frac{\log_2 3}{\log_2 4} \cdot \frac{\log_2 4}{\log_2 5} \cdot \frac{\log_2 5}{\log_2 6} \cdot \frac{\log_2 6}{\log_2 7} \cdot \frac{\log_2 7}{\log_2 8} =$$

$$= \frac{\log_2 2}{\log_2 8} = \frac{1}{3} \quad (\text{B})$$

$$26(00-7-31) 2 \log_2 3 \cdot \log_3 2 \cdot \log_3 \frac{1}{81} = 2 \cdot (-4) = -8$$

(D)

$$27(00-8-43) \sqrt{25^{\frac{1}{\log_6 5}} + 49^{\frac{1}{\log_8 7}}} =$$

$$= \sqrt{5^{2 \log_5 6} + 7^{2 \log_7 8}} = \sqrt{6^2 + 8^2} = 10 \quad (\text{A})$$

$$28(00-8-46) 36^{\log_6 5} + 10^{1 - \lg 2} - 3^{\log_6 36} =$$

$$= 6^{2 \log_6 5} + \frac{10}{10^{\lg 2}} - 3^2 = 25 + 5 - 9 = 21 \quad (\text{A})$$

$$29(98-1-33) = \frac{\log_2^2 14 + \log_2 14 \cdot \log_2 7 - 2 \log_2^2 7}{\log_2 14 + 2 \log_2 7} =$$

$$= \frac{\log_2^2 14 + 2 \log_2 14 \cdot \log_2 7 - \log_2 14 \cdot \log_2 7 - 2 \log_2^2 7}{\log_2 14 + 2 \log_2 7} =$$

$$= \frac{\log_2 14 (\log_2 14 + 2 \log_2 7) - \log_2 7 (\log_2 14 + 2 \log_2 7)}{\log_2 14 + 2 \log_2 7} =$$

$$= \frac{(\log_2 14 + 2 \log_2 7)(\log_2 14 - \log_2 7)}{\log_2 14 + 2 \log_2 7} = \log_2 \frac{14}{7} = 1$$

(D)

30(98-2-36)

$$(\log_3 27 - \log_3 9) \left(\log_3 48 + \log_3 \frac{1}{16} \right) + \log_3 81 =$$

$$= \log_3 \frac{9}{3} \cdot \log_3 \left(48 \cdot \frac{1}{16} \right) + 4 = 1 + 4 = 5 \quad (\text{D})$$

31(98-8-33)

$$= \frac{2 \log_3^2 14 - 2 \log_3^2 18 - \log_3 2 \cdot \log_3 18}{2 \log_3 2 + \log_3 18} =$$

$$= \frac{2 \log_3^2 2 - 2 \log_3 2 \cdot \log_3 18 + \log_3 2 \cdot \log_3 18 - 2 \log_3^2 18}{2 \log_3 2 + 2 \log_3 18} =$$

$$= \frac{2 \log_3 2 (\log_3 2 - \log_3 18) + \log_3 18 (\log_3 2 - \log_3 18)}{2 \log_3 2 + 2 \log_3 18} =$$

$$= \frac{(\log_3 2 - \log_3 18)(2\log_3 2 + \log_3 18)}{2\log_3 2 + \log_3 18} = \log_3 \frac{2}{18} = -2$$

(C)

$$\begin{aligned} 32(99-1-28) & \left(\frac{1}{\sqrt{2}-1} \right)^{\frac{\log_6 \log_6(\sqrt{2}+1)}{\log_6(\sqrt{2}+1)}} = \\ & = \left(\frac{\sqrt{2}+1}{(\sqrt{2}-1)(\sqrt{2}+1)} \right)^{\log_{\sqrt{2}+1} \log_6(\sqrt{2}+1)} = \\ & = (\sqrt{2}+1)^{\log_{\sqrt{2}+1} \log_6(\sqrt{2}+1)} = \log_6(\sqrt{2}+1) \quad (\text{A}) \end{aligned}$$

33(99-4-55)

$$\begin{aligned} & = \frac{\log_5^2 15 - \log_5^2 3 + 2\log_5 15 + 2\log_5 3}{\log_5 15 + \log_5 3} = \\ & = \frac{(\log_5 15 + \log_5 3)(\log_5 15 - \log_5 3) + 2(\log_5 15 + \log_5 3)}{\log_5 15 + \log_5 3} \end{aligned}$$

$$= \frac{(\log_5 15 + \log_5 3)(\log_5 15 - \log_5 3 + 2)}{(\log_5 15 + \log_5 3)} =$$

$$= \log_5 \frac{15}{3} + 2 = 1 + 2 = 3 \quad (\text{C})$$

34(96-1-33) $2^n = 5$; $\log_2 2^n = \log_2 5$; $n = \log_2 5$;

$$\lg 2 = \frac{1}{\log_2(2 \cdot 5)} = \frac{1}{1 + \log_2 5} = \frac{1}{n+1} \quad (\text{E})$$

35(96-10-36) $a = \log_4 125 = \log_{2^2} 5^3 = \frac{3}{2} \log_2 5$;

$$\log_2 5 = \frac{2a}{3};$$

$$\lg 64 = \frac{\log_2 64}{\log_2 10} = \frac{6}{1 + \log_2 5} = \frac{6}{1 + \frac{2a}{3}} = \frac{18}{2a+3} \quad (\text{C})$$

36(96-9-28) $a = \log_{50} 40 = \frac{\log_2 40}{\log_2 50} = \frac{\log_2 8 + \log_2 5}{\log_2 2 + \log_2 25}$

;

$$a = \frac{3 + \log_2 5}{1 + 2\log_2 5}; \quad a + 2a\log_2 5 = 3 + \log_2 5;$$

$$\log_2 5(2a - 1) = 3 - a; \quad \log_2 5 = \frac{3 - a}{2a - 1};$$

$$\log_5 2 = \frac{1 - 2a}{a - 3}; \quad (\text{E})$$

37(96-3-86)

$$a = \log_{98} 56 = \frac{\log_7 56}{\log_7 98} = \frac{\log_7 8 + \log_7 7}{\log_7 2 + \log_7 49};$$

$$a = \frac{3\log_7 2 + 1}{\log_7 2 + 2}; \quad a\log_7 2 + 2a = 3\log_7 2 + 1;$$

$$\log_7 2(a - 3) = 1 - 2a; \quad \log_7 2 = \frac{2a - 1}{3 - a}; \quad (\text{B})$$

38(96-12-86)

$$a = \log_{147} 63 = \frac{\log_7 63}{\log_7 147} = \frac{\log_7 9 + \log_7 7}{\log_7 3 + \log_7 49};$$

$$a = \frac{2\log_7 3 + 1}{\log_7 3 + 2}; \quad a\log_7 3 + 2a = 2\log_7 3 + 1;$$

$$\log_7 3(a - 2) = 1 - 2a; \quad \log_7 3 = \frac{1 - 2a}{a - 2}; \quad (\text{A})$$

39(96-13-27)

$$a = \log_{75} 45 = \frac{\log_5 45}{\log_5 75} = \frac{\log_5 9 + \log_5 5}{\log_5 3 + \log_5 25};$$

$$a = \frac{2\log_5 3 + 1}{\log_5 3 + 2}; \quad a\log_5 3 + 2a = 2\log_5 3 + 1;$$

$$\log_5 3(a - 2) = 1 - 2a; \quad \log_5 3 = \frac{1 - 2a}{a - 2}; \quad (\text{A})$$

40(98-2-33)

$$\log_a 256 = \log_a 2^8 = 8\log_a 2 = 2,4; \quad \log_a 2 = 0,3;$$

$$\log_a 4 - \log_a 2 = \log_a 2 = 0,3 \quad (\text{E})$$

41(98-3-30)

$$a = \log_{36} 108 = \frac{\log_2 108}{\log_2 36} = \frac{\log_2 4 + \log_2 27}{\log_2 4 + \log_2 9};$$

$$a = \frac{2 + 3\log_2 3}{2 + 2\log_2 3}; \quad 2a + 2a\log_2 3 = 2 + 3\log_2 3;$$

$$\log_2 3(2a - 3) = 2 - 2a; \quad \log_2 3 = \frac{2(1 - a)}{2a - 3}; \quad (\text{C})$$

42(98-10-77)

$$a = \log_6 108 = \frac{\log_2 108}{\log_2 6} = \frac{\log_2 4 + \log_2 27}{\log_2 2 + \log_2 3};$$

$$a = \frac{2 + 3\log_2 3}{1 + \log_2 3}; a + a\log_2 3 = 2 + 3\log_2 3;$$

$$\log_2 3(a - 3) = 2 - a; \log_2 3 = \frac{a - 2}{3 - a}; \text{ (D)}$$

$$43(00-1-88) a = \log_{12} 2 = \frac{1}{\log_2 12} = \frac{1}{\log_2 4 + \log_2 3};$$

$$a = \frac{1}{2 + \log_2 3}; \log_2 3 = \frac{1 - 2a}{a};$$

$$\log_6 16 = \frac{\log_2 16}{\log_2 6} = \frac{4}{\log_2 2 + \log_2 3} = \frac{4}{1 + \frac{1 - 2a}{a}} = \frac{4a}{1 - a} \text{ (C)}$$

$$44(00-1-41) \log_2(\log_2 a^8) - \log_2 \log_2 a =$$

$$\log_2(8\log_2 a) - \log_2 \log_2 a =$$

$$= \log_2 8 + \log_2 \log_2 a - \log_2 \log_2 a = 3 \text{ (C)}$$

$$45(00-6-32) a = \log_{0,5} 27 = \frac{\log_3 27}{\log_3 0,5} = \frac{3}{\log_3 0,5};$$

$$\log_3 0,5 = \frac{3}{a};$$

$$\log_{\sqrt{3}} \sqrt[6]{1,5} = \frac{2}{6} \log_3 1,5 = \frac{1}{3} \log_3 3 + \frac{1}{3} \log_3 0,5 = \frac{1}{3} + \frac{1}{3} \cdot \frac{3}{a} = \frac{1}{3} + \frac{1}{a} = \frac{1}{3} + a^{-1} \text{ (A)}$$

$$46(00-10-31) a = \log_2 3;$$

$$\log_8 0,75 = \frac{1}{3} \log_2 \frac{3}{4} = \frac{1}{3} (\log_2 3 - \log_2 4) =$$

$$= \frac{1}{3} (\log_2 3 - 2) = \frac{1}{3} (a - 2) \text{ (C)}$$

$$47(00-10-66) \log_a 27 = b; a^b = 3^3; a = 3^{\frac{3}{b}};$$

$$\log_{\sqrt{3}} \sqrt[6]{a} = \frac{2}{6} \log_3 a = \frac{1}{3} \log_3 3^{\frac{3}{b}} = \frac{1}{3} \cdot \frac{3}{b} = \frac{1}{b} \text{ (A)}$$

$$48(97-4-33) \lg 2 = a; \lg 7 = b;$$

$$\log_{35} 5 = \frac{1}{\log_5 35} = \frac{1}{1 + \log_5 7} = \frac{1}{1 + \frac{\lg 7}{\lg 5}} = \frac{\lg 5}{\lg 7 + \lg 5} =$$

$$= \frac{1 - \lg 2}{1 - \lg 2 + \lg 7} = \frac{1 - a}{1 - a + b} \text{ (B)}$$

$$49(97-9-73) \log_3 20 = a; \log_3 5 = b;$$

$$\frac{a}{b} = \frac{\log_3 20}{\log_3 5} = \log_5 20 = \log_5 5 + \log_5 4 = 1 + \log_5 4;$$

$$\log_5 4 = \frac{a - b}{b}; \log_4 5 = \frac{b}{a - b};$$

$$\log_4 500 = \log_4 4 + \log_4 125 = 1 + 3\log_4 5 =$$

$$= 1 + \frac{3b}{a - b} = \frac{a + 2b}{a - b} \text{ (C)}$$

$$50(98-11-44) \log_7 2 = a; \log_2 10 = b;$$

$$\log_4 39,2 = \frac{1}{2} \log_2 \frac{392}{10} = \frac{1}{2} (\log_2 392 - \log_2 10) = \frac{1}{2} (\log_2 49 + \log_2 8 - \log_2 10) = \frac{1}{2} (2\log_2 7 + 3 - \log_2 10) = \frac{1}{2} \left(\frac{2}{a} + 3 - b \right) = \frac{1}{a} + \frac{3}{2} - \frac{b}{2} \text{ (B)}$$

$$51(99-7-30) \log_2 3 = a; \log_2 5 = b;$$

$$\log_{45} 135 = \frac{\log_2 135}{\log_2 45} = \frac{\log_2 27 + \log_2 5}{\log_2 9 + \log_2 5} =$$

$$= \frac{3\log_2 3 + \log_2 5}{2\log_2 3 + \log_2 5} = \frac{3a + b}{2a + b} \text{ (A)}$$

$$52(99-10-35)$$

$$\log_2 a = 2; a = 4; \log_3 b = 2; b = 9;$$

$$\log_6(ab) = \log_6(9 \cdot 4) = \log_6 36 = 2 \text{ (E)}$$

$$53(00-3-33) \log_a x = 2; \log_b x = 3; \log_c x = 6;$$

$$\log_{abc} x = \frac{1}{\log_x abc} = \frac{1}{\log_x a + \log_x b + \log_x c} = \frac{1}{\frac{1}{2} + \frac{1}{3} + \frac{1}{6}} = 1 \text{ (C)}$$

$$54(00-3-35) \log_{14} 7 = a; \log_{14} 5 = b;$$

$$\log_{35} 28 = \frac{\log_{14} 28}{\log_{14} 35} = \frac{\log_{14} \frac{196}{7}}{\log_{14} (7 \cdot 5)} = \frac{2 - \log_{14} 7}{\log_{14} 7 + \log_{14} 5} =$$

$$= \frac{2 - a}{a + b} \text{ (A)}$$

$$55(00-8-38) \lg 5 = a; \lg 3 = b;$$

$$\log_{30} 8 = \frac{\lg 8}{\lg 30} = \frac{\lg \frac{1000}{125}}{\lg(10 \cdot 3)} = \frac{3 - 3\lg 5}{1 + \lg 3} = \frac{3 - 3a}{1 + b} \text{ (A)}$$

$$56(00-10-39) \log_7 2 = a; \log_2 10 = b;$$

$$\log_4 78,4 = \frac{1}{2} \log_2 \frac{784}{10} = \frac{1}{2} (\log_2 (49 \cdot 16) - \log_2 10) =$$

$$= \frac{1}{2} (2 \log_2 7 + 4 - b) = \frac{1}{a} + 2 - \frac{b}{2} \quad \text{(D)}$$

$$57(01-2-29) \left((\log_b^4 a + \log_a^4 b + 2)^{\frac{1}{2}} - 2 \right)^{\frac{1}{2}} =$$

$$= \left((\log_b^4 a + \log_a^4 b + 2 \log_b^2 a \log_a^2 b)^{\frac{1}{2}} - 2 \right)^{\frac{1}{2}} =$$

$$= \left((\log_b^2 a + \log_a^2 b)^2 - 2 \right)^{\frac{1}{2}} =$$

$$(\log_b^2 a + \log_a^2 b - 2)^{\frac{1}{2}} =$$

$$= (\log_b^2 a + \log_a^2 b - 2 \log_b a \log_a b)^{\frac{1}{2}} =$$

$$= ((\log_b a - \log_a b)^2)^{\frac{1}{2}} = |\log_b a - \log_a b|;$$

$b > a > 1$ bo'lgani uchun

$$|\log_b a - \log_a b| = \log_a b - \log_b a \quad \text{(A)}$$

$$58(01-3-14) 4^{\log_2(\sqrt[3]{2\sqrt{2}})^2} = (\sqrt[3]{2\sqrt{2}})^4 = (\sqrt[6]{8})^4 = 4 \quad \text{(C)}$$

$$59(01-3-28) \quad a > 0; b > 0; a^2 + b^2 = 7ab;$$

$$(a+b)^2 = 9ab; \quad a+b = 3\sqrt{ab};$$

$$\frac{2 \lg \frac{a+b}{3}}{\lg a + \lg b} = \frac{2 \lg \sqrt{ab}}{\lg(ab)} = \frac{\lg(ab)}{\lg(ab)} = 1 \quad \text{(A)}$$

$$60(01-5-16)$$

$$49^{1-\log_7 2} + 5^{-\log_5 4} = \frac{49}{(7^{\log_7 2})^2} + \frac{1}{5^{\log_5 4}} = \frac{49}{4} + \frac{1}{4} =$$

$$= \frac{50}{4} = 12,5 \quad \text{(A)}$$

$$61(01-6-36) \quad 2 \log_2 12 + \log_2 20 - \log_2 15 - \log_2 3 =$$

$$= \log_2 144 + \log_2 20 - \log_2 15 - \log_2 3 = \log_2 \frac{144 \cdot 20}{15 \cdot 3} =$$

$$= \log_2 64 = 6 \quad \text{(E)}$$

$$62(01-6-37) \quad \lg 8 \cdot \log_2 10 + \log_5 9 \cdot \log_3 5 =$$

$$= \frac{\log_2 8}{\log_2 10} \cdot \log_2 10 + \frac{\log_3 9}{\log_3 5} \cdot \log_3 5 = 3 + 2 = 5 \quad \text{(D)}$$

$$63(01-7-29) \quad 0,8(1 + 9^{\log_3 8})^{\log_{65} 5} =$$

$$0,8 \cdot (1 + (3^{\log_3 8})^2)^{\log_{65} 5} =$$

$$= 0,8 \cdot 65^{\log_{65} 5} = 0,8 \cdot 5 = 4 \quad \text{(C)}$$

$$64(01-7-24) \quad \lg 2 = a; \quad \lg 7 = b;$$

$$\log_5 9,8 = \log_5 \frac{98}{10} = \frac{\lg 98 - 1}{\lg 5} = \frac{2 \lg 7 + \lg 2 - 1}{1 - \lg 2} =$$

$$= \frac{a + 2b - 1}{1 - a} \quad \text{(B)}$$

$$65(01-8-31)$$

$$\log_{0,2} 27 = a; \quad 3 \log_{0,2} 3 = a; \quad \log_{0,2} 3 = \frac{a}{3};$$

$$\log_{\sqrt{3}} \sqrt[6]{1,8} = \frac{2}{6} \log_3 (9 \cdot 0,2) = \frac{1}{3} (2 + \log_3 0,2) =$$

$$= \frac{1}{3} \left(2 + \frac{3}{a} \right) = \frac{2}{3} + \frac{1}{a} \quad \text{(E)}$$

$$66(01-9-10) \quad \frac{\lg(7 - 4\sqrt{3})}{\lg(2 - \sqrt{3})} = \frac{\lg(2 - \sqrt{3})^2}{\lg(2 - \sqrt{3})} = 2 \quad \text{(A)}$$

$$67(01-9-17) \quad \frac{\lg^2(x^3)}{\lg^3(x^2)} \cdot \lg \sqrt{x} = \frac{9 \lg^2 x}{8 \lg^3 x} \cdot \frac{1}{2} \lg x = \frac{9}{16}$$

(A)

$$68(01-9-26) \quad 4 + \frac{1}{4} + \dots = \frac{4}{1 - \frac{1}{4}} = \frac{16}{3};$$

$$0,2^{\log_5(4 + \frac{1}{4} + \dots)} = \left(\frac{1}{5} \right)^{\log_5 \frac{16}{3}} = \frac{1}{5^{\log_5 \frac{16}{3}}} = \frac{1}{\frac{16}{3}} = \frac{3}{16} \quad \text{(A)}$$

$$69(01-10-16) \quad \frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \frac{1}{32} + \dots = \frac{\frac{1}{4}}{1 + \frac{1}{2}} = \frac{1}{6};$$

$$0,125^{\log_{2\sqrt{2}} \left(\frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \frac{1}{32} + \dots \right)} = \left(\frac{1}{8} \right)^{2 \log_8 \frac{1}{6}} = \frac{1}{\left(8^{\log_8 \frac{1}{6}} \right)^2} =$$

$$= \frac{1}{\left(\frac{1}{6} \right)^2} = 36 \quad \text{(C)}$$

70(01-10-33)

$$\frac{\log_3 256 \cdot \log_2 \frac{1}{81}}{\log_5 \frac{1}{16} \cdot \log_4 125} = \frac{\log_3 2^8 \cdot \log_2 3^{-4}}{\log_5 4^{-2} \cdot \log_4 5^3} =$$

$$= \frac{-4 \cdot 8 \cdot \log_3 2 \cdot \log_2 3}{-2 \cdot 3 \cdot \log_5 4 \cdot \log_4 5} = \frac{16}{3} = 5\frac{1}{3} \text{ (C)}$$

71(01-11-25) $\log_5 2 \cdot \log_4 243 \cdot \log_2 5 \cdot \log_3 4 =$
 $= \log_5 2 \cdot \log_2 5 \cdot \log_4 3^5 \cdot \log_3 4 = 4 \log_4 3 \cdot \log_3 4 =$
 $= 5 \text{ (C)}$

72(01-11-26) $\frac{3 \lg 2 + 3 \lg 5}{\lg 1300 - \lg 13} = \frac{3(\lg 2 + \lg 5)}{\lg \frac{1300}{13}} =$
 $= \frac{3 \lg 10}{\lg 100} = \frac{3}{2} = 1,5 \text{ (E)}$

73(01-11-27) $\log_3 4 = a; \log_5 4 = b;$
 $\log_4 45 = \log_4 9 + \log_4 5 = 2 \log_4 3 + \log_4 5 =$
 $= 2 \cdot \frac{1}{a} + \frac{1}{b} = \frac{2}{a} + \frac{1}{b} = \frac{2b + a}{ab} \text{ (E)}$

74(01-11-55) $\log_3 \left(\sqrt[3]{\sqrt{83} + \sqrt{2}} \cdot \sqrt[3]{\sqrt{245} + \sqrt{2}} \right) = t;$
 $\log_3 \left(\sqrt[3]{\sqrt{83} - \sqrt{2}} \cdot \sqrt[3]{\sqrt{245} - \sqrt{2}} \right) = x$ bo'lsin.
 $t + x = \log_3 \left(\sqrt[3]{\sqrt{83} + \sqrt{2}} \cdot \sqrt[3]{\sqrt{245} + \sqrt{2}} \right) +$
 $+ \log_3 \left(\sqrt[3]{\sqrt{83} - \sqrt{2}} \cdot \sqrt[3]{\sqrt{245} - \sqrt{2}} \right) =$
 $= \log_3 \left(\left(\sqrt[3]{\sqrt{83} + \sqrt{2}} \cdot \sqrt[3]{\sqrt{245} + \sqrt{2}} \right) \left(\sqrt[3]{\sqrt{83} - \sqrt{2}} \cdot \sqrt[3]{\sqrt{245} - \sqrt{2}} \right) \right) =$
 $= \log_3 \left(\sqrt[3]{83 - 2} \cdot \sqrt[3]{245 - 2} \right) = \log_3 \left(\sqrt[3]{81} \cdot \sqrt[3]{241} \right) =$
 $= \log_3 \left(\sqrt[3]{3^4 \cdot 3^5} \right) = \log_3 3^3 = 3;$
 $t + x = 3; x = 3 - t \text{ (D)}$

75(02-2-21) $\lg 5 = c;$
 $\lg 250 = \lg 25 + \lg 10 = 2 \lg 5 + 1 = 2c + 1 \text{ (A)}$

76(02-2-53) $\frac{\log_5 30}{\log_{30} 5} - \frac{\log_5 150}{\log_6 5} =$
 $= \log_5^2 30 - \log_5 6 (\log_5 5 + \log_5 30) =$
 $= \log_5^2 30 - \log_5 6 - \log_5 6 \cdot \log_5 30 =$
 $= \log_5 30 (\log_5 30 - \log_5 6) - \log_5 6 =$

$$= \log_5 30 - \log_5 6 = \log_5 5 = 1 \text{ (A)}$$

77(02-3-22) $a > 0; a \neq 1;$

$$\log_{\sqrt{a}} \sqrt[3]{a} = \frac{2}{3} \log_a a = \frac{2}{3} \text{ (A)}$$

78(02-3-33)

$$\frac{1}{\log_2 4} + \frac{1}{\log_4 4} + \frac{1}{\log_8 4} + \frac{1}{\log_{16} 4} + \frac{1}{\log_{32} 4} +$$

$$+ \frac{1}{\log_{64} 4} + \frac{1}{\log_{128} 4} = \log_4 2 + \log_4 4 + \log_2 8 +$$

$$+ \log_4 16 + \log_4 32 + \log_4 64 + \log_4 128 =$$

$$= \log_4 (2 \cdot 2^2 \cdot 2^3 \cdot 2^4 \cdot 2^5 \cdot 2^6 \cdot 2^7) = \log_{2^2} 2^{28} =$$

$$= \frac{28}{2} = 14 \text{ (A)}$$

79(02-4-38) $\log_{\frac{1}{6}} 2 + \log_{\frac{1}{6}} 3 = \log_{\frac{1}{6}} 6 = -1 \text{ (B)}$

80(02-5-23) $\log_4 a = \log_8 b; \frac{1}{2} \log_2 a = \frac{1}{3} \log_2 b;$

$$\frac{\log_2 b}{\log_2 a} = \frac{3}{2}; \log_a b = \frac{\log_2 b}{\log_2 a} = \frac{3}{2} = 1,5 \text{ (A)}$$

81(02-5-24) $\left(\log_3 \sqrt[3]{3^3 \sqrt[3]{3^3 \sqrt[3]{3}}} \right)^{-1} = \left(\log_3 3^{\frac{1}{27}} \right)^{-1} =$
 $= \left(\frac{1}{27} \right)^{-1} = 27 \text{ (A)}$

82(02-6-20) $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} \dots \frac{1}{1 - \frac{1}{3}} = \frac{1}{2};$

$$\log_{16} \frac{1}{2} = -\frac{1}{4}; \log_{128} 0,25^{-\frac{1}{4}} = \log_{128} \left(\frac{1}{4} \right)^{-\frac{1}{4}} =$$

$$= \log_{2^7} 2^{\frac{1}{2}} = \frac{1}{14} \text{ (C)}$$

83(02-6-36) $\frac{\log_2 729 \cdot \log_3 \frac{1}{256}}{\log_7 216 \cdot \log_6 343} = \frac{\log_2 3^6 \cdot \log_3 2^{-8}}{\log_7 6^3 \cdot \log_6 7^3} =$

$$= \frac{-8 \cdot 6 \cdot \log_2 3 \cdot \log_3 2}{3 \cdot 3 \cdot \log_7 6 \cdot \log_6 7} = -\frac{16}{3} = -5\frac{1}{3} \text{ (D)}$$

84(02-8-12) $b^{\log_5 7} = 7^{\log_5 b} = 4;$

$$b^{\log_5 \sqrt{7}} = (b^{\log_5 7})^{\frac{1}{2}} = 4^{\frac{1}{2}} = 2 \quad (\text{A})$$

$$85(02-8-13) \lg 2 = a; \lg 3 = b;$$

$$\log_9 20 = \frac{\lg 20}{\lg 9} = \frac{1 + \lg 2}{2 \lg 3} = \frac{1 + a}{2b} \quad (\text{A})$$

$$86(02-8-15) \sqrt[3]{2^{\log_2 5^3} + \log_3 5 \cdot \log_5 3^3} = \\ = \sqrt[3]{2^{\log_2 5} + 3 \log_3 5 \cdot \log_5 3} = \sqrt[3]{5 + 3} = \sqrt[3]{8} = 2 \quad (\text{A})$$

$$87(02-9-34) 9^{\log_3 7} = (3^{\log_3 7})^2 = 7^2 = 49;$$

$$\frac{1}{6} (1 + 49)^{\log_5 3} = \frac{1}{6} \cdot 50^{\log_5 3} = \frac{1}{6} \cdot 3 = 0,5 \quad (\text{B})$$

$$88(02-9-58) \log_a \left(\frac{a^2}{b} \right) = \log_a \frac{a^2}{b} + \log_a a = \\ = 1 + \frac{1}{\log_a \frac{a}{b}} = 1 + \frac{1}{\log_a a - \log_a b} = 1 + \frac{1}{1 - \log_a b} = \frac{1}{2};$$

$$\frac{1}{1 - \log_a b} = -\frac{1}{2}; \quad 2 = -1 + \log_a b; \quad \log_a b = 3;$$

$$\log_{a^2 b} ab = \frac{\log_a(ab)}{\log_a(a^2 b)} = \frac{1 + \log_a b}{2 + \log_a b} = \frac{1 + 3}{2 + 3} = 0,8 \quad (\text{E})$$

$$89(02-10-27) \lg 2 = a; \log_2 7 = b;$$

$$\lg 56 = \lg 2 + \lg 28 = \lg 2 + \frac{\log_2 28}{\log_2 10} = \lg 2 + \frac{2 + \log_2 7}{\log_2 10} =$$

$$= a + \frac{2 + b}{\frac{1}{a}} = a + 2a + ab = 3a + ab = a(3 + b) \quad (\text{A})$$

$$90(02-10-73)$$

$$\left(\frac{\log_6 27 + 2 \log_6 2}{\log_6 \sqrt[3]{0,25} + \log_6 \frac{1}{3}} \right)^3 = \left(\frac{\log_6 27 + \log_6 4}{\log_6 \sqrt[3]{\frac{1}{4}} + \log_6 \sqrt[3]{\frac{1}{27}}} \right)^3 =$$

$$= \left(\frac{\log_6 108}{\log_6 \sqrt[3]{\frac{1}{108}}} \right)^3 = \left(-\frac{1}{3} \cdot \log_6 108 \right)^3 = -27 \quad (\text{A})$$

$$91(02-11-31) \log_2 (5 - \sqrt{10}) + \log_{\frac{1}{2}} (\sqrt{5} - \sqrt{2}) =$$

$$= \log_2 (\sqrt{5}(\sqrt{5} - \sqrt{2})) - \log_2 (\sqrt{5} - \sqrt{2}) =$$

$$= \log_2 \frac{\sqrt{5}(\sqrt{5} - \sqrt{2})}{\sqrt{5} - \sqrt{2}} = \log_2 \sqrt{5};$$

$$16^{\log_2 \sqrt{5}} = (2^{\log_2 \sqrt{5}})^4 = (\sqrt{5})^4 = 25 \quad (\text{C})$$

$$92(02-11-32) \log_2 (\sqrt{3} - 1) + \log_2 (\sqrt{6} - 2) = a;$$

$$\log_2 (\sqrt{3} + 1) + \log_2 (\sqrt{6} + 2) = x \text{ bo'lsin.}$$

$$a + x = \log_2 (\sqrt{3} - 1) + \log_2 (\sqrt{6} - 2) +$$

$$+ \log_2 (\sqrt{3} + 1) + \log_2 (\sqrt{6} + 2) =$$

$$= \log_2 ((\sqrt{3} - 1)(\sqrt{3} + 1)) + \log_2 ((\sqrt{6} - 2)(\sqrt{6} + 2)) =$$

$$= \log_2 2 + \log_2 2 = 1 + 1 = 2;$$

$$a + x = 2; \quad x = 2 - a \quad (\text{E})$$

$$93(02-12-48) \frac{3 \lg 2 + 3 \lg 5}{\lg 1300 - \lg 0,13} = \frac{3(\lg 2 + \lg 5)}{\lg \frac{1300}{0,13}} =$$

$$= \frac{3 \lg 10}{\lg 10000} = \frac{3}{4} = 0,75 \quad (\text{E})$$

$$94(03-1-20) \log_5 2 < 0,5; \log_{11} 3 < 0,5;$$

$x = \log_5 3 + \log_5 11 < 1$; shuning uchun $\sqrt[3]{x}$ eng katta son. (E)

$$95(03-2-20) \frac{1 + 2 \log_3 2}{(1 + \log_3 2)^2} + \log_6^2 2 = \frac{\log_3 12}{\log_3^2 6} + \log_6^2 2 =$$

$$= \frac{\log_3 12 + (\log_6 2 \cdot \log_3 6)^2}{\log_3^2 6} = \frac{\log_3 12 + (\log_3 6^{\log_6 2})^2}{\log_3^2 6} =$$

$$= \frac{\log_3 6 + \log_3 2 + \log_3^2 2}{\log_3^2 6} = \frac{\log_3 6 + \log_3 2 \cdot (1 + \log_3 2)}{\log_3^2 6} =$$

$$= \frac{\log_3 6 + \log_3 2 \cdot \log_3 6}{\log_3^2 6} = \frac{\log_3 6(1 + \log_3 2)}{\log_3^2 6} =$$

$$= \frac{\log_3^2 6}{\log_3^2 6} = 1 \quad (\text{C})$$

$$96(03-2-25) p = \frac{1}{\lg \pi} + \frac{1}{\log_3 \pi} + \frac{1}{\log_2 \pi} =$$

$$= \log_{\pi} 10 + \log_{\pi} 5 + \log_{\pi} 2 = \log_{\pi} 100 > 4 \quad (\text{E})$$

$$97(03-3-33) \log_8 5^{2 \log_{25} 32} = \log_8 5^{\log_5 32} = \log_8 32 =$$

$$= \log_{2^3} 2^5 = \frac{5}{3} \quad (\text{C})$$

$$98(03-4-32) y = \ln(3^{\log_3 0,64} + 8^{\log_8 0,36}) = \\ = \ln(0,64 + 0,36) = \ln 1 = 0 \quad (\text{C})$$

$$99(03-4-33) 2\log_4 8 - 3\log_8 4 + \log_2 32 + 18 = \\ = \log_4 64 - \log_8 64 + \log_2 32 + 18 = \\ = 3 - 2 + 5 + 18 = 24 \quad (\text{B})$$

$$100(03-5-39) y = \log_5 \log_5 \sqrt[5]{\sqrt[5]{\sqrt[5]{5}}} = \\ = \log_5 \log_5 5^{5^{-4}} = \log_5 5^{-4} = -4 \quad (\text{A})$$

$$101(03-6-59) \lg 5 = 0,7;$$

$$\log_5 10 = \frac{1}{\lg 5} = \frac{1}{0,7} = \frac{10}{7} = 1\frac{3}{7} \quad (\text{D})$$

$$102(03-9-19) \log_{\frac{1}{3}} \left(\frac{\sqrt{3}}{7+2\sqrt{10}} \right) + \log_{\sqrt{3}} \left(\frac{1}{\sqrt{5}+\sqrt{2}} \right) = \\ = \log_3 \left(\frac{7+2\sqrt{10}}{\sqrt{3}} \right) - \log_3 (\sqrt{5}+\sqrt{2})^2 = \\ = \log_3 \left(\frac{7+2\sqrt{10}}{\sqrt{3}(\sqrt{5}+\sqrt{2})^2} \right) = \log_3 \left(\frac{7+2\sqrt{10}}{\sqrt{3}(7+2\sqrt{10})} \right) = \\ = \log_3 \frac{1}{\sqrt{3}} = \log_3 3^{-\frac{1}{2}} = -\frac{1}{2} = -0,5 \quad (\text{D})$$

103(03-11-82) $x = 3^{\sqrt{\log_3 2}}$; $y = 2^{\sqrt{\log_2 3}}$ bo'lsin. Har ikki tenglikni 2 asosga ko'ra logarifmlaymiz.

$$\log_2 x = \log_2 3^{\sqrt{\log_3 2}} = \sqrt{\log_3 2} \cdot \log_2 3 = \\ = \sqrt{\log_3 2 \cdot \log_2 3 \cdot \log_2 3} = \sqrt{\log_2 3};$$

$$\log_2 y = \log_2 2^{\sqrt{\log_2 3}} = \sqrt{\log_2 3} \text{ bundan}$$

$$\log_2 x = \log_2 y; x = y; x - y = 0;$$

$$3^{\sqrt{\log_3 2}} - 2^{\sqrt{\log_2 3}} = 0; 3^{\sqrt{\log_3 2}} - 2^{\sqrt{\log_2 3}} - 1 = -1 \quad (\text{D})$$

1.14.3. Logarifmik tenglamalar.

$$1(96-6-55) 3^{2\log_3 x} = 16; \begin{cases} 3^{\log_3 x^2} = 16; \\ x > 0 \end{cases}$$

$$\begin{cases} x^2 = 16; \\ x > 0 \end{cases}; x = 4 \quad (\text{C})$$

$$2(97-2-55) 4^{\log_4(x-5)} = 19; x - 5 = 19; x = 24$$

$$24 - 20 = 4 \quad (\text{C})$$

$$3(97-8-40) 4^{2\log_4 x} = 25; \begin{cases} 4^{\log_4 x^2} = 25; \\ x > 0 \end{cases}$$

$$\begin{cases} x^2 = 25; \\ x > 0 \end{cases}; x = 5 \quad (\text{A})$$

$$4(98-2-35)$$

$$2^{\log_2(x^3+4x+1)} = 8x+1; \begin{cases} x^3+4x+1=8x+1 \\ 8x+1 > 0 \\ x^3+4x+1 > 0 \end{cases}$$

$$\begin{cases} x(x^2-4)=0 \\ 8x+1 > 0 \\ x^3+4x+1 > 0 \end{cases}; \begin{cases} x_1=0; x_2=2; x_3=-2 \\ 8x+1 > 0 \\ x^3+4x+1 > 0 \end{cases}$$

$x = -2$ chet ildiz.

Javob 0 va 2 (C)

$$5(98-6-30) 2^{x^2} \cdot 3^x = 6; x_1 = 1; x_2 = ?.$$

Tenglamaning har ikki tomonini 2 asosga ko'ra logarifmlaymiz.

$$\log_2(2^{x^2} \cdot 3^x) = \log_2 6; \log_2 2^{x^2} + \log_2 3^x = \log_2 6;$$

$$x^2 + x \log_2 3 - \log_2 6 = 0; x_1 \cdot x_2 = -\log_2 6;$$

$$x_2 = -\log_2 6; \quad (\text{A})$$

$$6(98-9-34) \lg(x^2 + 2x - 3) = \lg(x - 3);$$

$$\begin{cases} x^2 + 2x - 3 = x - 3 \\ x^2 + 2x - 3 > 0 \\ x - 3 > 0 \end{cases}; \begin{cases} x^2 + 3x = 0 \\ x^2 + 2x - 3 > 0 \\ x > 3 \end{cases}$$

$$\begin{cases} x_1 = 0; x_2 = -3 \\ x^2 + 2x - 3 > 0 \\ x > 3 \end{cases}; \text{ har ikki}$$

ildiz chet ildiz.

$$x \in \emptyset \quad (\text{D})$$

$$7(99-2-32) \frac{1}{2^{\log_4 x}} = 4; 2^{-\log_4 x} = 2^2;$$

$$-\log_4 x = 2; \log_4 x = -2; x = \frac{1}{16};$$

$$\frac{16}{x} = \frac{16}{\frac{1}{16}} = 256 \quad (\text{E})$$

$$8(99-6-26) \log_{18} \log_2 \log_2 \left(-\frac{1}{x} \right) = 0;$$

$$\log_2 \log_2 \left(-\frac{1}{x} \right) = 1; \log_2 \left(-\frac{1}{x} \right) = 2;$$

$$-\frac{1}{x} = 4; x = -\frac{1}{4}; \quad (\text{D})$$

$$9(99-6-28) \log_2(54 - x^3) = 3\log_2 x;$$

$$\log_2(54 - x^3) = \log_2 x^3;$$

$$\begin{cases} 54 - x^3 = x^3 \\ 54 - x^3 > 0 \\ x^3 > 0 \end{cases}; \begin{cases} x^3 = \frac{54}{2} \\ x^3 > 0 \\ x^3 > 0 \end{cases} \text{ bulardan } x = 3 \quad (\text{D})$$

$$10(99-6-50) \log_{\frac{1}{5}} \log_5 \sqrt{5x} = 0;$$

$$\log_5 \sqrt{5x} = 1; \sqrt{5x} = 5; 5x = 25; x = 5 \text{ (E)}$$

$$11(99-8-31) \sqrt{3}^{\log_{\sqrt{5}} x-4} = \frac{1}{3}; 3^{\frac{1}{2}(\log_{\sqrt{5}} x-4)} = 3^{-1};$$

$$\frac{1}{2} \log_{\sqrt{5}} x - 2 = -1; \frac{1}{2} \log_{\sqrt{5}} x = 1; \log_{\sqrt{5}} x = 2;$$

$$x = 5 \text{ (D)}$$

$$12(00-1-37) \log_8 \log_4 \log_2 x = 0;$$

$$\log_2 \log_2 x = 1; \log_2 x = 4; x = 16; \text{ (C)}$$

$$13(00-2-24) \log_5 x = 2 \log_5 3 + 4 \log_{25} 7;$$

$$\log_5 x = \log_5 9 + \log_5 49; \log_5 x = \log_5 (9 \cdot 49);$$

$$x = 9 \cdot 49 = 441 \text{ (A)}$$

$$14(00-3-28) \left(\frac{4}{9}\right)^x \cdot \left(\frac{27}{8}\right)^{x-1} = \frac{\lg 4}{\lg 8};$$

$$\left(\frac{2}{3}\right)^{2x} \cdot \left(\frac{2}{3}\right)^{-3(x-1)} = \log_8 4; \left(\frac{2}{3}\right)^{2x-3x+3} = \frac{2}{3};$$

$$-x + 3 = 1; x = 2 \text{ (C)}$$

$$15(00-3-36) \log_2 \log_3 \log_4 \sqrt{x^3} = 0;$$

$$\log_3 \log_4 \sqrt{x^3} = 1; \log_4 \sqrt{x^3} = 3;$$

$$\sqrt{x^3} = 4^3; \sqrt{x} = 4; x = 16 \text{ (B)}$$

$$16(00-3-38) \lg\left(\frac{1}{2} + x\right) = \lg \frac{1}{2} - \lg x;$$

$$\begin{cases} \frac{1}{2} + x > 0 \\ x > 0 \end{cases} \text{ bundan } x > 0;$$

$$\lg\left(\frac{1+2x}{2}\right) = \lg \frac{1}{2x}; \frac{1+2x}{2} = \frac{1}{2x};$$

$$x + 2x^2 = 1; 2x^2 + x - 1 = 0; x_1 = -1 < 0; x_2 = \frac{1}{2}$$

$$\text{Javob: } \frac{1}{2} \text{ (B)}$$

$$17(00-3-39) x^{\lg x-1} = 100; x > 0; \text{ tenglamaning har}$$

ikki tomonini 10 asosga ko'ra logarifmlaymiz.

$$\lg x^{\lg x-1} = \lg 100; \lg x(\lg x - 1) = 2; \lg x = t$$

bo'lsin.

$$t(t-1) = 2; t^2 - t - 2 = 0; t_1 = 2; t_2 = -1;$$

$$\lg x = 2; x_1 = 100; \lg x = -1; x = \frac{1}{10};$$

$$x_1 \cdot x_2 = 100 \cdot \frac{1}{10} = 10 \text{ (A)}$$

$$18(00-3-41) \log_3(3^x - 8) = 2 - x; 3^x - 8 = 3^{2-x};$$

$$3^x - 8 = \frac{9}{3^x}; 3^x = t (t > 0) \text{ bo'lsin. } t - 8 = \frac{9}{t};$$

$$t^2 - 8t - 9 = 0; t_1 = 9; t_2 = -1 < 0;$$

$$3^x = 9; x = 2 \text{ (C)}$$

$$19(00-8-6) x^{\log_3 x^2 + \log_3^2 x - 10} = \frac{1}{x^2};$$

$$x^{\log_3 x^2 + \log_3^2 x - 10} = x^{-2}; \text{ bundan } x_1 = 1;$$

$$\log_3 x^2 + \log_3^2 x - 10 = -2;$$

$$\log_3^2 x + 2 \log_3 x - 8 = 0; \log_3 x = t \text{ bo'lsin.}$$

$$t^2 + 2t - 8 = 0; t_1 = 2; t_2 = -4;$$

$$\log_3 x = 2; x_2 = 9; \log_3 x = -4; x_3 = \frac{1}{81}; \text{ (A)}$$

$$20(00-8-15) \log_2(9^{x-1} + 7) = 2 \log_2(3^{x-1} + 1);$$

$$\log_2(9^{x-1} + 7) = \log_2(3^{x-1} + 1)^2;$$

$$9^{x-1} + 7 = (3^{x-1} + 1)^2;$$

$$9^{x-1} + 7 = 9^{x-1} + 2 \cdot 3^{x-1} + 1; 2 \cdot 3^{x-1} = 6;$$

$$3^{x-1} = 3;$$

$$x - 1 = 1; x = 2 \text{ (A)}$$

$$21(00-8-40) \log_3 x + \log_3 x^2 + \log_3 x^3 + \dots + \log_3 x^8 =$$

$$= \log_3(x \cdot x^2 \cdot x^3 \dots \cdot x^8) = \log_3 x^{36};$$

$$3^{\log_3 x^{36}} = 27x^{30}; x^{36} - 27x^{30} = 0; x^{30}(x^6 - 27) = 0;$$

$$x \neq 0; x^6 = 27; x = \sqrt[6]{27} = \sqrt{3} \text{ (A)}$$

$$22(00-10-82) (2x)^{\log_{2x}(x+45)^2} = 25; \begin{cases} 2x > 0 \\ 2x \neq 1 \end{cases}; \begin{cases} x > 0 \\ x \neq 0,5 \end{cases}$$

$$(x+4,5)^2 = 25; x+4,5 = \pm 5;$$

$x_1 \neq 0,5; x_2 = -9,5 < 0$. Tenglama yechimga ega emas. (A)

$$23(96-10-38) \log_2^2 x - 5 \log_2 x + 6 = 0; \log_2 x = t$$

bo'lsin.

$$t^2 - 5t + 6 = 0; t_1 = 3; t_2 = 2;$$

$$\log_2 x = 3; x_1 = 8; \log_2 x = 2; x_2 = 4;$$

$$x_1 \cdot x_2 = 4 \cdot 8 = 32 \text{ (C)}$$

$$24(96-1-35) \lg^2 x - \lg x - 2 = 0; \lg x = t \text{ bo'lsin.}$$

$$t^2 - t - 2 = 0; t_1 = 2; t_2 = -1;$$

$$\lg x = 2; x_1 = 100; \lg x = -1; x_2 = \frac{1}{10};$$

$$x_1 \cdot x_2 = 100 \cdot \frac{1}{10} = 10 \text{ (C)}$$

$$25(96-9-86) \log_3^2 x - 4 \log_3 x + 3 = 0; \log_3 x = t$$

bo'lsin.

$$t^2 - 4t + 3 = 0; t_1 = 3; t_2 = 1;$$

$$\log_3 x = 3; x_1 = 27; \log_3 x = 1; x_2 = 3;$$

$$x_1 \cdot x_2 = 27 \cdot 3 = 81 \text{ (B)}$$

$$26(98-3-33) \log_3^2 x - 3 \log_3 x + 2 = 0; \log_3 x = t$$

bo'lsin.

$$t^2 - 3t + 2 = 0; t_1 = 2; t_2 = 1;$$

$$\log_3 x = 2; x_1 = 9; \log_3 x = 1; x_2 = 3;$$

$$x_1 + x_2 = 9 + 3 = 12 \text{ (C)}$$

$$27(98-6-24) \log_2^2 x - 4 \log_2 x - 1 = 0; \log_2 x = t$$

bo'lsin.

$$t^2 - 4t - 1 = 0; t_1 = 2 + \sqrt{5}; t_2 = 2 - \sqrt{5};$$

$$\log_2 x = 2 + \sqrt{5}; x_1 = 2^{2+\sqrt{5}};$$

$$\log_2 x = 2 - \sqrt{5}; x_2 = 2^{2-\sqrt{5}};$$

$$x_1 \cdot x_2 = 2^{2+\sqrt{5}} \cdot 2^{2-\sqrt{5}} = 2^4 = 16 \text{ (C)}$$

$$28(98-10-80) \log_2^2 x - 4 \log_2 x + 3 = 0; \log_2 x = t$$

bo'lsin.

$$t^2 - 4t + 3 = 0; t_1 = 3; t_2 = 1;$$

$$\log_2 x = 3; x_1 = 8; \log_2 x = 1; x_2 = 2;$$

$$x_1 + x_2 = 8 + 2 = 10 \text{ (B)}$$

$$29(98-12-105) |x - 13| \log_2(x - 3) = 3(13 - x);$$

$$1) \begin{cases} (x - 13) \log_2(x - 3) + 3(x - 13) = 0; \\ x - 13 \geq 0 \end{cases}$$

$$\begin{cases} (x - 13)(\log_2(x - 3) + 3) = 0; \\ x \geq 13 \end{cases}; x_1 = 13$$

$$\begin{cases} \log_2(x - 3) = -3; \\ x \geq 13 \end{cases}; x_2 = 3 \frac{1}{8} < 13$$

$$2) \begin{cases} -(x - 13) \log_2(x - 3) + 3(x - 13) = 0; \\ x - 13 < 0 \end{cases}$$

$$\begin{cases} \log_2(x - 3) = 3; \\ x < 13 \end{cases}; x_2 = 11$$

$$x_1 + x_2 = 11 + 13 = 24 \text{ (D)}$$

$$30(99-3-20) \lg \sqrt{x - 5} + \lg \sqrt{2x - 3} + 1 = \lg 30;$$

$$\begin{cases} x - 5 > 0; \\ 2x - 3 > 0; \end{cases} \begin{cases} x > 5; \\ x > 1.5; \end{cases} x > 5;$$

$$\lg(\sqrt{x - 5} \sqrt{2x - 3}) = \lg 30 - 1;$$

$$\lg(\sqrt{(x - 5)(2x - 3)}) = \lg 3;$$

$$(\sqrt{(x - 5)(2x - 3)})^2 = 3^2; (x - 5)(2x - 3) = 9;$$

$$2x^2 - 13x + 6 = 0; x_1 = 6; x_2 = \frac{1}{2} < 5;$$

$$\text{Javob: } x = 6 \text{ (B)}$$

$$31(99-6-55) \log_{\sqrt{2}} x + \frac{2}{\log_x 2} = 4; x \neq 1; x > 0;$$

$$2 \log_2 x + 2 \log_2 x = 4; 4 \log_2 x = 4; \log_2 x = 1;$$

$$x = 2 \text{ (A)}$$

$$32(99-8-32)$$

$$\lg(10x^2) \lg x = 1; (\lg 10 + \lg x^2) \lg x = 1;$$

$$(\lg 10 + 2 \lg x) \lg x = 1;$$

$$2 \lg^2 x + \lg x - 1 = 0; \lg x = t$$

$$2t^2 + t - 1 = 0; t_1 = \frac{1}{2}; t_2 = -1;$$

$$\lg x = \frac{1}{2}; x_1 = \sqrt{10}; \lg x = -1; x_2 = \frac{1}{10}.$$

$$\text{Kichik ildiz } 0,1 \text{ (B)}$$

$$33(00-1-47) \log_2^2 x - 2 \log_2 x^2 + 3 = 0; .$$

$$\log_2^2 x - 4 \log_2 x + 3 = 0; \log_2 x = t \text{ bo'lsin.}$$

$$t^2 - 4t + 3 = 0; t_1 = 3; t_2 = 1;$$

$$\log_2 x = 3; x_1 = 8; \log_2 x = 1; x_2 = 2;$$

$$x_1 + x_2 = 8 + 2 = 10 \text{ (D)}$$

$$34(00-4-40) \lg^2 x - \lg^2(10x) = 6 - \lg^2(100x);$$

$$(\lg x - \lg(10x))(\lg x + \lg(10x)) = 6 - (\lg 100 + \lg x)^2;$$

$$\lg \frac{x}{10x} \cdot (\lg x + \lg 10 + \lg x) = 6 - (2 + \lg x)^2;$$

$$- (2 \lg x + 1) = 6 - (4 + 4 \lg x + \lg^2 x);$$

$$- 2 \lg x - 1 = 6 - 4 - 4 \lg x - \lg^2 x;$$

$$\lg^2 x + 2\lg x - 3 = 0; \lg x = t \text{ bo'lsin.}$$

$$t^2 + 2t - 3 = 0; t_1 = 1; t_2 = -3;$$

$$\lg x = 1; x_1 = 10; \lg x = -3; x_2 = \frac{1}{1000};$$

$$x_1 \cdot x_2 = 10 \cdot \frac{1}{1000} = 0,01 \text{ (D)}$$

$$35(97-12-54) \log_2(x+2) + \log_2(x+3) = 1;$$

$$\begin{cases} x+2 > 0 \\ x+3 > 0 \end{cases}; \begin{cases} x > -2 \\ x > -3 \end{cases};$$

$$\log_2(x+2)(x+3) = 1; (x+2)(x+3) = 2;$$

$$x^2 + 5x + 4 = 0; x_1 = -1; x_2 = -4 < 0;$$

$$8 - x = 8 - (-1) = 9 \text{ (B)}$$

$$36(98-11-45) \log_x 2 \cdot \log_{2x} 2 = \log_{4x} 2;$$

$$\frac{1}{\log_2 x \cdot \log_2(2x)} = \frac{1}{\log_4(4x)};$$

$$\log_2 x \cdot \log_2(2x) = \log_2(4x);$$

$$\log_2 x(1 + \log_2 x) = 2 + \log_2 x;$$

$$\log_2 x + \log_2^2 x = 2 + \log_2 x; \log_2^2 x = 2;$$

$$\log_2 x = \sqrt{2}; x_1 = 2^{\sqrt{2}};$$

$$\log_2 x = -\sqrt{2}; x_2 = 2^{-\sqrt{2}};$$

$$x_2 \cdot x_1 = 2^{\sqrt{2}} \cdot 2^{-\sqrt{2}} = 1; \text{ (A)}$$

$$37(99-3-21) \log_4(x+12) \cdot \log_x 2 = 1; x \neq 1; x > 0$$

$$\frac{\frac{1}{2} \log_2(x+12)}{\log_2 x} = 1; \frac{1}{2} \log_x(x+12) = 1;$$

$$\log_x(x+12) = 2; x+12 = x^2;$$

$$x^2 - x - 12 = 0; x_1 = 4; x_2 = -3 < 0; \text{ (A)}$$

$$38(00-8-39)$$

$$\log_{\sqrt{5}} x + \log_{4\sqrt{5}} x + \log_{6\sqrt{5}} x + \dots + \log_{16\sqrt{5}} x = 36;$$

$$2\log_5 x + 4\log_5 x + 6\log_5 x + \dots + 16\log_5 x = 36;$$

$$72\log_5 x = 36; \log_5 x = \frac{1}{2}; x = \sqrt{5} \text{ (A)}$$

$$39(00-10-40) \log_x 3 \cdot \log_{3x} 3 = \log_{9x} 3;$$

$$\frac{1}{\log_3 x \cdot \log_3(3x)} = \frac{1}{\log_3(9x)};$$

$$\log_3 x \cdot \log_3(3x) = \log_3(9x);$$

$$\log_3 x(1 + \log_3 x) = 2 + \log_3 x;$$

$$\log_3 x + \log_3^2 x = 2 + \log_3 x; \log_3^2 x = 2;$$

$$\log_3 x = \sqrt{2}; x_1 = 3^{\sqrt{2}};$$

$$\log_3 x = -\sqrt{2}; x_2 = 3^{-\sqrt{2}};$$

$$x_2 \cdot x_1 = 3^{\sqrt{2}} \cdot 3^{-\sqrt{2}} = 1; \text{ (C)}$$

$$40(97-1-59) x^{\lg 25} + 25^{\lg x} = 10; x^{\lg 25} = 25^{\lg x};$$

$$2 \cdot 25^{\lg x} = 10; 25^{\lg x} = 5; 5^{2\lg x} = 5; 2\lg x = 1;$$

$$\lg x = \frac{1}{2}; x = \sqrt{10}; \text{ (C)}$$

$$41(97-6-59) x^{\lg 9} + 9^{\lg x} = 6; x^{\lg 9} = 9^{\lg x};$$

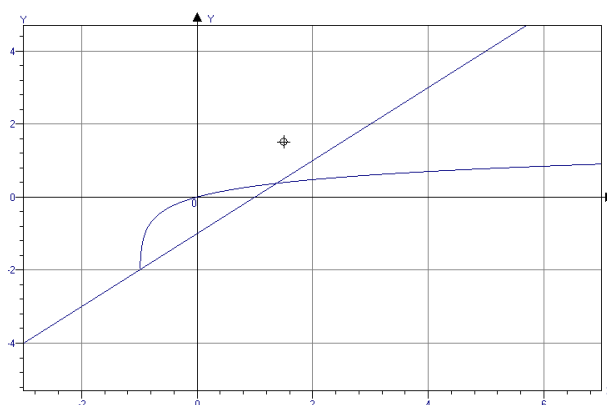
$$2 \cdot 9^{\lg x} = 6; 9^{\lg x} = 3; 3^{2\lg x} = 3; 2\lg x = 1;$$

$$\lg x = \frac{1}{2}; x = \sqrt{10}; \text{ (C)}$$

$$42(97-7-35) \lg(x+1) = x - 1; \text{ tenglama}$$

ildizlarining sonini funksiya grafiklarini chizish orqali topamiz.

$$\begin{cases} y = \lg(x+1) \\ y = x-1 \end{cases};$$



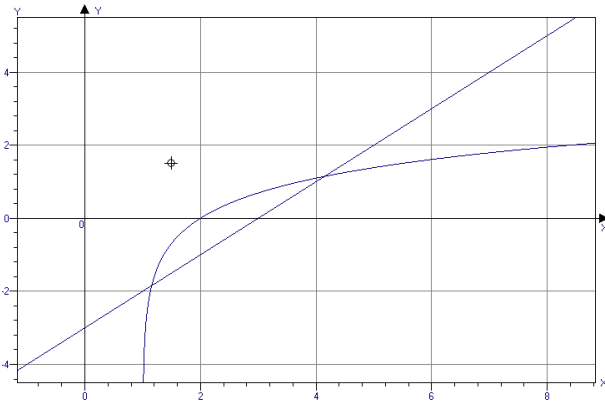
Funksiya grafiklari ikki nuqtada kesishgan.

Tenglama ikki ildizga ega. (B)

$$43(97-10-35) \ln(x-1) = x - 3; \text{ tenglama}$$

ildilaining sonini funksiya grafiklarini chizish orqali topamiz.

$$\begin{cases} y = \ln(x-1) \\ y = x-3 \end{cases};$$



Funksiya grafiklari ikki nuqtada kesishgan.

Tenglama ikki ildizga ega. **(B)**

$$44(00-2-22) \begin{cases} 3^x \cdot 2^y = 972 \\ \log_{\sqrt{3}}(x-y) = 2 \end{cases}; \begin{cases} 3^x \cdot 2^y = 972 \\ x-y=3 \end{cases}$$

$$\begin{cases} 3^x \cdot 2^y = 972 \\ x=3+y \end{cases}; 3^{3+y} \cdot 2^y = 972; 27 \cdot 3^y \cdot 2^y = 972;$$

$$6^y = 36; y = 2; x = 5; xy = 5 \cdot 2 = 10 \text{ (C)}$$

45(00-4-43)

$$\frac{(7^{x^2-5x+7} - 7)\sqrt{x^2+x-12} \cdot \lg(2x-7)}{\ln(3x-5)(\sqrt{2x-1} - \sqrt{8-x})} = 0;$$

$$1) \begin{cases} \ln(3x-5) \neq 0 \\ \sqrt{2x-1} - \sqrt{8-x} \neq 0 \end{cases}; \begin{cases} x \neq 2 \\ x \neq 3 \end{cases}$$

2)

$$\left\{ \begin{array}{l} 7^{x^2-5x+7} = 7 \\ \sqrt{x^2+x-12} \cdot \lg(2x-7) = 0 \end{array} \right. \quad \left\{ \begin{array}{l} 7^{x^2-5x+7} = 7 \\ \sqrt{x^2+x-12} = 0 \end{array} \right.$$

$$x \in (3,5;8)$$

$$a) 7^{x^2-5x+7} = 7; x^2 - 5x + 7 = 1; x^2 - 5x + 6 = 0;$$

$$x_1 = 3 < 3,5; x_2 = 2 < 3,5;$$

$$b) x^2 + x - 12 = 0; x_1 = 3 < 3,5; x_2 = -4 < 3,5$$

$$d) \lg(2x-7) = 0; 2x-7 = 1; x = 4;$$

Tenglama bitta ildizga ega. **(B)**

$$46(01-1-22) \frac{\lg(2x-5)}{\lg(3x^2-39)} = \frac{1}{2};$$

$$\begin{cases} 2x-5 > 0 \\ 3x^2-39 > 0 \end{cases} \neq 0;$$

$$2\lg(2x-5) = \lg(3x^2-39);$$

$$\lg(2x-5)^2 = \lg(3x^2-39);$$

$$(2x-5)^2 = 3x^2-39; 4x^2-20x+25 = 3x^2-39;$$

$$x^2-20x+64 = 0; x_1 = 16; x_2 = 4; \text{ (D)}$$

$$47(01-1-23) \log_{\sqrt{x}} x - \frac{1}{\log_x 3} = 1;$$

$$2 - \frac{1}{\log_x 3} = 1; \frac{1}{\log_x 3} = 1; \log_x 3 = 1; x = 3 \text{ (B)}$$

$$48(01-2-66) \log_4(2 + \sqrt{x+3}) = 2 \cos \frac{5\pi}{3};$$

$$\log_4(2 + \sqrt{x+3}) = 1; 2 + \sqrt{x+3} = 4; \sqrt{x+3} = 2;$$

$$x+3 = 4; x = 1 \text{ (A)}$$

$$49(01-2-73) x^{\frac{\lg x + 5}{3}} = 10^{5 + \lg x}; \text{ tenglamaning har}$$

ikki tomonini 10 asosga ko'ra logarifmlaymiz.

$$\lg x^{\frac{\lg x + 5}{3}} = \lg 10^{5 + \lg x}; \frac{(\lg x + 5)}{3} \lg x = 5 + \lg x;$$

$$\lg^2 x + 5 \lg x = 15 + 3 \lg x;$$

$$\lg^2 x + 2 \lg x - 15 = 0; \lg x = t \text{ bo'lsin.}$$

$$t^2 + 2t - 15 = 0; t_1 = 3; t_2 = -5;$$

$$\lg x = 3; x_1 = 10^3; \lg x = -5; x_2 = \frac{1}{10^5};$$

$$x_1 \cdot x_2 = 10^3 \cdot \frac{1}{10^5} = \frac{1}{100} = 0,01 \text{ (E)}$$

50(01-3-26)

$$\lg \left(3^{\sqrt{\frac{x^2-4x}{x-3}}} + 1 \right) = 1; 3^{\sqrt{\frac{x^2-4x}{x-3}}} + 1 = 10;$$

$$3^{\sqrt{\frac{x^2-4x}{x-3}}} = 3^2; \sqrt{\frac{x^2-4x}{x-3}} = 2; \frac{x^2-4x}{x-3} = 4;$$

$$\begin{cases} \frac{x^2-4x}{x-3} \geq 0 \\ x \neq 3 \end{cases}$$

$$x^2 - 4x = 4x - 12; x^2 - 8x + 12 = 0; x_1 = 2; x_2 = 6;$$

$$x_1 + x_2 = 2 + 6 = 8; \text{ (C)}$$

$$51(01-5-10) \lg x + \lg \frac{4-x}{10} = \lg \lg 2 - 1;$$

$$\begin{cases} 4-x > 0 \\ x > 0 \end{cases}; \begin{cases} x < 4 \\ x > 0 \end{cases}; 0 < x < 4;$$

$$\lg \left(x \cdot \frac{4-x}{10} \right) = \lg \frac{\lg 2}{10}; \frac{4x-x^2}{10} = \frac{\lg 2}{10};$$

$$4x - x^2 = \lg 2; x^2 - 4x + \lg 2 = 0;$$

$$x_{1,2} = \frac{4 \pm \sqrt{16 - 4 \lg 2}}{2}; \text{ Bu ildizlar } (0;1) \text{ oraliqqa}$$

tegishli bo'lgani uchun. Berilgan tenglama ikki ildizga ega. **(A)**

$$52(01-5-11) \log_a x - \log_{a^2} x + \log_{a^4} x = \frac{3}{4};$$

$$\log_a x - \frac{1}{2} \log_a x + \frac{1}{4} \log_a x = \frac{3}{4}; \quad \frac{3}{4} \log_a x = \frac{3}{4}$$

$$\log_a x = 1; \quad x = a \quad (\mathbf{A})$$

$$53(01-5-12) x^{\log_x(x^2-1)} = 3; \quad x \neq 1; \quad x > 0;$$

$$x^2 - 1 = 3; \quad x^2 = 4; \quad x_1 = 2; \quad x_2 = -2 < 0; \quad (\mathbf{A})$$

$$54(01-7-25) \lg(3 + 2\lg(1 + x)) = 0;$$

$$3 + 2\lg(1 + x) = 1; \quad 2\lg(x + 1) = -2; \quad \lg(x + 1) = -1;$$

$$x + 1 = \frac{1}{10}; \quad x = -0,9 \quad (\mathbf{D})$$

$$55(01-7-26) \log_2 |x - 1| = 1; \quad |x - 1| = 2;$$

$$x - 1 = 2; \quad x_1 = 3; \quad x - 1 = -2; \quad x_2 = -1; \quad (\mathbf{E})$$

56(01-8-33) $x^{\lg 0,2} = 0,2^{\lg x}$; Istaglan musbat son tengsizlikning yechimi bo'ladi, shuning uchun 5 ga karrali eng kichik ildiz $x=5$.

$$6^{\frac{\lg(6+5)}{\lg 6}} = 6^{\frac{\lg 11}{\lg 6}} = 6^{\log_6 11} = 11 \quad (\mathbf{C})$$

$$57(01-9-1) \log_x(9x^2) \cdot \log_3^2 x = 4;$$

$$(\log_x 9 + \log_x x^2) \cdot \log_3^2 x = 4;$$

$$(\log_x 3 + 1) \cdot \log_3^2 x = 2; \quad \left(\frac{1}{\log_3 x} + 1 \right) \cdot \log_3^2 x = 2;$$

$$\log_3 x = t \quad \text{bo'lsin.} \quad \left(\frac{1}{t} + 1 \right) t^2 = 2; \quad t + t^2 = 2;$$

$$t^2 + t - 2 = 0; \quad t_1 = 1; \quad t_1 = -2;$$

$$\log_3 x = 1; \quad x_1 = 3; \quad \log_3 x = -2; \quad x_2 = \frac{1}{9}$$

$$x_1 + x_2 = 3 + \frac{1}{9} = 3\frac{1}{9}; \quad (\mathbf{A})$$

58(01-9-9) $x^{3-\log_3 x} = 9$; tenglamaning har ikki tomonini 3 asosga ko'ra logarifmlaymiz.

$$\log_3 x^{3-\log_3 x} = \log_3 9; \quad (3 - \log_3 x) \log_3 x = 2;$$

$$\log_3 x = t; \quad \text{bo'lsin.}$$

$$(3 - t)t = 2; \quad 3t - t^2 = 2; \quad t^2 - 3t + 2 = 0;$$

$$t_1 = 1; \quad t_2 = 2;$$

$$\log_3 x = 1; \quad x_1 = 3; \quad \log_3 x = 2; \quad x_2 = 9;$$

$$\sqrt{9 \cdot 3} = 3\sqrt{3} \quad (\mathbf{A})$$

$$59(01-9-22)$$

$$\lg(169 + x^3) - 3\lg(x + 1) = 0; \quad x + 1 > 0; \quad x > -1$$

$$\lg(169 + x^3) - \lg(x + 1)^3 = 0; \quad \lg \frac{169 + x^3}{(x + 1)^3} = 0;$$

$$\frac{169 + x^3}{(x + 1)^3} = 1; \quad 169 + x^3 = x^3 + 3x^2 + 3x + 1;$$

$$3x^2 + 3x - 168 = 0; \quad x^2 + x - 56 = 0;$$

$$x_1 = -8 < -1; \quad x_2 = 7; \quad (\mathbf{A})$$

$$60(01-9-36)$$

$$\log_3(x - 1); \quad \log_3(x + 1); \quad \log_3(2x - 1);$$

$$x - 1 > 0; \quad x > 1.$$

Bu sonlar arifmetik progressiyaning ketma-ket hadlari bo'lsa quyidagi tenglik bajariladi.

$$2\log_3(x + 1) = \log_3(x - 1) + \log_3(2x - 1);$$

$$\log_3(x + 1)^2 = \log_3((x - 1)(2x - 1));$$

$$(x + 1)^2 = (x - 1)(2x - 1); \quad x^2 + 2x + 1 = 2x^2 - 2x - x + 1;$$

$$x^2 - 5x = 0; \quad x(x - 5) = 0; \quad x_1 = 0 < 1; \quad x_2 = 5 \quad (\mathbf{E})$$

$$61(01-9-41) \lg(5x - 2) = \lg(2 - 5x);$$

$$\begin{cases} 5x - 2 > 0 \\ 2 - 5x > 0 \end{cases}; \quad \begin{cases} x > \frac{2}{5} \\ x < \frac{2}{5} \end{cases}; \quad x = 0 \quad (\mathbf{B})$$

$$62(01-9-44)$$

$$\log_7^2(x^2 + 5x - 13) + \log_7^{\frac{2}{7}}(x^2 - 8x + 13) = 0;$$

Bu tenglik bajarilishi uchun har bir qo'shiluvchi 0 ga teng bo'lishi kerak.

$$\begin{cases} \log_7^2(x^2 + 5x - 13) = 0 \\ \log_7^{\frac{2}{7}}(x^2 - 8x + 13) = 0 \end{cases}; \quad \begin{cases} x^2 + 5x - 13 = 1 \\ x^2 - 8x + 13 = 1 \end{cases};$$

$$\begin{cases} x_1 = 2; & x_2 = -7; \\ x_1 = 6; & x_2 = 2 \end{cases}; \quad \mathbf{x=2} \quad (\mathbf{B})$$

$$63(01-10-29) x^{\frac{\lg x}{2}} = \left(\frac{x}{10} \right)^2; \quad \text{tenglamaning har ikki}$$

tomonini 10 asosga ko'ra logarifmlaymiz.

$$\lg x^{\frac{\lg x}{2}} = \lg \left(\frac{x}{10} \right)^2; \quad \frac{\lg x}{2} \cdot \lg x = 2\lg \frac{x}{10}; \quad \frac{\lg^2 x}{2} = 2\lg x -$$

$$\lg^2 x - 4\lg x + 4 = 0; \quad (\lg x - 2)^2 = 0; \quad \lg x - 2 = 0;$$

$$\lg x = 2; \quad x = 100; \quad (\mathbf{B})$$

64(01-10-32) $2^{x^2} + \log_3 x^3 = 515$; $x=3$ berilgan

tenglamaning ildizi. Endi tenglamaning boshqa ildizi yo'qligini ko'rsatamiz.

$y = 2^{x^2}$; $y = 515 - \log_3 x^3$; birinchi funksiya o'suvchi

ikkinchi funksiya esa kamayuvchi. Shu sababdan tenglama $x=3$, yagona ildizga ega. **(B)**

65(01-11-29)

$\log_x(3x^2 - 2) = 4$; $x \neq 1$; $x > 0$; $3x^2 - 2 > 0$;

$3x^2 - 2 = x^4$; $x^4 - 3x^2 + 2 = 0$; $x^2 = t$;

$t^2 - 3t + 2 = 0$; $t_1 = 2$; $t_2 = 1$;

$x^2 = 1$; $x \neq \pm 1$; $x^2 = 2$; $x = -\sqrt{2} < 0$; $x = \sqrt{2}$;

tenglama yagona ildizga ega. **(D)**

66(01-11-33) $\log_3(3^{2x} - 26 \cdot 3^x) = x$;

$3^{2x} - 26 \cdot 3^x > 0$; $3^x > 26$;

$3^{2x} - 26 \cdot 3^x = 3^x$; $3^{2x} - 27 \cdot 3^x = 0$; $3^x(3^x - 27) = 0$;

$3^x \neq 0$; $3^x = 27$; $x = 3$ **(D)**

67(02-10-60)

$0,2 \log_x \frac{1}{32} = -0,5$; $0,2 \log_x 2^{-5} = -0,5$;

$-\log_x 2 = -0,5$; $\log_x 2 = \frac{1}{2}$; $x^{\frac{1}{2}} = 2$; $x = 4$; **(D)**

68(02-2-24) $3x \log_3 x + 2 = \log_3 x + 6x$; $x > 0$;

$3x \log_3 x - \log_3 x - 6x + 2 = 0$;

$\log_3 x(3x - 1) - 2(3x - 1) = 0$; $(3x - 1)(\log_3 x - 2) = 0$

1) $3x - 1 = 0$; $x = \frac{1}{3}$; 2) $\log_3 x = 2$; $x = 9$ **(A)**

69(02-3-35)

$\log_3(4 \cdot 3^x - 1) = 2x + 1$; $4 \cdot 3^x - 1 > 0$;

$4 \cdot 3^x - 1 = 3^{2x+1}$; $3 \cdot 3^{2x} - 4 \cdot 3^x + 1 = 0$; $3^x = t$;

$3t^2 - 4t + 1 = 0$; $t_1 = 1$; $t_2 = \frac{1}{3}$;

$3^x = 1$; $x = 0$; $3^x = 3^{-1}$; $x = -1$;

$|x_1 - x_2| = |-1 - 0| = 1$ **(A)**

70(02-3-36)

$\log_x 2 + \log_{4x} 4 = 1$; $x \neq 1$; $x \neq \frac{1}{4}$; $x > 0$;

$\frac{1}{\log_2 x} + \frac{1}{\log_4 4x} = 1$; $\frac{1}{\log_2 x} + \frac{2}{2 + \log_2 x} = 1$; $\log_2 x = t$

$\frac{1}{t} + \frac{2}{2+t} = 1$; $2+t+2t = 2t+t^2$; $t^2 - t - 2 = 0$;

$t_1 = 2$; $t_2 = -1$; $\log_2 x = 2$; $x_1 = 4$; $\log_2 x = -1$; $x_2 = \frac{1}{2}$

$x_1 \cdot x_2 = 4 \cdot \frac{1}{2} = 2$ **(A)**

71(02-3-31) $\frac{1}{2x} \lg 3 = \lg \left(3^{\frac{1}{x}} - 6 \right)$;

$\lg 3^{\frac{1}{2x}} = \lg \left(3^{\frac{1}{x}} - 6 \right)$; $3^{\frac{1}{2x}} = 3^{\frac{1}{x}} - 6$; $3^{\frac{1}{2x}} = t > 0$

bo'lsin.

$t = t^2 - 6$; $t^2 - t - 6 = 0$; $t_1 = 3$; $t_2 = -2 < 0$;

$3^{\frac{1}{2x}} = 3$; $\frac{1}{2x} = 1$; $x = \frac{1}{2}$ **(A)**

72(02-5-25) $\lg(x+11) - 0,5 \lg(2x+7) = 2 - \lg 25$;

$\lg(x+11) - \lg \sqrt{2x+7} = \lg \frac{100}{25}$;

$\lg \frac{x+11}{\sqrt{2x+7}} = \lg 4$; $\frac{x+11}{\sqrt{2x+7}} = 4$; $x+11 = 4\sqrt{2x+7}$;

$(x+11)^2 = (4\sqrt{2x+7})^2$; $x^2 + 22x + 11 = 16(2x+7)$;

$x^2 + 22x + 121 = 32x + 112$; $x^2 - 10x + 9 = 0$;

$x_1 + x_2 = 10$ **(D)**

73(02-5-27) $\begin{cases} \log_9 \frac{x^2}{\sqrt{y}} = \frac{1}{2} \\ \log_3(xy) = 3 \end{cases}$; $\begin{cases} \frac{1}{2} \log_3 \frac{x^2}{\sqrt{y}} = \frac{1}{2} \\ \log_3(xy) = 3 \end{cases}$;

$\begin{cases} \log_3 x^2 - \log_3 \sqrt{y} = 1 \\ \log_3 x + \log_3 y = 3 \end{cases}$; $\begin{cases} 2 \log_3 x - \frac{1}{2} \log_3 y = 1 \\ 2 \log_3 x + 2 \log_3 y = 6 \end{cases}$

tenglamalarni ayiramiz.

$-\frac{5}{2} \log_3 y = -5$; $\log_3 y = 2$; $y = 9$; $x = 3$;

$x + y = 9 + 3 = 12$ **(C)**

74(02-6-34) $x^{2 \lg x} = 10x^2$; tenglamaning ha ikki

tomonini 10 asosga ko'ra logarifmlaymiz.

$\lg x^{2 \lg x} = \lg 10x^2$; $2 \lg x \cdot \lg x = 1 + 2 \lg x$;

$$2\lg^2 x - 2\lg x - 1 = 0; \lg x = t \text{ bo'lsin.}$$

$$2t^2 - 2t - 1 = 0; t_1 = \frac{1 + \sqrt{2}}{2}; t_2 = \frac{1 - \sqrt{2}}{2};$$

$$\lg x = \frac{1 + \sqrt{2}}{2}; x_1 = 10^{\frac{1 + \sqrt{2}}{2}}; \lg x = \frac{1 - \sqrt{2}}{2}; x_2 = 10^{\frac{1 - \sqrt{2}}{2}}$$

$$x_1 \cdot x_2 = 10^{\frac{1 + \sqrt{2}}{2}} \cdot 10^{\frac{1 - \sqrt{2}}{2}} = 10 \text{ (B)}$$

75(02-6-35) $3^{x^2} + \log_2 x^3 = 84; x=2$ berilgan

tenglamaning ildizi. Endi tenglamaning boshqa ildizi yo'qligini ko'rsatamiz.

$$y = 3^{x^2};$$

$$y = 84 - \log_2 x^3; \text{ birinchi funksiya o'suvchi}$$

ikkinchi funksiya esa kamayuvchi. Shu sababdan tenglama $x=3$, yagona ildizga ega. **(B)**

76(02-7-6) $2 \cdot 3^{\log_7 x} + 3 \cdot x^{\log_7 3} = 45;$

$$3^{\log_7 x} = 3^{\log_7 x}; 5 \cdot 3^{\log_7 x} = 45; 3^{\log_7 x} = 9;$$

$$\log_7 x = 2; x = 49; \text{ (A)}$$

77(02-8-16) $\log_2(3 - x) - \log_{0.5}(1 - x) = 3;$

$$\begin{cases} 3 - x > 0 \\ 1 - x > 0 \end{cases}; \begin{cases} x < 3 \\ x < 1 \end{cases}; x < 1;$$

$$\log_2(3 - x) + \log_2(1 - x) = 3; \log_2((3 - x)(1 - x)) = 3$$

$$3 - 3x - x + x^2 = 8; x^2 - 4x - 5 = 0; x_1 = 5 > 3; x_2 =$$

;

$$5 - (-1) = 6 \text{ ni qo'shsak. (A)}$$

78(02-10-69) $\log_2(2^{2x} + 16^x) = 2\log_4 12;$

$$\log_2(2^{2x} + 16^x) = \log_2 12; 4^x + 16^x = 12; 4^x = t > 0;$$

$$t + t^2 = 12; t^2 + t - 12 = 0; t_1 = -4 < 0; t_2 = 3;$$

$$4^x = 3; x = \log_4 3 \text{ (A)}$$

79(02-10-71) $\begin{cases} \log_2(x - y) = 1 \\ 2^x \cdot 3^{y+1} = 72 \end{cases}; \begin{cases} x - y = 2 \\ 2^x \cdot 3^{y+1} = 72 \end{cases};$

$$\begin{cases} x = 2 + y \\ 2^x \cdot 3^{y+1} = 72 \end{cases}; 2^{2+y} \cdot 3^{y+1} = 72; 4 \cdot 2^y \cdot 3 \cdot 3^y = 72;$$

$$6^y = 6; y = 1; x = 3; \sqrt{xy} = \sqrt{3 \cdot 1} = \sqrt{3} \text{ (A)}$$

80(02-11-33) $\log_2^2 \frac{x}{2} - \log_2(4x) = 3;$

$$(\log_2 x - \log_2 2)^2 - (\lg_2 4 + \log_2 x) = 3;$$

$$(\log_2 x - 1)^2 - (2 + \log_2 x) = 3;$$

$$\log_2^2 x - 2\log_2 x + 1 - 2 - \log_2 x = 3;$$

$$\log_2^2 x - 3\log_2 x - 4 = 0; \log_2 x = t \text{ bo'lsin.}$$

$$t^2 - 3t - 4 = 0; t_1 = 4; t_2 = -1;$$

$$\log_2 x = 4; x_1 = 16; \log_2 x = -1; x_1 = \frac{1}{2};$$

$$x_1 \cdot x_2 = 16 \cdot \frac{1}{2} = 8 \text{ (D)}$$

81(02-11-34) $\log_3 x + \log_{\sqrt{x}} x - \log_{\frac{1}{3}} x = 6;$

$$\log_3 x + 2\log_x x + \log_3 x = 6; 2\log_3 x = 4;$$

$$\log_3 x = 2; x = 9; \frac{x^2 - x}{4} = \frac{9^2 - 9}{4} = 18 \text{ (D)}$$

82(02-12-49) $\log_3(3^{2x} - 26 \cdot 3^x) = x;$

$$3^{2x} - 26 \cdot 3^x > 0; 3^x > 26;$$

$$3^{2x} - 26 \cdot 3^x = 3^x; 3^{2x} - 27 \cdot 3^x = 0; 3^x(3^x - 27) = 0;$$

$$3^x \neq 0; 3^x = 27; x = 3 \text{ (D)}$$

83(02-12-50) $\begin{cases} \lg(x^2 + y^2) = 2 \\ \lg 2 + \lg(xy) = \lg 96 \end{cases}; x > 0;$

$$\begin{cases} x^2 + y^2 = 100 \\ \lg(2xy) = \lg 96 \end{cases}; \begin{cases} x^2 + y^2 = 100 \\ 2xy = 96 \end{cases};$$

$$(x + y)^2 = 196; x + y = 14 \text{ (B)}$$

84(03-1-11)

$$\log_x(5x - 4) = 2; x > 0; x \neq 1; x > \frac{4}{5};$$

$$5x - 4 = x^2; x^2 - 5x + 4 = 0; x_1 = 4; x_2 \neq 1; \text{ (B)}$$

85(03-9-20) $\log_{5+2x}(5x^2 + 19x + 19) = 2;$

$$\begin{cases} 5 + 2x > 0 \\ 5 + 2x \neq 1 \\ 5x^2 + 19x + 19 > 0 \end{cases}; \begin{cases} x > -\frac{5}{2} \\ x \neq -\frac{2}{5} \\ x > 0 \end{cases};$$

$$5x^2 + 19x + 19 = (5 + 2x)^2;$$

$$5x^2 + 19x + 19 = 25 + 20x - 4x^2; x^2 - x - 6 = 0;$$

$$x_1 = 3; x \neq -2; \text{ tenglama 1 ta ildizga ega, demak}$$

$$m = 1. \frac{2 \cdot m + 2}{x_0} = \frac{2 \cdot 1 + 2}{3} = \frac{4}{3} \text{ (C)}$$

86(03-11-78) $(2x - k)\log_2 x = 0;$

$\log_2 x = 0$; $x = 1$; k qanday qiymat qabul qilishidan qat'iy nazar $x=1$ tenglamaning ildizi bo'ladi.

$x=1$ bo'lsa $k=2$ boladi. Tenglama boshqa ildizga ega bo'lmasligi uchun $x_2 \leq 0$ bo'lishi kerak.

$$2x - k = 0; x_2 = \frac{k}{2} \leq 0; k \leq 0;$$

Javob: $k \leq 0$; $k = 2$ (E)

87(03-5-28) Izlanayotgan sonlar

$b_1; b_1q; b_1q^2$ bo'lsin shartga asosan

$$b_1 > 0; q > 1.$$

$$\begin{cases} b_1 + b_1q + b_1q^2 = 42 \\ \log_2 b_1 + \log_2(b_1q) + \log_2(b_1q^2) = 9 \end{cases}$$

$$\begin{cases} b_1 + b_1q + b_1q^2 = 42; \\ \log_2(b_1^3q^3) = 9 \end{cases}; \begin{cases} b_1(1+q+q^2) = 42; \\ (b_1^3q^3) = 2^9 \end{cases}$$

$$\begin{cases} b_1(1+q+q^2) = 42; \\ b_1q = 8 \end{cases}; \frac{b_1(1+q+q^2)}{b_1q} = \frac{42}{8};$$

$$\frac{1+q+q^2}{q} = \frac{21}{4}; 4+4q+4q^2 = 21q;$$

$$4q^2 - 17q + 4 = 0; q_1 = \frac{1}{4} < 1; q_2 = 4 \text{ (A)}$$

88(03-7-21) $\log_{\sqrt{5}}(4^x - 6) - \log_{\sqrt{5}}(2^x - 2) = 2$;

$$\begin{cases} 4^x - 6 > 0; \\ 2^x - 2 > 0; \end{cases}; \begin{cases} 4^x > 6 \\ 2^x > 2 \end{cases}$$

$$\log_{\sqrt{5}} \frac{4^x - 6}{2^x - 2} = 2; \frac{4^x - 6}{2^x - 2} = 5; 2^x = t \text{ bo'lsin.}$$

$$\frac{t^2 - 6}{t - 2} = 5; t^2 - 6 = 5t - 10; t^2 - 5t + 4 = 0;$$

$$t_1 = 4; t_1 = 1; 2^x = 4; x = 2; 2^x \neq 1; \text{ (C)}$$

89(03-2-4) $\begin{cases} 2 \lg b = \lg a + 3; \\ a^4 = b^2 \end{cases}; \begin{cases} \lg b^2 = \lg(10^3 a); \\ a^4 = b^2 \end{cases}$;

$$\begin{cases} b^2 = 10^3 a; \\ a^4 = b^2 \end{cases}; a^4 = 10^3 a; a^3 = 10^3; a = 10; 10^4 = b^2; b = 100;$$

$$a + b = 10 + 100 = 110 \text{ (D)}$$

90(03-4-34) $\log_4 \frac{(2-x)^2}{(3-x)^3} = -3 \log_4 |3-x|$;

$x \neq 2$; $(x-2)^2 > 0$ bo'lgani uchun $(3-x)^3 > 0$

bo'lishi kerak, demak $3-x > 0$, $x < 3$; $|3-x| = 3-x$;

$$\log_4 \frac{(2-x)^2}{(3-x)^3} = \log_4 (3-x)^{-3};$$

$$\frac{(2-x)^2}{(3-x)^3} = \frac{1}{(3-x)^3};$$

$$(2-x)^2 = 1; x_1 = 1; x_2 = 3 \text{ chet ildiz.}$$

$$x - 27 = 1 - 27 = -26 \text{ (C)}$$

91(03-8-47)

$$\lg(2^x + x + 4) = x - x \lg 5; 2^x + x + 4 > 0;$$

$$10^{\lg(2^x + x + 4)} = 10^{x - x \lg 5}; 2^x + x + 4 = \frac{10^x}{(10^{\lg 5})^x};$$

$$2^x + x + 4 = \frac{10^x}{5^x}; 2^x + x + 4 = 2^x; x = -4 \text{ (A)}$$

92(03-11-13) $7^{\frac{2x^2-5x-9}{2}} = (\sqrt{2})^{3 \log_2 7}$;

$$7^{\frac{2x^2-5x-9}{2}} = 2^{\log_2 7^{\frac{3}{2}}}; \frac{2x^2-5x-9}{2} = \frac{3}{2};$$

$$2x^2 - 5x - 9 = 3; 2x^2 - 5x - 12 = 0; x_1 = 4; x_2 = -1,5$$

(E)

93(03-7-38) $\sqrt{2 + \log_3 \sqrt{x}} \cdot \log_x 9 + \sqrt{2} = 0$;

$$x > 0; x \neq 1; 2 + \log_3 \sqrt{x} \geq 0;$$

$$\frac{2 \cdot \sqrt{2 + \frac{1}{2} \log_3 \sqrt{x}}}{\log_3 x} + \sqrt{2} = 0; \log_3 x = t \text{ bo'lsin.}$$

$$\frac{2 \sqrt{2 + \frac{1}{2} t}}{t} + \sqrt{2} = 0; 2 \sqrt{\frac{2+t}{2}} + \sqrt{2} t = 0;$$

$$\sqrt{2+t} + t = 0; \sqrt{2+t} = -t; 2+t = t^2; (-2 \leq t < 0);$$

$$t^2 - t - 2 = 0; t_1 = 2 > 0; t_2 = -1;$$

$$\log_3 x = -1; x = \frac{1}{3} \text{ (A)}$$

94(03-4-36) $\begin{cases} x^{\lg y} = 1000; \\ \log_x x = 3; \end{cases}; \begin{cases} \lg x^{\lg y} = \lg 1000; \\ x = y^3 \end{cases}$;

$$\begin{cases} \lg y \lg x = 3; \\ x = y^3 \end{cases}; \lg y \cdot \lg y^3 = 3; 3 \lg^2 y = 3;$$

$$\lg^2 y = 3; \lg y = \pm 1; y_1 = 10; y_2 = \frac{1}{10}; \text{ (C)}$$

95(03-12-76) $3^{\log_3^2 x} + x^{\log_3 x} = 162; x > 0$;

$$\left(3^{\log_3 x}\right)^{\log_3 x} + x^{\log_3 x} = 162; \quad x^{\log_3 x} + x^{\log_3 x} = 162;$$

$$2x^{\log_3 x} = 161; \quad x^{\log_3 x} = 81; \quad \log_3 x^{\log_3 x} = \log_3 81;$$

$$\log_3 x \cdot \log_3 x = 4; \quad \log_3^2 x = 4; \quad \log_3 x = \pm 2;$$

$$x_1 = 9; \quad x_2 = \frac{1}{9}; \quad x_1 \cdot x_2 = 9 \cdot \frac{1}{9} = 1 \quad \text{(C)}$$

$$\mathbf{96(03-3-34)} \quad \log_{0,2}^2 \frac{x}{25} + \log_{0,2}^2 \frac{x}{5} = 1;$$

$$\log_5^2 \frac{x}{25} + \log_5^2 \frac{x}{5} = 1;$$

$$(\log_5 x - \log_5 25)^2 + (\log_5 x - \log_5 5)^2 = 1$$

$$(\log_5 x - 2)^2 + (\log_5 x - 1)^2 = 1; \quad \log_5 x = t \text{ bo'lsin.}$$

$$(t - 2)^2 + (t - 1)^2 = 1; \quad t^2 - 4t + 4 + t^2 - 2t + 1 = 1;$$

$$2t^2 - 6t + 4 = 0; \quad t^2 - 3t + 2 = 0; \quad t_1 = 1; \quad t_2 = 2;$$

$$\log_5 x = 1; \quad x_1 = 5; \quad \log_5 x = 2; \quad x_2 = 25;$$

$$x_1 \cdot x_2 = 5 \cdot 25 = 125 \quad \text{(B)}$$

$$\mathbf{97(03-9-21)}$$

$$\log_{4x} \frac{4}{x} + \frac{1}{\log_x^2 4} = 1; \quad x \neq 1; \quad x \neq \frac{1}{4}; \quad x > 0;$$

$$\frac{\log_4 \frac{4}{x}}{\log_4 4x} + \log_4^2 x = 1; \quad \frac{1 - \log_4 x}{1 + \log_4 x} + \log_4^2 x = 1;$$

$$\log_4 x = t \text{ bo'lsin.}$$

$$\frac{1-t}{1+t} + t^2 = 1; \quad \frac{1-t}{1+t} - (1-t^2) = 0;$$

$$\frac{1-t}{1+t} - (1-t)(1+t) = 0; \quad (1-t) \left(\frac{1}{1+t} - 1 - t \right) = 0;$$

$$1-t = 0; \quad t_1 = 1;$$

$$\left(\frac{1}{1+t} - 1 - t \right) = 0; \quad \frac{1}{1+t} - 1 - t = 0; \quad \frac{1 - (1+t)^2}{1+t} = 0;$$

$$\frac{-2t - t^2}{1+t} = 0; \quad t^2 + 2t = 0; \quad t_2 = 0; \quad t_3 = -2;$$

$$\log_4 x = 1; \quad x = 4; \quad \log_4 x = 0; \quad x = 1; \quad \log_4 x = -2;$$

$$x_1 + x_2 + x_3 = 4 + 1 + \frac{1}{16} = \frac{81}{16} \quad \text{(C)}$$

1.14.4. Logarifmik tengsizliklar.

$$\mathbf{1(96-3-87)} \quad y = \log_2 \log_3 \sqrt{4x - x^2 - 2};$$

$$\begin{cases} 4x - x^2 - 2 > 0 \\ \log_3 \sqrt{4x - x^2 - 2} > 0 \end{cases}; \quad \begin{cases} 4x - x^2 - 2 > 0 \\ \sqrt{4x - x^2 - 2} > 1 \end{cases};$$

$$\begin{cases} 4x - x^2 - 2 > 0 \\ 4x - x^2 - 2 > 1 \end{cases}; \quad 4x - x^2 - 2 > 1; \quad x^2 - 4x + 3 < 0;$$

$$(x - 3)(x - 1) < 0; \quad x \in (1; 3) \quad \text{(B)}$$

$$\mathbf{2(96-7-33)} \quad \log_{\frac{1}{\sqrt{2}}} \frac{4x-1}{4x+8} < 0;$$

$$\begin{cases} \frac{4x-1}{4x+8} > 1 \\ \frac{4x-1}{4x+8} > 0 \end{cases}; \quad \begin{cases} \frac{4x-1}{4x+8} > 1 \\ \frac{4x-1}{4x+8} - 1 > 0 \end{cases};$$

$$\frac{4x-1-4x-8}{4x+8} > 0; \quad \frac{-9}{4x+8} > 0; \quad 4x+8 < 0; \quad x < -2;$$

$$x \in (-\infty; -2) \quad \text{(E)}$$

$$\mathbf{3(97-1-24)} \quad \log_{\frac{1}{\sqrt{3}}} (x-5) + 2 \log_{\sqrt{3}} (x-5) < 4;$$

$$-2 \log_3 (x-5) + 4 \log_3 (x-5) < 4;$$

$$\log_3 (x-5) < 2; \quad \begin{cases} x-5 < 9 \\ x-5 > 0 \end{cases}; \quad \begin{cases} x < 14 \\ x > 5 \end{cases};$$

$$x \in (5; 14) \quad \text{(B)}$$

$$\mathbf{4(97-1-56)} \quad \log_5 (5 - 2x) \leq 1;$$

$$\begin{cases} 5-2x \leq 5 \\ 5-2x > 0 \end{cases}; \quad \begin{cases} -2x \leq 0 \\ -2x > -5 \end{cases}; \quad \begin{cases} x \geq 0 \\ x < 2,5 \end{cases};$$

$$x \in [0; 2,5) \quad \text{(D)}$$

$$\mathbf{5(97-3-33)} \quad \log_{\sqrt{3}} \left(\frac{3x}{3x-1,5} \right) > 0;$$

$$\begin{cases} \frac{3x}{3x-1,5} > 1 \\ \frac{3x}{3x-1,5} > 0 \end{cases}; \quad \begin{cases} \frac{3x}{3x-1,5} > 1 \\ \frac{3x}{3x-1,5} - 1 > 0 \end{cases};$$

$$\frac{3x - 3x + 1,5}{3x - 1,5} > 0; \quad \frac{1,5}{3x - 1,5} > 0; \quad 3x - 1,5 > 0; \quad x > 0,5;$$

$$x \in (0,5; \infty) \quad \text{(A)}$$

$$\mathbf{6(97-4-16)} \quad y = 2 - \lg x; \quad y < 0;$$

$$2 - \lg x < 0; \quad -\lg x < -2; \quad \lg x > 2; \quad x > 100 \quad \text{(A)}$$

$$\mathbf{7(97-6-24)} \quad \log_2 (3 - 2x) - \log_{\frac{1}{8}} (3 - 2x) > \frac{4}{3};$$

$$\log_2 (3 - 2x) + \frac{1}{3} \log_2 (3 - 2x) > \frac{4}{3};$$

$$\frac{4}{3} \log_2 (3 - 2x) > \frac{4}{3}; \quad \log_2 (3 - 2x) > 1$$

$$3 - 2x > 2; \quad -2x > -1; \quad x < 0,5;$$

$$x \in (-\infty; 0,5) \quad \text{(A)}$$

$$8(7-7-33) \log_{\frac{2}{\sqrt{5}}} \left(\frac{5x}{5x-1} \right) < 0;$$

$$\begin{cases} \frac{5x}{5x-1} > 1 \\ \frac{5x}{5x-1} > 0 \end{cases}; \frac{5x}{5x-1} > 1; \frac{5x}{5x-1} \cdot 1 > 0;$$

$$\frac{5x - 5x + 1}{5x - 1} > 0; \frac{1}{5x - 1} > 0; 5x - 1 > 0; x > 0,2;$$

$$x \in (0,2; \infty) \text{ (B)}$$

$$10(97-11-24) \log_{\frac{1}{3}}(x+2) - \log_9(x+2) > -\frac{3}{2};$$

$$- \log_3(x+2) - \frac{1}{2} \log_3(x+2) < -\frac{3}{2};$$

$$-\frac{3}{2} \log_3(x+2) < -\frac{3}{2}; \log_3(x+2) > 1;$$

$$\begin{cases} x+2 < 3 \\ x+2 > 0 \end{cases}; \begin{cases} x < 1 \\ x > -2 \end{cases}; x \in (-2;1) \text{ (D)}$$

$$11(97-12-53) \left(\frac{1}{2} \right)^{\log_{0,5} x(x-4)} > 0;$$

$$x(x-4) > 0; x \in (-\infty;0) \cup (4;\infty) . \text{ Eng kichik}$$

musbat yechim 5 (C)

$$12(98-2-37) \log_{0,2}(x^4 + 2x^2 + 1) > \log_{0,2}(6x^2 + 1);$$

$$x^4 + 2x^2 + 1 < 6x^2 + 1; x^4 - 4x^2 < 0; x^2(x^2 - 4) < 0;$$

$$x^2(x-2)(x+2) < 0; x \in (-2;0) \cup (2;0) . \text{ Manfiy}$$

yechimlar. (-2;0) (B)

$$13(98-3-32) \log_5(3-x) - \log_5 12 < 0;$$

$$\log_5(3-x) < \log_5 12; \begin{cases} 3-x < 12 \\ 3-x > 0 \end{cases}; \begin{cases} x > -9 \\ x < 3 \end{cases};$$

$$-9 < x < 3. 11 \text{ ta butun son tengsizlikni}$$

qanoatlantiradi. (D)

$$14(98-4-30) \log_3 \left(\frac{4x-9}{2x+5} + 1,5 \right) < 1;$$

$$\begin{cases} \frac{4x-9}{2x+5} + 1,5 < 3 \\ \frac{4x-9}{2x+5} + 1,5 > 0 \end{cases}; \begin{cases} \frac{4x-9-3x-7,5}{2x+5} < 0 \\ \frac{4x-9+3x+7,5}{2x+5} > 0 \end{cases};$$

$$\begin{cases} \frac{x-16,5}{2x+5} < 0 \\ \frac{7x-1,5}{2x+5} > 0 \end{cases}; \begin{cases} (x-16,5)(x+2,5) < 0 \\ \left(x-\frac{1,5}{7}\right)(x+2,5) > 0 \end{cases};$$

$$x \in \left(\frac{3}{14}; 16,5 \right) . 16 \text{ ta butun son tengsizlikni}$$

qanoatlantiradi. (A)

$$15(98-9-35) \log_{0,3}(2x^2 + 4) \geq \log_{0,3}(x^2 + 20);$$

$$2x^2 + 4 \leq x^2 + 20; x^2 - 16 \leq 0; (x-4)(x+4) \leq 0;$$

$$x \in [-4;4] . \frac{-4+4}{2} = 0 \text{ (E)}$$

$$16(98-10-79) \log_2(4-x) - \log_2 7 < 0;$$

$$\log_2(4-x) < \log_2 7; \begin{cases} 4-x < 7 \\ 4-x > 0 \end{cases}; \begin{cases} x > -3 \\ x < 4 \end{cases};$$

$$-3 < x < 4. 6 \text{ ta butun son tengsizlikni}$$

qanoatlantiradi. (A)

$$17(98-2-33) \log_{3x^2+5} (9x^4 + 27x^2 + 28) > 2;$$

$$3x^2 + 5 > 0; 3x^2 + 5 \neq 1;$$

$$9x^4 + 27x^2 + 28 > (3x^2 + 5)^2;$$

$$9x^4 + 27x^2 + 28 > 9x^4 + 30x^2 + 25;$$

$$-3x^2 + 3 > 0; x^2 - 1 < 0; (x-1)(x+1) < 0;$$

$$x \in (-1;1) . \text{ Butun yechim } 0 \text{ (E)}$$

$$18(99-3-17) \log_2 \log_{\frac{1}{3}} \log_5 x > 0;$$

$$\begin{cases} x > 0 \\ \log_5 x > 0 \\ \log_{\frac{1}{3}} \log_5 x > 1 \end{cases}; \begin{cases} x > 0 \\ \log_5 x > 1 \\ \log_5 x \leq 1 \\ \log_5 x \leq \frac{1}{3} \end{cases}; \begin{cases} x > 1 \\ x > 1 \\ x > 1 \\ x > \sqrt[3]{5} \end{cases};$$

$$x \in (1; \sqrt[3]{5}) \text{ (E)}$$

$$19(99-6-9) \log_2(2x-1) < 3;$$

$$\begin{cases} 2x-1 < 8 \\ 2x-1 > 0 \end{cases}; \begin{cases} x < 4,5 \\ x > 0,5 \end{cases}; x \in (0,5;4,5) . \text{ Eng katta butun yechim } 4 \text{ (D)}$$

$$20(00-3-40) \log_4(x+1) \leq \log_4(5-x);$$

$$\begin{cases} x+1 \leq 5-x \\ x+1 > 0 \end{cases}; \begin{cases} x \leq 2 \\ x < -1 \end{cases}; x \in (-1;2] \text{ (E)}$$

$$21(00-4-41) \log_{x^2}(x+2) \leq 1;$$

$$1) \begin{cases} x^2 > 1 \\ x+2 \leq x^2 \\ x+2 > 0 \end{cases}; \begin{cases} x^2 - 1 > 0 \\ x^2 - x - 2 \geq 0 \\ x > -2 \end{cases}; \begin{cases} (x-1)(x+1) > 0 \\ (x-2)(x+1) \geq 0 \end{cases};$$

$$x \in (-2; -1) \cup [2; \infty)$$

$$2) \begin{cases} x^2 < 1 \\ x+2 \geq 0 \\ x > 0 \end{cases}; \begin{cases} x^2 - 1 < 0 \\ x^2 - x - 2 = 0 \\ x > 0 \end{cases}; \begin{cases} (x-1)(x+1) < 0 \\ (x-2)(x+1) = 0 \\ x > 0 \end{cases};$$

$$x \in (-1;0) \cup (0;1) . \text{ Har ikkovidan}$$

$$x \in (-2; -1) \cup (-1;0) \cup (0;1) \cup [2; \infty) \text{ (C)}$$

$$22(00-4-42)$$

$$x = 2,25; 3 - x^2 + 2x = 3 - 2,25^2 + 2 \cdot 2,25 = 2,4375$$

;

$$x^2 - x - 2 = 2,25^2 - 2,25 - 2 = 0,8125,$$

$$\log_c(3 - x^2 + 2x) < \log_c(x^2 - x - 2) \text{ tengsizlik}$$

$x=2,25$ da to'g'ri bo'lishi uchun $0 < c < 1$ bo'lishi kerak, chunki $2,4375 > 0,871$.

$$\begin{cases} 3 - x^2 + 2x > 0 \\ x^2 - 1 > 0 \\ 3 - x^2 + 2x > 0 \end{cases}; \quad \begin{cases} x^2 - 1 > 0 \\ x^2 - 1 > 0 \\ 3 - x^2 + 2x > 0 \end{cases};$$

$$\begin{cases} (x-3)(x+1) < 0 \\ (x-2)(x+1) > 0 \\ (x-2,5)(x+1) > 0 \end{cases}; \quad x \in (2; 2,5) \quad (\text{C})$$

23(00-7-34) $2^{\log_2(x-3)} + (x-3)^2 < 6;$

$$\begin{cases} x-3+x^2-6x+9 < 6 \\ x-3 > 0 \end{cases}; \quad \begin{cases} x^2-5x < 0 \\ x > 3 \end{cases}; \quad \begin{cases} x(x-5) < 0 \\ x > 3 \end{cases};$$

$x \in (3; 5)$. Tengsizlikning eng kichik yechimi 4 va u 15 da 11 ta kam. (C)

24(00-9-22) $\log_{\frac{1}{5}}(x+17)^8 \leq \log_{\frac{1}{5}}(x+13)^8;$

$$8 \log_{\frac{1}{5}} |x+17| \leq 8 \log_{\frac{1}{5}} |x+13|;$$

$$\log_{\frac{1}{5}} |x+17| \leq \log_{\frac{1}{5}} |x+13|;$$

$$\begin{cases} |x+17| \leq |x+13| \\ x+17 \neq 0 \\ x+13 \neq 0 \end{cases}; \quad \begin{cases} (x+17)^2 - (x+13)^2 \leq 0 \\ x \geq -13 \end{cases};$$

$$\begin{cases} 4(2x+30) \leq 0 \\ x \geq -17 \\ x \geq -13 \end{cases}; \quad \begin{cases} x \leq -15 \\ x \geq -13 \end{cases};$$

$x \in (-15; -13) \cup (-13; \infty)$ (B)

25(96-9-29) $y = \log_2 \log_{0,5} \sqrt{4x - x^2 - 2};$

$$\begin{cases} 4x - x^2 - 2 > 0 \\ \log_{0,5} \sqrt{4x - x^2 - 2} > 0 \end{cases}; \quad \begin{cases} 4x - x^2 - 2 > 0 \\ \sqrt{4x - x^2 - 2} < 1 \end{cases};$$

$$\begin{cases} x^2 - 4x + 2 < 0 \\ 4x - x^2 - 2 < 1 \end{cases}; \quad \begin{cases} x^2 - 4x + 2 < 0 \\ x^2 - 4x + 3 > 0 \end{cases};$$

$$\begin{cases} (x - (2 + \sqrt{2}))(x - (2 - \sqrt{2})) < 0 \\ (x - 1)(x - 3) > 0 \end{cases};$$

$x \in (2 - \sqrt{2}; 1) \cup (3; 2 + \sqrt{2})$ (A)

26(96-12-87) $y = \log_2 \log_{0,5} \sqrt{4x - 4x^2};$

$$\begin{cases} 4x - 4x^2 > 0 \\ \log_{0,5} \sqrt{4x - 4x^2} > 0 \end{cases}; \quad \begin{cases} 4x - 4x^2 > 0 \\ \sqrt{4x - 4x^2} < 1 \end{cases};$$

$$\begin{cases} 4x^2 - 4x < 0 \\ 4x - 4x^2 < 1 \end{cases}; \quad \begin{cases} 4x^2 - 4x < 0 \\ 4x^2 - 4x + 1 > 0 \end{cases};$$

$$\begin{cases} x(x-1) < 0 \\ (2x-1)^2 > 0 \end{cases}; \quad x \in \left(0; \frac{1}{2}\right) \cup \left(\frac{1}{2}; 1\right) \quad (\text{E})$$

27(96-13-28) $y = \log_2 \log_3 \sqrt{4x - 4x^2};$

$$\begin{cases} 4x - 4x^2 > 0 \\ \log_3 \sqrt{4x - 4x^2} > 0 \end{cases}; \quad \begin{cases} 4x - 4x^2 > 0 \\ \sqrt{4x - 4x^2} > 1 \end{cases};$$

$$\begin{cases} 4x^2 - 4x < 0 \\ 4x - 4x^2 > 1 \end{cases}; \quad \begin{cases} 4x^2 - 4x < 0 \\ 4x^2 - 4x + 1 < 0 \end{cases};$$

$$\begin{cases} x(x-1) < 0 \\ (2x-1)^2 < 0 \end{cases}; \quad x \in \emptyset \quad (\text{B})$$

28(98-2-34) $\begin{cases} \log_p 15 < \log_p 10 \\ \log_{5p} 8 > \log_{5p} 6 \end{cases}; \quad \begin{cases} 0 < p < 1 \\ 5p > 1 \end{cases};$

$$\begin{cases} 0 < p < 1 \\ p > \frac{1}{5} \end{cases}; \quad p \in \left(\frac{1}{5}; 1\right) \quad (\text{D})$$

29(98-6-25) $\log_{0,2} \log_4(x^2 - 5) < 0;$

$$\begin{cases} \log_4(x^2 - 5) > 1 \\ x^2 - 5 > 0 \end{cases}; \quad \begin{cases} x^2 - 5 > 4 \\ x^2 - 5 > 0 \end{cases}; \quad x^2 - 9 > 0;$$

$(x-3)(x+3) > 0; \quad x \in (-\infty; -3) \cup (3; \infty)$ (B)

30(98-11-39) $\log_x 6 > \log_x 12; \quad 0 < x < 1$ (B)

31(99-10-38) $4^{\log_2 x} + x^2 < 32; \quad (2^{\log_2 x})^2 + x^2 < 32;$

$$\begin{cases} x^2 + x^2 < 32 \\ x > 0 \end{cases}; \quad \begin{cases} x^2 - 16 < 0 \\ x > 0 \end{cases}; \quad \begin{cases} (x-4)(x+4) < 0 \\ x > 0 \end{cases};$$

$x \in (0; 4)$. Butun yechimlar 1, 2, 3, bularning yigindisi 6 (E)

32(96-3-88) $(x+2)^{\log_2(x^2+1)} < (x+2)^{\log_2(2x+9)};$

1) $\begin{cases} x+2 > 1 \\ \log_2(x^2+1) < \log_2(2x+9) \end{cases}; \quad \begin{cases} x > -1 \\ x^2 + 1 > 2x + 9 \end{cases};$

$$\begin{cases} x > -1 \\ x^2 - 2x - 8 < 0 \\ 2x > -9 \end{cases}; \quad \begin{cases} x > -1 \\ (x-4)(x+2) < 0 \\ x > -4,5 \end{cases};$$

$x \in (-1; 4)$

2) $\begin{cases} 0 < x+2 < 1 \\ \log_2(x^2+1) > \log_2(2x+9) \end{cases};$

$$\begin{cases} -2 < x < -1 \\ x^2 + 1 > 2x + 9 \end{cases};$$

$$\begin{cases} x^2 - 2x - 8 > 0 \\ 2x > -9 \end{cases}; \quad \begin{cases} (x-4)(x+2) > 0 \\ x > -4,5 \end{cases}; \quad \text{bu tengsizliklar}$$

sistemi yechimga ega emas.

Javob: $x \in (-1; 4)$ (D)

33(96-9-30) $x^{\log_{0,3}(x^2-5x+4)} < x^{\log_{0,3}(x-1)}; \quad x-1 > 0$

bo'lgani uchun $x > 1$ bo'ladi.

$$\begin{cases} x > 1 \\ \log_{0,3}(x^2-5x+4) < \log_{0,3}(x-1) \end{cases};$$

$$\begin{cases} x > 1 \\ x^2 - 5x + 4 > x - 1 \end{cases};$$

$$\begin{cases} x > 1 \\ x^2 - 5x + 4 > 0 \end{cases};$$

$$\begin{cases} x > 1 \\ (x-4)(x-1) > 0 \end{cases}; \quad x \in (5; \infty) \quad (\text{C})$$

34(96-12-88)

$$(x-2)^{\log_1(x^2-5x+5)} < (x-2)^{\log_1(x-3)}; \quad x-3 > 0$$

bo'lgani uchun $x-2 > 1$ bo'lad.

1) $\begin{cases} x-3 > 0 \\ \log_1(x^2-5x+5) < \log_1(x-3) \end{cases};$

$$\begin{cases} x > 3 \\ x^2 - 5x + 5 > x - 3 \end{cases}; \quad \begin{cases} x > 3 \\ x^2 - 6x + 8 > 0 \end{cases};$$

$$\begin{cases} x > 3 \\ (x-4)(x-2) > 0 \end{cases}; \quad x \in (4; \infty) \quad (\text{D})$$

35(96-13-29)

$$(x-2)^{\log_2(x^2-5x+5)} < (x-2)^{\log_2(x-3)}; \quad x-3 > 0$$

bo'lgani uchun $x-2 > 1$ bo'ladi.

$$1) \begin{cases} x-3 > 0 \\ \log_2(x^2 - 5x + 5) < \log_2(x-3) \end{cases}$$

$$\begin{cases} x > 3 \\ x^2 - 5x + 5 < x - 3 \end{cases}$$

$$x \in \left(\frac{5 + \sqrt{5}}{2}; 4 \right)$$

(C)

36(98-11-49) $x^{\log_2 x + 4} < 32$ tengsizlikning har ikki tomonini 2 asosga ko'ra lgarifmlaymiz.

$$\log_2 x^{\log_2 x + 4} < \log_2 32; \log_2 x(\log_2 x + 4) < 5;$$

$\log_2 x = t$ bo'lsin.

$$t(t+4) < 5; t^2 + 4t - 5 < 0; (t-1)(t+5) < 0;$$

$$-5 < t < 1; -5 < \log_2 x < 1; 2^{-5} < x < 2;$$

$$x \in (2^{-5}; 2) \text{ (E)}$$

$$37(98-4-39) \frac{\sqrt{6-x}}{\log_{\frac{1}{3}}(x-3)} \geq 0;$$

1) $x=6$ tengsizlikning yechimi.

2) $\begin{cases} x-3 > 0 \\ \sqrt{6-x} \geq 0 \end{cases}; x \in (3; 4)$. Yagona natural yechim 6. (B)

38(98-4-27)

$$(3x^2 + 7x + 13) \left(x - \frac{1}{\pi} \right)^2 \log_{1-x^2} \left(x^2 + \frac{1}{x^2} \right) \geq 0;$$

$3x^2 + 7x + 13 > 0$ chunki $D < 0$. Tengsizlikning har ikki tomonini $3x^2 + 7x + 13$ bo'lib

$$\left(x - \frac{1}{\pi} \right)^2 \log_{1-x^2} \left(x^2 + \frac{1}{x^2} \right) \geq 0 \text{ ni hosil qilamiz.}$$

$$1) \begin{cases} x - \frac{1}{\pi} = 0 \\ 1 - x^2 > 0 \end{cases}; \text{ bundan } x = \frac{1}{\pi};$$

$$2) x \neq \frac{1}{\pi} \text{ bo'lsa } \left(x - \frac{1}{\pi} \right)^2 > 0 \text{ bo'ladi.}$$

Tengsizlikning $\left(x - \frac{1}{\pi} \right)^2$ har ikki tomonini bo'lib

$$\log_{1-x^2} \left(x^2 + \frac{1}{x^2} \right) \geq 0 \text{ ni hosil qilamiz.}$$

Bu tengsizlik yechimga ega emas chunki

$$x^2 + \frac{1}{x^2} \geq 2, \quad 0 < 1 - x^2 < 1. \text{ Shunday qilib yagona}$$

$$\text{musbat yechim } x = \frac{1}{\pi} \text{ (D)}$$

39(01-1-24) $\log_2 x \leq \frac{2}{\log_2 x - 1}$; $\log_2 x = t$ bo'lsin.

$$t \leq \frac{2}{t-1}; t - \frac{2}{t-1} \leq 0; \frac{t^2 - t - 2}{t-1} \leq 0; \frac{(t-2)(t+1)}{t-1} \leq 0;$$

$$\begin{cases} (t-2)(t+1)(t-1) \leq 0 \\ t \neq 1 \end{cases}; t \leq -1; 1 < t \leq 2;$$

$$1) \begin{cases} \log_2 x \leq -1 \\ x > 0 \end{cases}; \begin{cases} x \leq \frac{1}{2} \\ x > 0 \end{cases}; x \in (0; \frac{1}{2}]$$

$$2) \begin{cases} 1 < \log_2 x \leq 2 \\ x > 0 \end{cases}; \begin{cases} 2 < x \leq 4 \\ x > 0 \end{cases}; x \in (2; 4]$$

$$\text{Javob: } x \in \left(0; \frac{1}{2} \right] \cup (2; 4] \text{ (E)}$$

40(01-1-25) $|\log_3 x| - \log_3 x - 3 < 0$;

$$1) \begin{cases} \log_3 x - \log_3 x - 3 < 0 \\ \log_3 x \geq 0 \end{cases}; \begin{cases} -3 < 0 \\ x \geq 1 \end{cases}$$

$$2) \begin{cases} -\log_3 x - \log_3 x - 3 < 0 \\ x > 0 \end{cases}; \begin{cases} -2\log_3 x < 3 \\ x > 0 \end{cases}$$

$$\begin{cases} \log_3 x > -\frac{3}{2} \\ x > 0 \end{cases}; \begin{cases} x > \frac{1}{3\sqrt{3}} \\ x > 0 \end{cases}; x \in \left(\frac{1}{3\sqrt{3}}; 1 \right)$$

$$\text{Har ikkovidan } x \in \left(\frac{1}{3\sqrt{3}}; \infty \right) \text{ (E)}$$

41(01-2-28) $\log_{x^2} (3 - 2x) > 1$;

$$1) \begin{cases} x^2 > 1 \\ 3 - 2x > x^2 \\ 3 - 2x > 0 \end{cases}; \begin{cases} x^2 - 1 > 0 \\ x^2 + 2x - 3 < 0 \\ -2x > -3 \end{cases}; \begin{cases} (x-1)(x+1) > 0 \\ (x+3)(x-1) < 0 \\ x < 1.5 \end{cases}$$

$$x \in (-3; -1)$$

$$2) \begin{cases} x^2 > 1 \\ 3 - 2x > x^2 \\ 3 - 2x > 0 \end{cases}; \begin{cases} x^2 - 1 > 0 \\ x^2 + 2x - 3 < 0 \\ -2x > -3 \end{cases}; \begin{cases} (x-1)(x+1) > 0 \\ (x+3)(x-1) < 0 \\ x < 1.5 \end{cases}$$

Bu tengsizliklar sistemasi yechimga ega emas.

$x=-2$ yagona butun yechim 1 ta. (D)

$$42(01-2-75) \begin{cases} \log_3 3 > \log_3 7 \\ \log_{\frac{1}{3}} \left(x - \frac{1}{3} \right) \leq 1 \end{cases}; \begin{cases} 0 < x < 1 \\ x - \frac{1}{3} \geq \frac{1}{2} \end{cases}$$

$$\begin{cases} 0 < x < 1 \\ x \geq \frac{5}{6} \end{cases}; x \in \left[\frac{5}{6}; 1 \right) \text{ (D)}$$

43(01-2-80) $y = \sqrt{\lg^2 |2x - 9| (5x - 6 - x^2)}$

$$1) \lg^2 |2x - 9| = 0; |2x - 9| = 1; x_1 = 4; x_2 = 5;$$

$$\begin{cases} 5x - 6 - x^2 \geq 0 \\ \lg^2 |2x - 9| \neq 0 \end{cases}; \begin{cases} x^2 - 5x + 6 \leq 0 \\ x \neq 4; x \neq 5 \end{cases}$$

$$\begin{cases} (x-3)(x-2) \leq 0 \\ x \neq 4; x \neq 5 \end{cases}; \begin{cases} 2 \leq x \leq 3 \\ x \neq 4; x \neq 5 \end{cases}$$

2,3,4 va 5 butun yechimlar. Bu sonlarning yig'indisi 14 (E)

$$44(01-3-24) \log_6 \left(\frac{x}{3} + 7 \right) > 0; \quad \frac{x}{3} + 7 > 1;$$

$$\frac{x}{3} > -6; \quad x > -18. \text{ Eng kichik butun yechim } -17$$

(D)

$$45(01-4-28) \log_{\frac{1}{3}}(5 - 2x) > -2;$$

$$\begin{cases} 5 - 2x > 0 \\ 5 - 2x < 9 \end{cases}; \begin{cases} x < 2.5 \\ x > -2 \end{cases}; \quad x \in (-2; 2.5) \quad (\mathbf{B})$$

$$46(01-6-38) \log_{\frac{1}{2}}(2^x - 128) \geq -7;$$

$$\begin{cases} 2^x - 128 \leq \left(\frac{1}{2}\right)^{-7} \\ 2^x - 128 > 0 \end{cases}; \begin{cases} 2^x - 2^7 \leq 2^7 \\ 2^x - 2^7 > 0 \end{cases}; \begin{cases} 2^x \leq 2^8 \\ 2^x > 2^7 \end{cases};$$

$$\begin{cases} x \leq 8 \\ x > 7 \end{cases}; \quad x \in (7; 8]. \text{ Yagona butun yechim } 8 \quad (\mathbf{D})$$

$$47(01-6-39) \begin{cases} \log_2 x^2 \geq 2 \\ \log_5 x^2 \leq 2 \end{cases}; \begin{cases} x^2 \geq 4 \\ x^2 \leq 25 \end{cases}; \begin{cases} x^2 - 4 \geq 0 \\ x^2 - 25 \leq 0 \end{cases};$$

$$\begin{cases} (x-2)(x+2) \geq 0 \\ (x-5)(x+5) \leq 0 \end{cases}; \quad x \in [-5; -2] \cup [2; 5]. \text{ Bu oraliqda 8 ta butun}$$

son bor. (D)

$$48(01-7-27) |\log_2 x| \leq 3; \quad -3 \leq \log_2 x \leq 3;$$

$$\frac{1}{8} \leq x \leq 8. \text{ Bu oraliqdagi butun sonlar } 2, 3, 5 \text{ va } 7.$$

Bu sonlarning yig'indisi 17 (C)

$$49(01-7-28) \log_{\frac{1}{3}}(x-1) - 2 \log_{\frac{1}{9}}(2x-3) < 0;$$

$$\log_{\frac{1}{3}}(x-1) - \log_{\frac{1}{3}}(2x-3) < 0;$$

$$\begin{cases} \log_{\frac{1}{3}} \frac{x-1}{2x-3} < 0 \\ x-1 > 0 \\ 2x-3 > 0 \end{cases}; \begin{cases} \frac{x-1}{2x-3} > 1 \\ x > 1 \\ x > 1.5 \end{cases}; \begin{cases} \frac{x-1}{2x-3} - 1 > 0 \\ x > 1.5 \end{cases};$$

$$\begin{cases} \frac{x+2}{x-1.5} > 0 \\ x > 1.5 \end{cases}; \begin{cases} (x-2)(x-1.5) < 0 \\ x > 1.5 \end{cases}; \quad x \in (1.5; 2) \quad (\mathbf{A})$$

$$50(01-7-35) 0.5^{\log_3(x^2+6x-7)} \geq \frac{1}{4};$$

$$\left(\frac{1}{2}\right)^{\log_3(x^2+6x-7)} \geq \left(\frac{1}{2}\right)^2; \quad \log_3(x^2+6x-7) \leq 2;$$

$$\begin{cases} x^2+6x-7 \leq 9 \\ x^2+6x-7 > 0 \end{cases}; \begin{cases} (x+8)(x-2) \leq 0 \\ (x-7)(x+1) > 0 \end{cases};$$

$$x \in (-1; 2]. \text{ Eng katta butun yechim } 2 \quad (\mathbf{B})$$

$$51(01-9-3) \frac{2 \log_2(3-2x)}{\log_2 0.1} < 0; \quad \log_2 0.1 < 0$$

bo'lgani uchun $\log_2(3-2x) > 0$ bo'lishi kerak.

$$3-2x > 1; \quad x < 1; \quad x \in (-\infty; 1) \quad (\mathbf{A})$$

$$52(01-9-45) \sqrt{4x^2-5x-9} < \ln \frac{1}{2}; \quad \ln \frac{1}{2} < 0$$

bo'lgani uchun tengsizlik yechimga ega emas. (E)

$$53(01-10-30) (x^2-6x+5)\sqrt{\log_3(x-2)} \leq 0;$$

$$\begin{cases} x^2-6x+5 \leq 0 \\ \log_3(x-2) \geq 0 \end{cases}; \begin{cases} (x-5)(x-1) \leq 0 \\ x \geq 3 \end{cases}; \quad x \in [3; 5] \quad (\mathbf{E})$$

$$54(01-10-31) \frac{\log_3(1-2x)}{\log_{0.2}(x^2+2x+2)} < 0; \text{ Bu}$$

tengsizlik o'rinli bo'lishi uchun quyadigilar bajarilishi kerak.

$$1) \begin{cases} \log_3(1-2x) > 0 \\ \log_{0.2}(x^2+2x+2) < 0 \end{cases}; \begin{cases} 1-2x > 1 \\ x^2+2x+2 > 1 \end{cases}; \begin{cases} x < 0 \\ (x+1)^2 > 0 \end{cases};$$

$$x \in (-\infty; -1) \cup (-1; 0)$$

$$2) \begin{cases} \log_3(1-2x) < 0 \\ \log_{0.2}(x^2+2x+2) > 0 \end{cases}; \begin{cases} 1-2x < 1 \\ x^2+2x+2 > 1 \end{cases}; \begin{cases} x > 0 \\ (x-1)^2 < 0 \end{cases};$$

Bu tengsizliklar sistemasi yechimga ega emas.

$$\text{Javob: } x \in (-\infty; -1) \cup (-1; 0) \quad (\mathbf{D})$$

$$55(01-11-28) 12^{\log_{12}(x+3)} > 2x-5;$$

$$\begin{cases} x+3 > 2x-5 \\ x+3 > 0 \end{cases}; \begin{cases} x < 8 \\ x > -3 \end{cases}; \quad x \in (-3; 8). \text{ Eng kichik butun yechim } -2$$

(B).

$$56(01-11-32) \frac{x-5}{\log_x 3} < 0; \quad \begin{cases} x-5 < 0 \\ x \neq 1 \\ x > 0 \end{cases};$$

$$\left\{ \begin{array}{l} \approx \\ \approx \\ \approx \\ \approx \end{array} \right.$$

$$x \in (0; 1) \cup (1; 5) \quad (\mathbf{C})$$

$$57(02-1-59) \log_2^3 x - 3 \log_2^2 x \geq 0;$$

$$\log_2^2 x (\log_2 x - 3) \geq 0;$$

$$1) \log_2^2 x = 0; \quad x = 1;$$

$$2) \log_2 x \geq 3; \quad x \geq 8; \quad x \in [1] \cup [8; \infty) \quad (\mathbf{E})$$

$$58(02-2-26) \log_{0.5}(2x+1) < \log_2(2-3x);$$

$$\log_2 \frac{1}{2x+1} < \log_2(2-3x); \quad \begin{cases} \frac{1}{2x+1} < 2-3x \\ 2x+1 > 0 \\ 2-3x > 0 \end{cases}$$

$$\begin{cases} \frac{1}{2x+1} - 2 + 3x < 0 \\ 2x > -1 \\ -3x > -2 \end{cases}; \begin{cases} \frac{1-4x-2+6x^2+3x}{2x+1} < 0 \\ x > -\frac{1}{2} \\ x < \frac{2}{3} \end{cases};$$

$$\begin{cases} (2x+1)(6x^2-x-1) \leq 0 \\ x \geq -\frac{1}{2} \\ x \leq \frac{1}{3} \end{cases};$$

$$\begin{cases} (x+\frac{1}{2})(x-\frac{1}{2})(x+\frac{1}{3}) \leq 0 \\ x \geq -\frac{1}{2} \\ x \leq \frac{1}{3} \end{cases};$$

$$x \in \left(-\frac{1}{3}; \frac{1}{2}\right) \text{ (A)}$$

$$59(02-3-40) \log_{\frac{\pi}{6}} \frac{2x+3}{3x-2} > \log_{\frac{\pi}{6}} 2; \quad \frac{\pi}{6} < 1;$$

$$\begin{cases} \frac{2x+3}{3x-2} < 2 \\ \frac{2x+3}{3x-2} > 0 \end{cases}; \begin{cases} \frac{2x+3-6x+4}{3x-2} < 0 \\ \frac{2x+3}{3x-2} > 0 \end{cases};$$

$$\begin{cases} \frac{-4x+7}{3x-2} < 0 \\ \frac{2x+3}{3x-2} > 0 \end{cases}; \begin{cases} \left(x-\frac{7}{4}\right)\left(x-\frac{2}{3}\right) > 0 \\ \left(x+\frac{3}{2}\right)\left(x-\frac{2}{3}\right) > 0 \end{cases};$$

$$x \in (-\infty; -1.5) \cup \left(\frac{7}{4}; \infty\right). \text{ Eng kichik musbat}$$

butun yechim 2 (A)

$$60(02-4-42) -\lg x < 1; \lg x > -1; x > \frac{1}{10}. \text{ Eng}$$

kichik butun yechim 1 (D)

$$61(02-4-43) \log_{16}(3x+1) > 0.5; \quad 3x+1 > 4;$$

$x > 1$. Eng kichik butun yechim 2 (E)

$$62(02-5-26) 2\log_8(x-2) - \log_8(x-3) > \frac{2}{3};$$

$$\log_8(x-2)^2 - \log_8(x-3) > \frac{2}{3};$$

$$\begin{cases} \log_8 \frac{(x-2)^2}{x-3} > \frac{2}{3} \\ x-2 > 0 \\ x-3 > 0 \end{cases}; \begin{cases} \frac{(x-2)^2}{x-3} > 4 \\ x > 3 \end{cases}$$

$$\begin{cases} \frac{x^2-4x+4}{x-3} - 4 > 0 \\ x > 3 \end{cases}; \begin{cases} \frac{x^2-8x+16}{x-3} > 0 \\ x > 3 \end{cases};$$

$$\begin{cases} (x-4)^2(x-3) > 0 \\ x > 3 \end{cases}; \quad x \in (3;4) \cup (4;\infty) \text{ (E)}$$

$$63(02-6-37) \frac{\log_5(5-x^2)}{\log_2(x^4+x^2+1)} > 0; \text{ Bu tengsizlik}$$

o'rinli bo'lishi uchun quyadigilar bajarilishi kerak.

$$1) \begin{cases} \log_5(5-x^2) < 0 \\ \log_2(x^4+x^2+1) < 0 \end{cases}; \begin{cases} 5-x^2 < 1 \\ x^4+x^2+1 < 1 \end{cases}; \begin{cases} x^2-4 > 0 \\ x^4+x^2 < 0 \end{cases};$$

bundan $x \in \emptyset$

$$2) \begin{cases} \log_5(5-x^2) > 0 \\ \log_2(x^4+x^2+1) > 0 \end{cases}; \begin{cases} 5-x^2 > 1 \\ x^4+x^2+1 > 1 \end{cases}; \begin{cases} x^2-4 < 0 \\ x^2-5 < 0 \\ x^4+x^2 > 0 \end{cases};$$

$$\begin{cases} (x-2)(x+2) \leq 0 \\ (x-\sqrt{5})(x+\sqrt{5}) \leq 0 \\ x \neq 0 \end{cases}; \quad x \in (-2;0) \cup (0;2).$$

Butun yechimlar -1 va 1. 2 ta (C)

$$64(02-6-38) (x^2-8x+7)\sqrt{\log_5(x^2-3)} \leq 0;$$

$$1) \log_5(x^2-3) = 0; \quad x^2-3=1; \quad x = \pm 2;$$

$$2) \begin{cases} x^2-8x+7 \leq 0 \\ \log_5(x^2-3) > 0 \\ x^2-3 > 0 \end{cases}; \quad \begin{cases} (x-7)(x-1) \leq 0 \\ x^2-3 > 1 \\ x^2-3 > 0 \end{cases};$$

$$\begin{cases} (x-7)(x-1) \leq 0 \\ (x-2)(x+2) > 0 \end{cases}; \quad x \in (2;7]. \text{ Har ikkovidan}$$

$$x \in [-2] \cup [2;7] \text{ (B)}$$

$$65(02-9-35) \lg(x-2) < 2 - \lg(27-x);$$

$$\lg(x-2) + \lg(27-x) < 2;$$

$$\begin{cases} x-2 > 0 \\ 27-x > 0 \\ \lg((x-2)(27-x)) < 2 \end{cases}; \begin{cases} x > 2 \\ x < 27 \\ (x-2)(27-x) < 100 \end{cases};$$

$$\begin{cases} x > 2 \\ x < 27 \\ x^2-29x+154 > 0 \end{cases}; \begin{cases} x > 2 \\ x < 27 \\ (x-22)(x-7) > 0 \end{cases};$$

$x \in (2;7) \cup (22;27)$. Bu oraliqqa 8 ta butun son tegishli. (B)

$$66(02-10-72) (2 - \log_2 x)\sqrt{x^2-1} \geq 0;$$

$$1) \begin{cases} x^2-1=0 \\ x > 0 \end{cases}; \quad \begin{cases} x = \pm 1 \\ x > 0 \end{cases}; \quad x = 1$$

$$2) \begin{cases} 2 - \log_2 x \geq 0 \\ x^2-1 > 0 \\ x > 0 \end{cases}; \quad \begin{cases} \log_2 x \leq 2 \\ x^2-1 > 0 \\ x > 0 \end{cases}; \quad \begin{cases} x \leq 4 \\ (x-1)(x+1) > 0 \\ x > 0 \end{cases};$$

$x \in (1;4]$. Har ikkovidan $x \in [1;4]$ (A)

$$67(02-11-35) \frac{2\log_3 x}{2 + \log_3 x} \leq 1; \quad \log_3 x = t \text{ bo'lsin.}$$

$$\frac{2t}{t+2} \leq 1; \quad \frac{2t}{t+2} - 1 \leq 0; \quad \frac{t-2}{t+2} \leq 0; \quad \begin{cases} (t-2)(t+2) \leq 0 \\ t \neq -2 \end{cases}$$

$$-2 < t \leq 2; \quad -2 < \log_3 x \leq 2; \quad \frac{1}{9} < x \leq 9; \text{ Bu}$$

oraliqdagi tub sonlar 2,3,5 va 7. Bularning yig'indisi 17 (E)

$$68(02-11-36) \sqrt{5-x} \left(\log_{\frac{1}{3}}(2x-4) + \frac{1}{\log_x 3} \right) \geq 0;$$

$$1) \begin{cases} \sqrt{5-x} \geq 0 \\ \log_{\frac{1}{3}}(2x-4) + \frac{1}{\log_x 3} \geq 0 \end{cases}; \quad \begin{cases} x \leq 5 \\ x \neq 2 \end{cases}; \quad x = 2$$

$$2) \begin{cases} \log_{\frac{1}{3}}(2x-4) + \frac{1}{\log_x 3} \geq 0 \\ x > 2 \\ 5-x > 0 \end{cases};$$

$$\begin{cases} -\log_3(2x-4) + \log_3 x \geq 0 \\ x > 2 \\ x < 5 \end{cases};$$

$$\begin{cases} \log_3 \frac{x}{2x-4} \geq 0 \\ x > 2 \\ x < 5 \end{cases}; \quad \begin{cases} \frac{x}{2x-4} \geq 1 \\ x > 2 \\ x < 5 \end{cases}; \quad \begin{cases} \frac{-x+4}{2x-4} \geq 0 \\ x > 2 \\ x < 5 \end{cases};$$

$$\begin{cases} (x-2) < (x-4) < 0 \\ x \geq 2 \\ x \leq 4 \end{cases}; x \in (2; 4]. \text{ Har ikkovidan}$$

$x \in (2; 4] \cup \{5\}$. Tengsizlikning 3 ta butun yechimi bor. **(D)**

$$69(03-1-12) 5^{\sqrt{5-x}} \leq (x-4) \ln(x-4).$$

$\begin{cases} 5-x \geq 0 \\ x-4 > 0 \end{cases}; \begin{cases} x \leq 5 \\ x > 4 \end{cases}$; Tengsizlikning aniqlanish sohasiga tegishli yagona butun son 5 va u tengsizlikning yechimi emas. Tengsizlikning butun yechimi mavjud emas. **(A)**

$$70(03-1-29) \log_x 3 < 2;$$

$$1) \begin{cases} x > 1 \\ 3 < x^2 \end{cases}; \begin{cases} x > 1 \\ (x-\sqrt{3})(x+\sqrt{3}) > 0 \end{cases}; x \in (\sqrt{3}; \infty)$$

$$2) \begin{cases} 0 < x < 1 \\ 3 > x^2 \end{cases}; \begin{cases} 0 < x < 1 \\ (x-\sqrt{3})(x+\sqrt{3}) < 0 \end{cases}; x \in (0; 1)$$
. Har ikkovidan

$$x \in (0; 1) \cup (\sqrt{3}; \infty) \text{ (C)}$$

$$71(03-2-22) \log_4(2 - \sqrt{x+3}) < 2 \cos \frac{5\pi}{3};$$

$$\log_4(2 - \sqrt{x+3}) < 1;$$

$$\begin{cases} x+3 \geq 0 \\ 2 - \sqrt{x+3} > 0 \\ 2 - \sqrt{x+3} < 4 \end{cases}; \begin{cases} x \geq -3 \\ \sqrt{x+3} < 2 \\ \sqrt{x+3} > -2 \end{cases}; \begin{cases} x \geq -3 \\ x < 1 \end{cases}$$

$x \in [-3; 1)$. Butun yechimlar -3, -2, -1, 0. 4 ta **(B)**.

$$72(03-3-35) \left(\frac{1}{2}\right)^{\log_{0,2} \log_2 \left(\frac{9x+6}{9x^2+2}\right)} > \left(\frac{1}{2}\right)^0;$$

$$\log_{0,2} \log_2 \left(\frac{9x+6}{9x^2+2}\right) < 0; \log_2 \left(\frac{9x+6}{9x^2+2}\right) > 1;$$

$$\frac{9x+6}{9x^2+2} > 2; 9x^2+2 > 0; 9x+6 > 18x^2+4;$$

$$18x^2 - 9x - 2 < 0; \left(x - \frac{2}{3}\right) \left(x + \frac{1}{6}\right) < 0;$$

$$x \in \left(-\frac{1}{6}; \frac{2}{3}\right) \text{ (D)}$$

$$73(03-4-35) 10^{\lg(x-2)-2} < 4; 10^{\lg\left(\frac{x-2}{100}\right)} < 4;$$

$$\begin{cases} \frac{x-2}{100} < 4 \\ x-2 > 0 \end{cases}; \begin{cases} x-2 < 400 \\ x > 2 \end{cases}; \begin{cases} x < 402 \\ x > 2 \end{cases};$$

$2 < x < 402$; Eng katta butun yechim 401 **(B)**

$$74(03-6-60) \log_{\frac{1}{3}}(2x-3) > 1;$$

$$\begin{cases} 2x-3 < \frac{1}{3} \\ 2x-3 > 0 \end{cases}; \begin{cases} 2x < \frac{10}{3} \\ 2x > 3 \end{cases}; \begin{cases} x < \frac{5}{3} \\ x > \frac{3}{2} \end{cases}; \frac{1}{2} < x < \frac{2}{3} \text{ (A)}$$

$$75(03-7-71) \log_2 \sqrt[3]{x+1} < \log_8 16;$$

$$\frac{1}{3} \log_2(x+1) < \frac{1}{3} \log_2 16; \log_2(x+1) < \log_2 16;$$

$$\begin{cases} x+1 < 16 \\ x+1 > 0 \end{cases}; \begin{cases} x < 15 \\ x > -1 \end{cases}; x \in (-1; 15) \text{ (E)}$$

$$76(03-8-51) \log_x(4x-3) \geq 2;$$

$$1) \begin{cases} x > 1 \\ 4x-3 \geq x^2 \\ 4x-3 > 0 \end{cases}; \begin{cases} x > 1 \\ x^2 - 4x + 3 \geq 0 \\ 4x > 3 \end{cases}; \begin{cases} x > 1 \\ (x-3)(x-1) \geq 0 \end{cases}$$

$$x \in (1; 3]$$

$$2) \begin{cases} 0 < x < 1 \\ 4x-3 \geq x^2 \\ 4x-3 > 0 \end{cases}; \begin{cases} x < 1 \\ x^2 - 4x + 3 \geq 0 \\ 4x > 3 \end{cases}; \begin{cases} x < 1 \\ (x-3)(x-1) \geq 0 \\ x < 0,75 \end{cases}$$

Bu tengsizliklar sistemasi butun yechimga ega emas, demak $x \in (1; 3]$.

Butun yechimlar 2 va 3. Bu sonlarning yig'indisi

5. **(A)**

$$77(03-9-22) \frac{\log_2 x - 2}{\log_2 x - 4} \leq 0;$$

$$\begin{cases} (\log_2 x - 2)(\log_2 x - 4) \leq 0 \\ \log_2 x \neq 4 \end{cases}; 2 \leq \log_2 x < 4;$$

$4 \leq x < 16$. Bu oraliqda 4 ta tub son bor. **(C)**

$$78(03-9-23)$$

$$|x-8| \left(\log_5(x^2 - 3x - 4) + \frac{2}{\log_3 0,2} \right) \leq 0;$$

$$1) |x-8| = 0; x = 8;$$

$$2) x \neq 8; \log_5(x^2 - 3x - 4) - \log_5 9 \leq 0;$$

$$\begin{cases} \log_5(x^2 - 3x - 4) \leq \log_5 9 \\ x^2 - 3x - 4 > 0 \end{cases}; \begin{cases} x^2 - 3x - 4 \leq 9 \\ x^2 - 3x - 4 > 0 \end{cases}$$

$$\begin{cases} x^2 - 3x - 13 \leq 0 \\ x^2 - 3x - 4 > 0 \end{cases}; \begin{cases} \left(x - \frac{3+\sqrt{61}}{2}\right) \left(x - \frac{3-\sqrt{61}}{2}\right) \leq 0 \\ (x-4)(x+1) > 0 \end{cases}$$

$$x \in \left(\frac{3-\sqrt{61}}{2}; -1\right) \cup \left(4; \frac{3+\sqrt{61}}{2}\right). \text{ Butun}$$

yechimlar -2,5 va 8. 3ta **(D)**

$$79(03-9-40) f(x) = \sqrt{\log_{\frac{1}{2}}(x-2) + 2};$$

$$\begin{cases} \log_{\frac{1}{2}}(x-2) + 2 \geq 0 \\ x-2 > 0 \end{cases}; \begin{cases} \log_{\frac{1}{2}}(x-2) \geq -2 \\ x-2 > 0 \end{cases};$$

$$\begin{cases} x-2 \leq 4 \\ x > 2 \end{cases}; \begin{cases} x \leq 6 \\ x > 2 \end{cases}; 2 < x \leq 6; \text{ bu oraliqda 4 ta butun son mavjud.}$$

(D)

$$80(03-12-24) \log_3(x-2)^2 \leq 4;$$

$$\begin{cases} (x-2)^2 \leq 9 \\ x-2 \neq 0 \end{cases}; \begin{cases} (x-2)^2 - 9 \leq 0 \\ x \neq 2 \end{cases}; \begin{cases} (x-11)(x+7) \leq 0 \\ x \neq 2 \end{cases};$$

$x \in [-7; 2) \cup (2; 11]$. Bu oraliqda 18 ta butun son mavjud. **(D)**

81(01-12-57) $e^{\ln(3x^2 - 27)} \leq 21$;

$$\begin{cases} 3x^2 - 27 \leq 21 \\ 3x^2 - 27 > 0 \end{cases}; \begin{cases} 3x^2 - 48 \leq 0 \\ x^2 - 9 > 0 \end{cases}; \begin{cases} (x-4)(x+4) \leq 0 \\ (x-3)(x+3) > 0 \end{cases}$$

$x \in [-4; -3) \cup (3; 4]$. -4 va 4 butun yechimlar. 2ta **(E)**