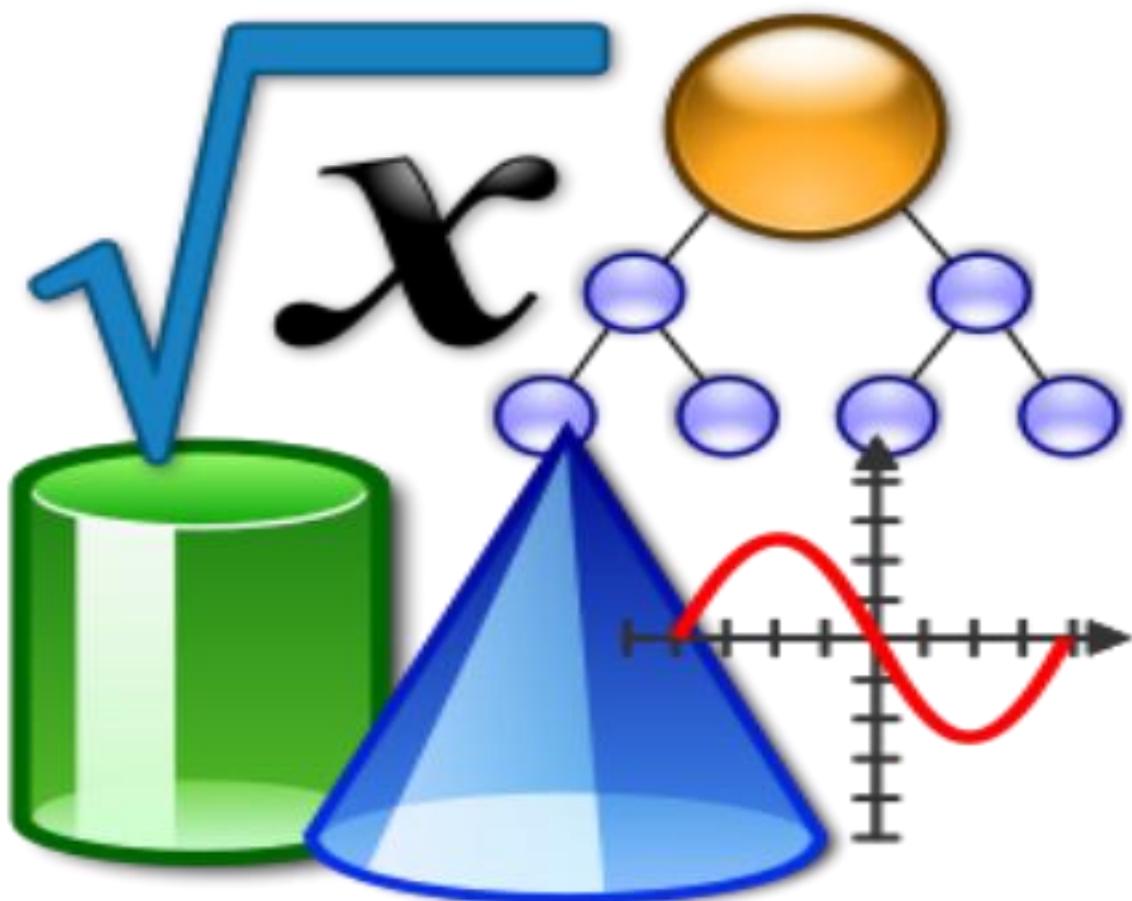


**11-sinf o'quvchilari uchun**

# **MATEMATIKA**

**fanidan yakuniy imtihon javoblari**



**2025**

1-savol

Hisoblashga doir misollar

① Ifodaning qiyomatini toping:

$$\log_5 250 - \log_5 2 + \sqrt[4]{48} : \sqrt[4]{3} = \log_5 \left(\frac{250}{2}\right) + \sqrt[4]{\frac{48}{3}}$$

$$= \log_5 (125) + \sqrt[4]{16} = \log_5 (5^3) + 2 = 3+2=5$$

$$② \log_6 4 + \log_6 9 + \sqrt[3]{2} \cdot \sqrt[3]{32} = \log_6 (4 \cdot 9) + \sqrt[3]{2 \cdot 32} =$$

$$= \log_6 (36) + \sqrt[3]{64} = 2+4=6$$

$$③ \log_{12} 12000 - \log_{12} 12 + \left(\frac{1}{2}\right)^{-3} = \log_{12} (12000:12) + \left(\frac{2}{1}\right)^3 =$$

$$= \log_{12} 1000 + 8 = 3+8=11$$

$$④ \log_{12} 2 + \log_{12} 6 - \sqrt[4]{243} : \sqrt[4]{3} = \log_{12} (2 \cdot 6) - \sqrt[4]{\frac{243}{3}} =$$

$$= \log_{12} (12) - \sqrt[4]{81} = 1-3=-2$$

$$⑤ \log_{\frac{1}{2}} 4 - \sqrt[3]{5} \cdot \sqrt[3]{25} + \log_{6} 1 =$$

$$= \log_{(2)^{-1}(2)} (-1) - \sqrt[3]{5 \cdot 25} + 0 = -1 \cdot 2 - 5 = -7$$

$$⑥ \log_3 24 - \log_3 8 + \left(\frac{1}{5}\right)^{-2} = \log_3 \left(\frac{24}{8}\right) + \left(\frac{5}{1}\right)^2 =$$

$$= \log_3 (3) + 25 = 26$$

$$⑦ \log_8 (16) + \log_8 (4) - \sqrt[3]{270} : \sqrt[3]{15} = \log_8 (16 \cdot 4) - \sqrt[3]{\frac{270}{15}} =$$

$$= \log_8 (64) - \sqrt[3]{3^3} = 2-3 = -1$$

$$\textcircled{8} \quad \log_5(\log_2(32) + \sqrt[3]{\frac{27}{8}}) = \log_5(\log_2(2^5) + \sqrt[3]{(\frac{3}{2})^3}) = \\ = \log_5(5) + \frac{3}{2} = 1 + \frac{3}{2} = \frac{5}{2}$$

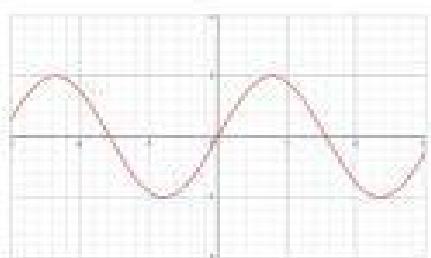
$$\textcircled{9} \quad \sqrt[4]{20000} : \sqrt[4]{2} \cdot \log_{0,1}(1000) = \\ = \sqrt[4]{20000/2} \cdot \log_{10^{-1}}(10^3) = 10 \cdot \frac{3}{-2} = -30$$

$$\textcircled{10} \quad (\sqrt[3]{5})^6 + \log_{18}(2) + \log_{18}(9) = \\ = \sqrt[3]{5^{2 \cdot 3}} + \log_{18}(2 \cdot 9) = (\sqrt[3]{5})^2 + \log_{18}(18) = 5 + 1 = 6$$

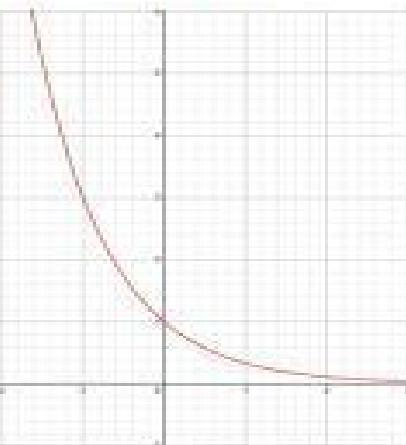
## 2-savol

### II. Funksiyalar (graflarni o'qish)

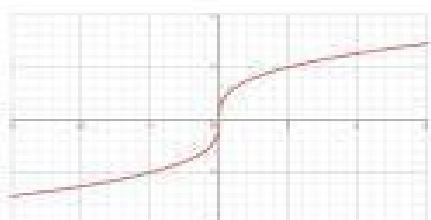
1. Quyida keltirilgan olti funksiyadan to'rtasining grafigi rasmida tasvirlangan. Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



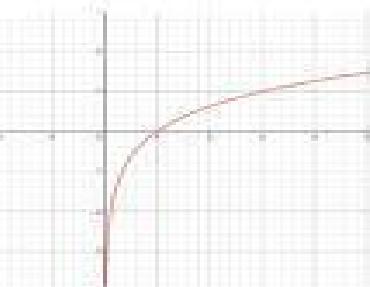
A



B



C



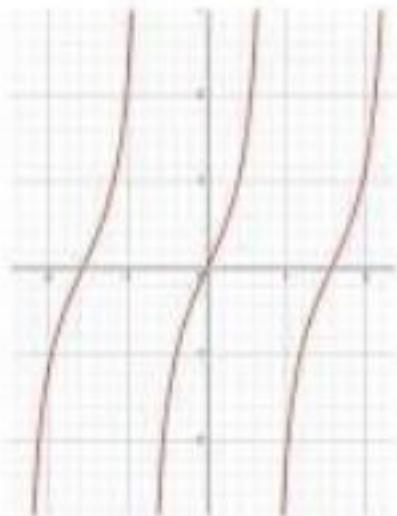
D

Funksiyalar:

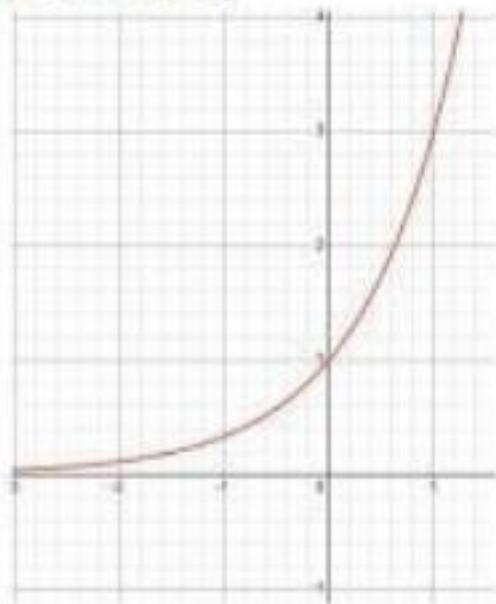
1) $y = \log_3 x$	3) $y = \sqrt[3]{x}$	5) $y = \cos 2x$
2) $y = 3^{-x}$	4) $y = \sin 2x$	6) $y = 2^x$

A	B	C	D
4	2	3	1

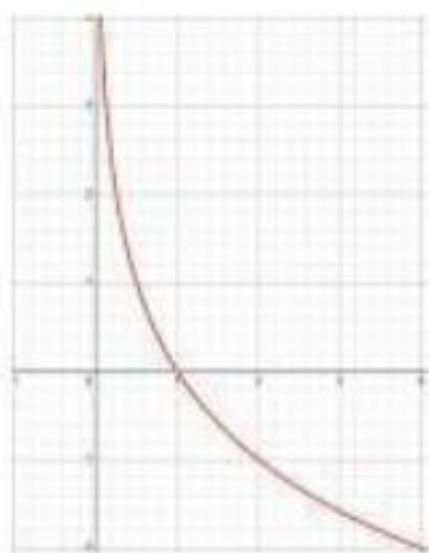
2. Quyida keltirilgan olti funksiyadan to'rttasining grafigi rasmida tasvirlangan.  
Funksiyalar va ularning grafigi o'ttasidagi moslikni toping.



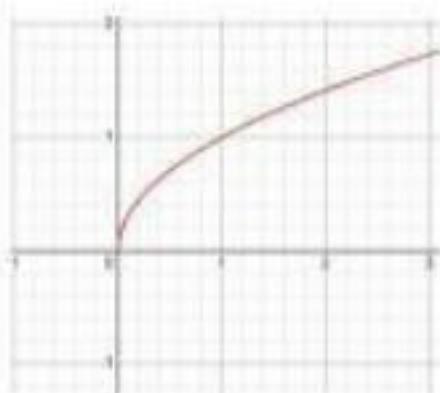
A



B



C



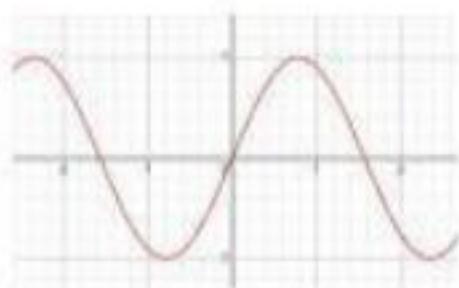
D

Funksiyalar:

1) $y = -\log_2 x$	3) $y = \sqrt{x}$	5) $y = \cos 2x$
2) $y = 3^x$	4) $y = \operatorname{tg} 2x$	6) $y = 2^{-x}$

A	B	C	D
4	2	1	3

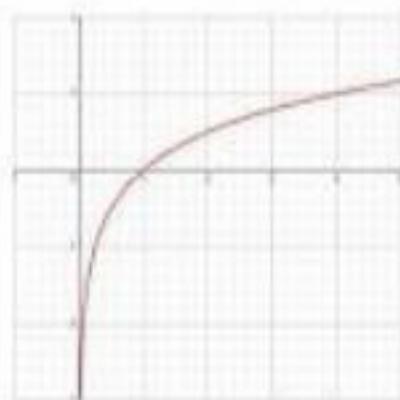
3. Quyida keltirilgan olti funksiyadan to'rtasining grafigi rasmda tasvirlangan. Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



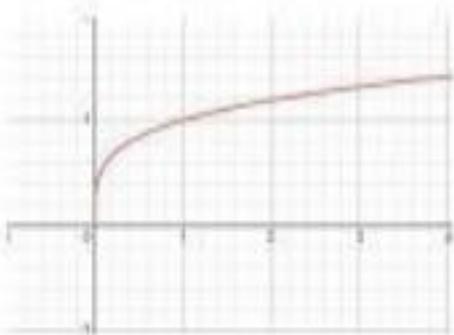
A



B



C



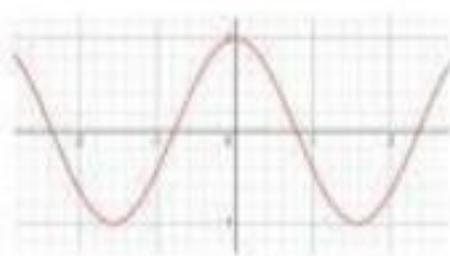
D

Funksiyalar:

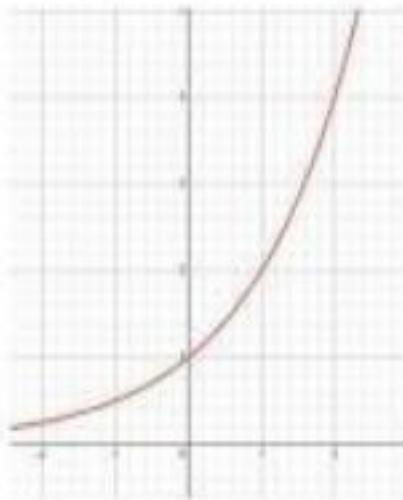
1) $y = \log_4 x$	3) $y = \sqrt[4]{x}$	5) $y = \sin 2x$
2) $y = 4^{-x}$	4) $y = \operatorname{tg} 2x$	6) $y = 2^x$

A	B	C	D
5	2	1	3

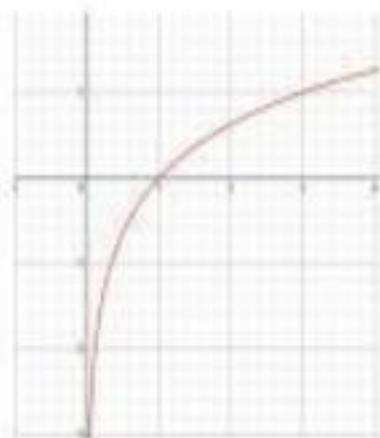
4. Quyida keltirilgan olti funksiyadan to'rttasining grafigi rasmida tasvirlangan. Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



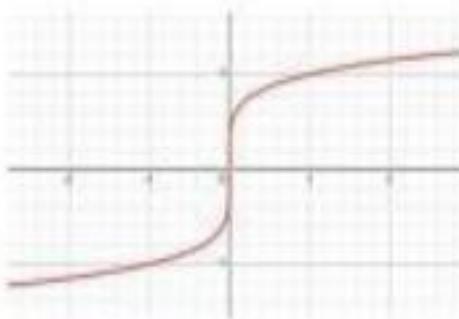
A



B



C



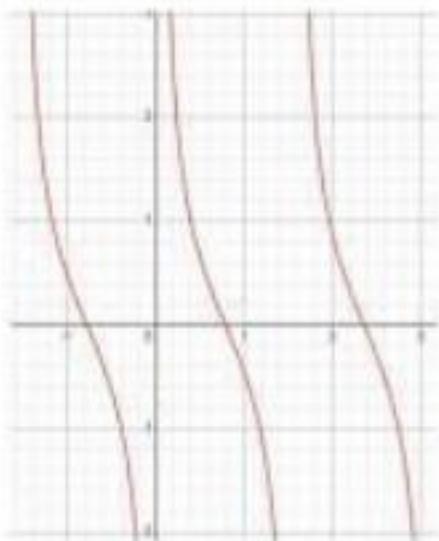
D

Funksiyalar:

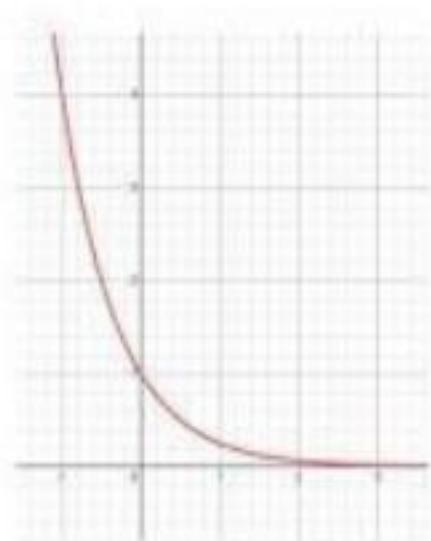
1) $y = \log_3 x$	3) $y = \sqrt[3]{x}$	5) $y = \sin 2x$
2) $y = 3^{-x}$	4) $y = \cos 2x$	6) $y = 2^x$

A	B	C	D
4	6	1	3

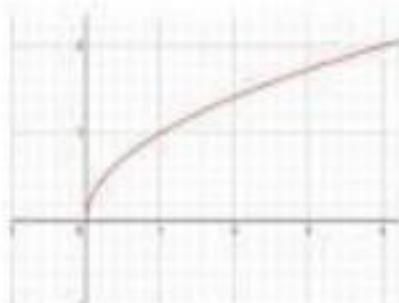
5. Quyida keltirilgan olti funksiyadan to'rttasining grafigi rasmda tasvirlangan. Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



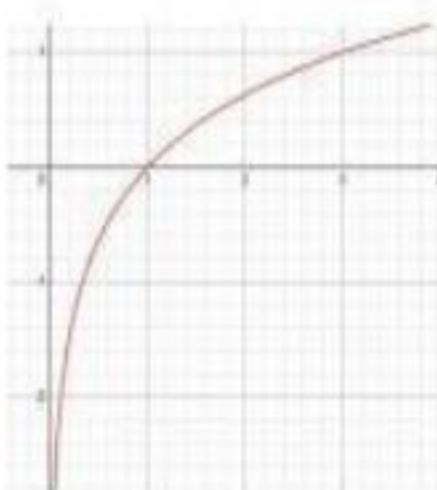
A



B



C



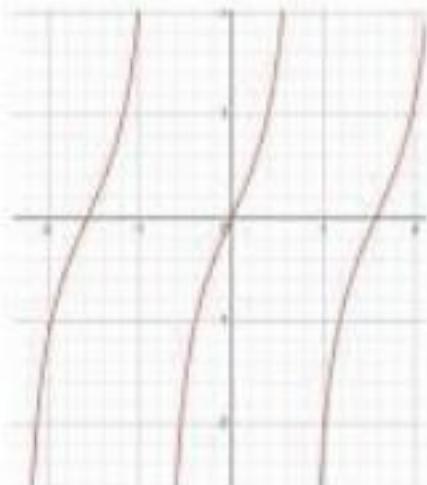
D

Funksiyalar:

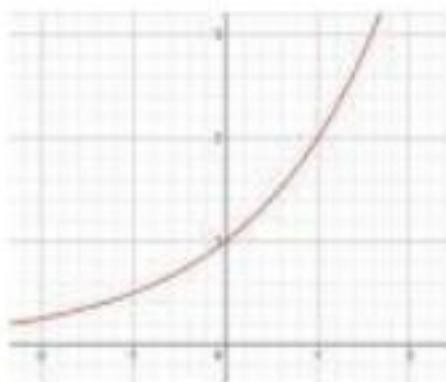
1) $y = \log_3 x$	3) $y = \sqrt{x}$	5) $y = \sin 2x$
2) $y = 4^{-x}$	4) $y = \operatorname{ctg} 2x$	6) $y = 2^x$

A	B	C	D
4	2	3	1

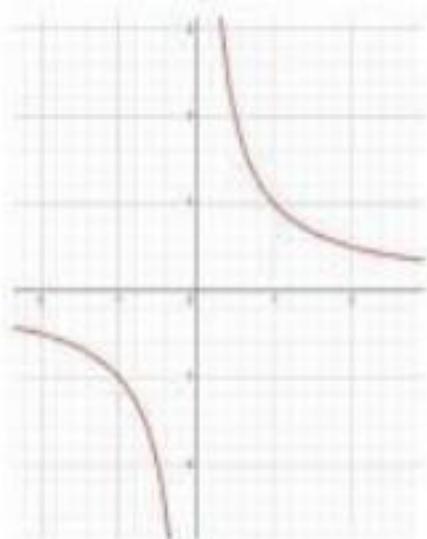
6. Quyida keltirilgan olti funksiyadan to'rttasining grafigi rasmda tasvirlangan. Funksiyalar va ularning grafigi o'ttasidagi moslikni toping.



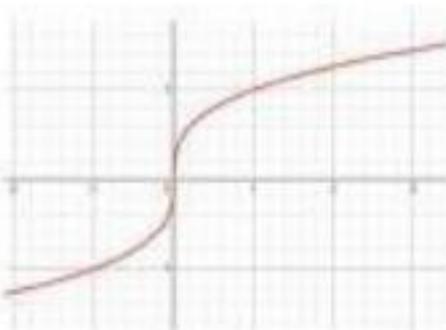
A



B



C



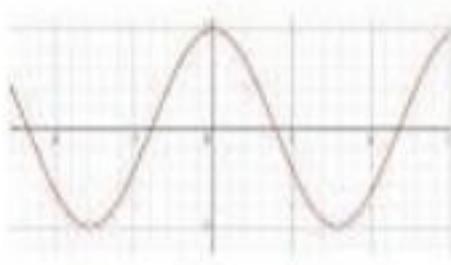
D

Funksiyalar:

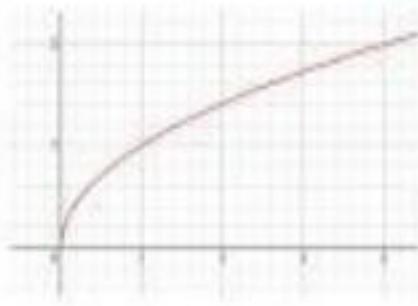
1) $y = \log_3 x$	3) $y = \sqrt[3]{x}$	5) $y = \sin 2x$
2) $y = \frac{1}{x}$	4) $y = \operatorname{tg} 2x$	6) $y = 2^x$

A	B	C	D
4	6	2	3

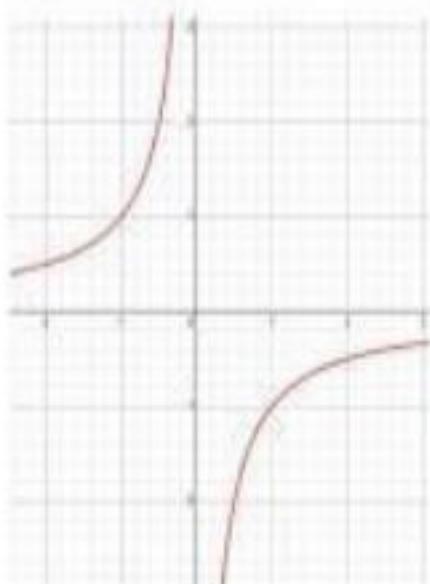
7. Quyida keltirilgan olti funksiyadan to'rtasining grafigi rasmda tasvirlangan. Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



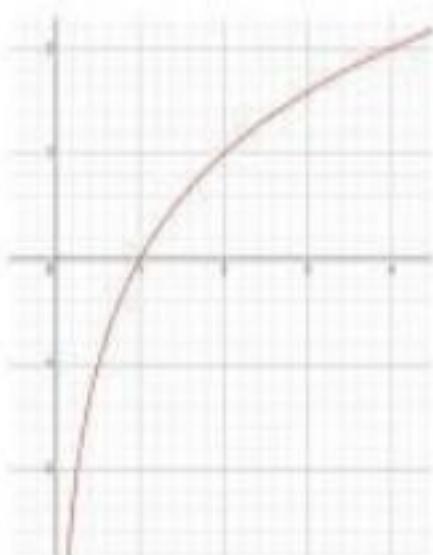
A



B



C



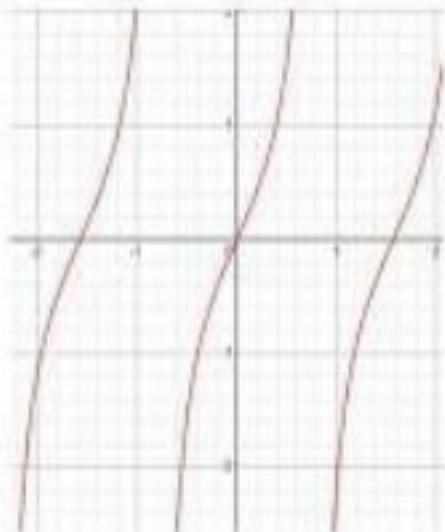
D

Funksiyalar:

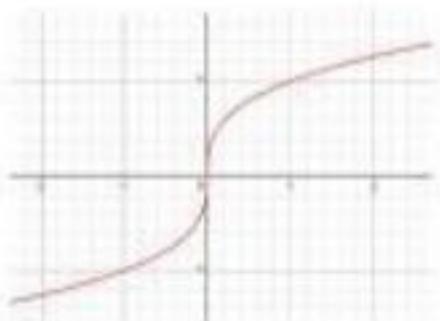
1) $y = \log_2 x$	3) $y = \sqrt{x}$	5) $y = \frac{1}{x}$
2) $y = -\frac{1}{x}$	4) $y = \cos 2x$	6) $y = \cos x$

A	B	C	D
4	3	2	2

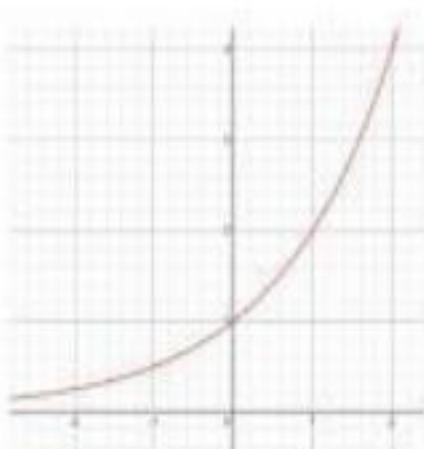
5. Quyida keltirilgan olti funksiyadan to'rttasining grafigi rasmda tasvirlangan.  
Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



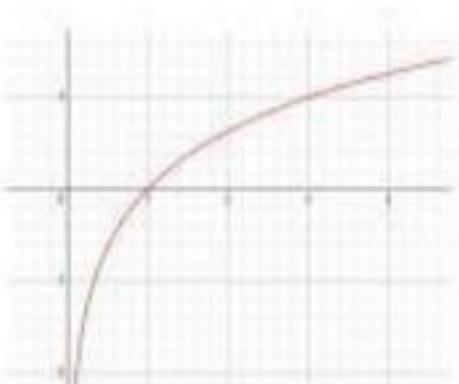
A



B



C



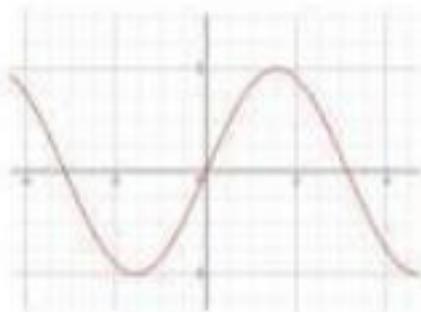
D

Funksiyalar:

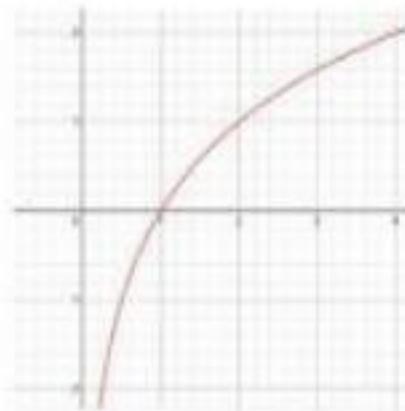
1) $y = \log_3 x$	3) $y = \sqrt[3]{x}$	5) $y = \operatorname{tg} 2x$
2) $y = 2^x$	4) $y = \operatorname{ctg} 2x$	6) $y = 3^{-x}$

A	B	C	D
5	3	2	1

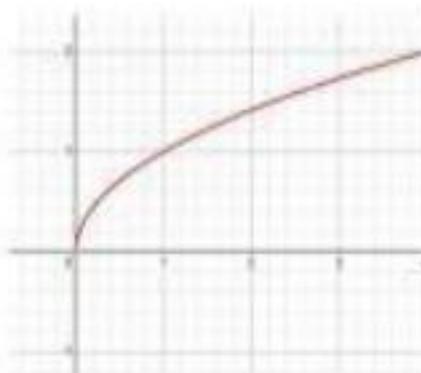
9. Quyida keltirilgan olti funksiyadan to'rtasining grafigi rasmida tasvirlangan.  
Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



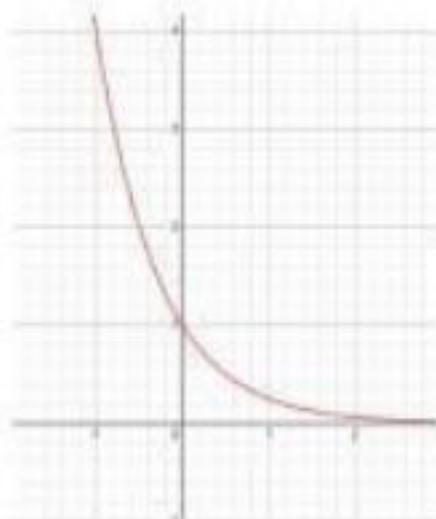
A



B



C



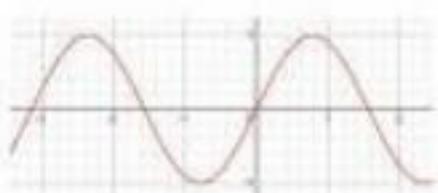
D

Funksiyalar:

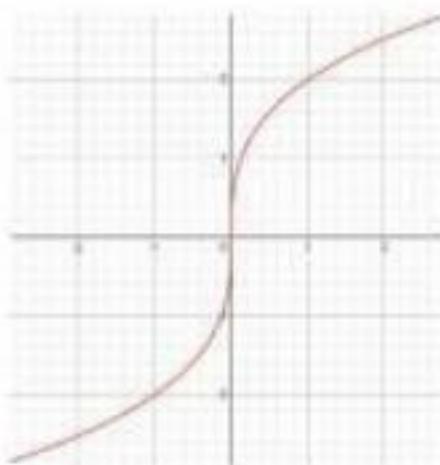
1) $y = \log_2 x$	3) $y = \sqrt{x}$	5) $y = 2 \cos x$
2) $y = 2^x$	4) $y = 2 \sin x$	6) $y = 4^{-x}$

A	B	C	D
4	1	3	6

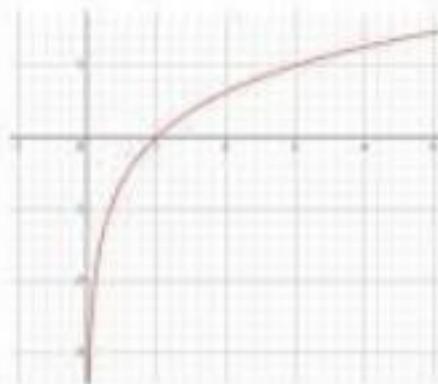
10. Quyida keltirilgan olti funksiyadan to'rtasining grafigi rasmda tasvirlangan.  
Funksiyalar va ularning grafigi o'rtaqidagi moslikni toping.



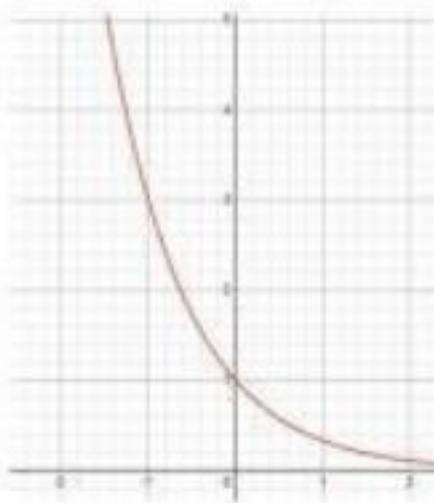
A



B



C



D

Funksiyalar:

1) $y = \log_3 x$	3) $y = 2^{\sqrt[3]{x}}$	5) $y = \cos x$
2) $y = 3^{-x}$	4) $y = \sin 2x$	6) $y = 2^x$

A	B	C	D
4	3	1	2

**3-savol**

III Korsatuvchi tenglama va tengsizliklar

$$\textcircled{1} \quad 3^x + 3^{x+2} \geq 90 \quad \textcircled{2} \quad 5^x + 5^{x+2} \leq 130$$

$$3^x(1 + 3^2) \geq 90$$

$$3^x \cdot 10 \geq 90$$

$$3^x \geq 9$$

$$3^x \geq 3^2$$

$$x \geq 2$$

$$5^x(1 + 5^2) \leq 130$$

$$5^x \cdot 26 \leq 130$$

$$5^x \leq 5^1$$

$$x \leq 1$$

$$\textcircled{3} \quad 2^x + 2^{x+3} < 36$$

$$2^x(1 + 2^3) < 36$$

$$2^x \cdot 9 < 36$$

$$2^x < 4$$

$$2^x < 2^2$$

$$x < 2$$

$$\textcircled{4} \quad 4 \cdot 2^{x-1} < 2^{x+4}$$

$$(2^2)^{2x-1} < 2^{x+4}$$

$$2^{4x-4} < 2^{x+4}$$

$$4x - 4 < x + 4$$

$$4x - x < 4 + 4$$

$$3x < 8$$

$$x < \frac{8}{3}$$

$$\textcircled{5} \quad 9^{2x-1} \leq 3^{x+7}$$

$$(3^2)^{2x-1} \leq 3^{x+7}$$

$$3^{4x-2} \leq 3^{x+7}$$

$$4x-2 \leq x+7$$

$$4x-x \leq 7+2$$

$$3x \leq 9$$

$$x \leq 3$$

$$\textcircled{7} \quad 9^x - 6 \cdot 3^x = 27$$

$$3^{2x} - 3^x \cdot 6 = 27$$

$$3^x(3^2 - 6) = 27$$

$$3^x \cdot 3 = 27$$

$$3^x = 9$$

$$3^x = 3^2$$

$$x = 2$$

$$\textcircled{9} \quad 25^x - 6 \cdot 5^x + 5 = 0$$

$$(5^x)^2 - 6 \cdot 5^x + 5 = 0$$

$$5^x = t$$

$$t^2 - 6t + 5 = 0$$

$$t_1 = 1 \quad t_2 = 5$$

$$5^x = 1 \quad 5^x = 5$$

$$5^x = 5^1$$

$$x = 1$$

$$\textcircled{6} \quad 3^{2x} - 8 \cdot 3^x - 9 = 0$$

$$3^x(3^2 - 8) - 9 = 0$$

$$3^x \cdot 1 - 9 = 0$$

$$3^x = 9$$

$$3^x = 3^2$$

$$x = 2$$

$$\textcircled{8} \quad 4^x + 3 \cdot 2^x = 10$$

$$(2^{2x}) + 3 \cdot 2^x = 10$$

$$2^x(2^2 + 3) = 10$$

$$(2^x)^2 + 3 \cdot 2^x = 10$$

$$2^x = t$$

$$t^2 + 3t = 10$$

$$t_1 \cdot t_2 = -10 \quad t_1 + t_2 = -3$$

$$t_1 = 2 \quad t_2 = -5$$

$$2^x = -5 \quad \emptyset$$

$$2^x = 2$$

$$x = 1$$

$$\textcircled{10} \quad 4^x + 2 \cdot 2^x = 8$$

$$(2^x)^2 + 2 \cdot 2^x - 8 = 0 \quad 2^x = t$$

$$t^2 + 2t - 8 = 0$$

$$t_1 = -4 \quad t_2 = 2$$

$$2^x = -4 \quad \emptyset$$

$$2^x = 2 \quad x = 1$$

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● 50MP Triple Camera

**4-savol**

**IU.** Logarifmik tenglama va tengsizliklar

$$\textcircled{1} \quad (\log_4 x)^2 + 3 = 4 \cdot \log_4 x \quad \log_4 x = t$$

$$t^2 + 3 = 4t$$

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

$$t_1 = 3 \quad \log_4 x = 3 \quad x = 4^3 = 64$$

$$t_2 = 1 \quad \log_4 x = 1 \quad x = 4^1 = 4$$

$$\textcircled{2} \quad \log_{10}(100x) \cdot \lg x = 3 \quad \lg = \log_{10}$$

$$(\log_{10}(100) + \log_{10}(x)) \cdot \log_{10}(x) = 3$$

$$(2 + \log_{10}(x)) \cdot \log_{10}(x) = 3$$

$$2\log_{10}(x) + (\log_{10}(x))^2 = 3 \quad \log_{10}(x) = t$$

$$t^2 + 2t - 3 = 0$$

$$t_1 = -3 \quad \log_{10}(x) = -3 \quad x = 10^{-3} = \frac{1}{1000}$$

$$t_2 = 1 \quad \log_{10}(x) = 1 \quad x = 10^1 = 10$$

$$\textcircled{3} \quad \log_2 x \cdot \log_2(4x) - 15 = 0$$

$$\log_2 x \cdot \log_2(2^2 x) - 15 = 0$$

$$\log_2 x \cdot (\log_2(2^2) + \log_2(x)) - 15 = 0$$

$$2\log_2(x) + \log_2(x)\log_2(x) - 15 = 0$$

$$t^2 + 2t - 15 = 0$$

$$\cancel{\log_2(x)} = t$$

$$t_1 = -5 \quad \log_2 x = -5 \quad x = 2^{-5} = \frac{1}{32}$$

$$\textcircled{4} \quad \log_2 x = 3 \quad x = 2^3 = 8$$



HONOR X4a  
50MP Camera

$$④. (\log_2 x)^2 = \log_2 x^3$$

$$(\log_2 x)^2 = 3 \log_2 x$$

$$(\log_2 x)^2 - 3 \log_2 x = 0$$

$$\log_2(x)(\log_2(x) - 3) = 0$$

$$\log_2(x) = 0 \quad x = 2^0 = 1$$

$$\log_2(x) - 3 = 0 \Rightarrow$$

$$\log_2(x) = 3 \quad x = 2^3 = 8$$

$$⑤. \log_3 x \cdot \log_3(3x) - 6 = 0$$

$$\log_3 x \cdot (\log_3(3) + \log_3(x)) - 6 = 0$$

$$\log_3 x (1 + \log_3(x)) - 6 = 0 \quad (\log_3(x) = t)$$

$$t + t^2 - 6 = 0$$

$$t_1 = -3 \quad \log_3(x) = -3 \quad x = 3^{-3} = \frac{1}{27}$$

$$t_2 = 2 \quad \log_3(x) = 2 \quad x = 3^2 = 9$$

$$⑥. \log_{0,5}(2x+6) \geq \log_{0,5}(x+8)$$

Arsoslarini bir xilligi uchun tashlab yuboramiz  
ishoraq almashadi

$$2x+6 \leq x+8$$

$$2x-x \leq 8-6$$

$$x \leq 2 \quad \text{Javob: } (-3, 2]$$

$$2x+6 > 0$$

$$2x > -6$$

$$x > -3$$

$$\textcircled{7} \quad \log_8(3x-1) - \log_8(3-x) > 0$$

$$\log_8(3x-1) > \log_8(3-x)$$

Aşostalar bir xil tashlab yuboromiz,  
ishora o'zgartiraydi;

$$3x-1 > 3-x$$

$$3x+1 > 3+x$$

$$4x > 4$$

$$x > 1$$

$$3x-1 > 0 \quad x > \frac{1}{3}$$

$$3-x > 0 \quad x < 3$$

$$\text{Javob: } (1, 3)$$

$$\textcircled{8} \quad \log_{0,5}(3x-4) \leq -1$$

$$3x-4 \leq 0,5^{-1}$$

$$3x-4 \leq 2$$

$$x \leq 2$$

$$3x-4 > 0$$

$$x > \frac{4}{3}$$

$$\left[ \frac{4}{3}, 2 \right]$$

$$\textcircled{9} \quad \log_{0,2}(5x+1) > \log_{0,2}(3x+7)$$

$$5x+1 < 3x+7$$

$$2x < 6$$

$$x < 3$$

$$5x+1 > 0 \quad x > -\frac{1}{5}$$

$$3x+7 > 0 \quad x > -\frac{7}{3}$$

$$\text{Javob: } \left( -\frac{1}{5}, 3 \right)$$

$$\textcircled{10} \quad \log_3(2x-3) - \log_3(6-x) \geq 0$$

$$\log_3\left(\frac{2x-3}{6-x}\right) \geq 0 \quad \begin{cases} x \geq 3 \\ x < 6 \end{cases}$$

$$3 \leq \frac{2x-3}{6-x}$$

$$\begin{cases} x \leq 3 \\ x > 6 \end{cases}$$

$$\text{Javob: } [3, 6)$$

## 5-savol

IV Trigonometrik tenglamalar va tengsizliklar

$$\sin 2x = \sqrt{3} \sin x$$

$$2 \sin x \cos x - \sqrt{3} \sin x = 0$$

$$\sin x (2 \cos x - \sqrt{3}) = 0$$

$$\begin{aligned} \sin x &= 0 & 2 \cos x - \sqrt{3} &= 0 \\ \Downarrow & & \cos x &= \frac{\sqrt{3}}{2} \end{aligned}$$

$$\text{J: } x = k\pi \quad k \in \mathbb{Z}$$

$$x = \frac{\pi}{6} + 2k\pi \quad k \in \mathbb{Z}$$

$$x = \frac{11\pi}{6} + 2k\pi \quad k \in \mathbb{Z}$$

$$③ \sin 2x - 2 \sin^2 x = 0$$

$$2 \sin x \cos x - 2 \sin^2 x = 0$$

$$2 \sin x (\cos x - \sin x) = 0$$

$$2 \sin x = 0 \quad x = k\pi \quad k \in \mathbb{Z}$$

$$\cos x - \sin x = 0 \quad \cos x = \sin x$$

$$x = \frac{\pi}{4} + k\pi \quad k \in \mathbb{Z}$$

$$\text{J: } x = k\pi \quad k \in \mathbb{Z}$$

$$x = \frac{\pi}{4} + k\pi \quad k \in \mathbb{Z}$$

$$② \operatorname{tg} x + 3 \operatorname{ctg} x = 4$$

$$\operatorname{tg} x + 3 \cdot \frac{1}{\operatorname{tg} x} - 4 = 0$$

$$\operatorname{tg} x + 3 \cdot \frac{1}{\operatorname{tg} x} - 4 = 0$$

$$\operatorname{tg}^2 x + 3 - 4 \operatorname{tg} x = 0$$

$$\operatorname{tg} x \neq 0$$

$$\operatorname{tg}^2 x + 3 - 4 \operatorname{tg} x = 0$$

$$\operatorname{tg} x = t$$

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

$$\begin{aligned} t_1 &= 3 & \operatorname{tg} x &= 1 \\ t_2 &= 1 & \operatorname{tg} x &= 3 \end{aligned}$$

$$\text{J: } x = \frac{\pi}{4} + k\pi \quad k \in \mathbb{Z}$$

$$④ \cos 4x + \sin^2 2x = 1$$

$$\cos^2 2x - \sin^2 2x + \sin^2 2x = 1$$

$$\cos^2 2x = 1$$

$$\cos 2x = \pm 1$$

$$x = \frac{\pi}{2} + k\pi \quad k \in \mathbb{Z}$$

$$k = k\pi$$

$$⑤ \sin 2x + \sqrt{2} \cos x = 0$$

$$2 \sin x \cdot \cos x + \sqrt{2} \cos x = 0$$

$$2 \sin x \cdot \cos x + \sqrt{2} \cos x = 0$$

$$\cos x (2 \sin x + \sqrt{2}) = 0$$

$$\cos x = 0 \Rightarrow x = \frac{\pi}{2} + k\pi$$

$$2 \sin x + \sqrt{2} = 0$$

$$\sin x = -\frac{\sqrt{2}}{2} \Rightarrow x = \frac{5\pi}{4} + 2k\pi$$

$$x = \frac{7\pi}{4} + 2k\pi$$

$$⑦ \tan x - 1 = 2 \cot x$$

$$\tan x - 1 - 2 \cot x = 0$$

$$\tan x - 1 - \frac{2}{\tan x} = 0$$

$$\frac{\tan^2 x - \tan x - 2}{\tan x} = 0$$

$$\tan^2 x - \tan x - 2 = 0 \quad \tan x = n$$

$$n^2 - n - 2 = 0 \quad n=2 \quad n=-1$$

$$\tan x = -1 \quad \tan x = 2$$

$$\frac{3\pi}{4} + k\pi \quad x = \arctan(2) + k\pi$$

$$⑩ \tan^2 2x - 3 = 0$$

$$\tan^2 2x = 3$$

$$\tan 2x = \sqrt{3} \quad \tan 2x = -\sqrt{3}$$

$$x = \frac{\pi}{3} + \frac{\pi k}{2}, x = \frac{\pi}{6} + \frac{\pi k}{2} \quad k \in \mathbb{Z}$$

$$⑥ 4 \sin 2x \cdot \cos 2x = \sqrt{3}$$

$$4 \cdot 2 \sin x \cdot \cos x (\cos^2 x - \sin^2 x) = \sqrt{3}$$

$$2 \sin(4x) = \sqrt{3}$$

$$\sin(4x) = \frac{\sqrt{3}}{2}$$

$$4x = \frac{\pi}{3} \quad 4x = \frac{2\pi}{3}$$

$$j: \frac{\pi}{3} + 2k\pi \quad k \in \mathbb{Z}$$

$$\frac{2\pi}{3} + 2k\pi \quad k \in \mathbb{Z}$$

$$⑧ \sin x \cdot \cos x + \sin^2 x = 0$$

$$\sin x (\cos x + \sin x) = 0$$

$$\sin x = 0 \quad x = \pi k \quad k \in \mathbb{Z}$$

$$\cos x + \sin x = 0$$

$$\cos x = -\sin x \quad x = \frac{3\pi}{4} + k\pi$$

$$k \in \mathbb{Z}$$

$$⑨ \cos 3x + \sin 3x = 0$$

$$\cos 3x = -\sin 3x \quad / \cos 3x$$

$$1 = -\tan 3x \quad \tan 3x = -1$$

$$3x = -\frac{\pi}{4} + \pi n \quad n \in \mathbb{Z}$$

$$x = -\frac{\pi}{12} + \frac{\pi n}{3} \quad n \in \mathbb{Z}$$

## 6-savol

U1

Funksiyani hissila yordamida teshirish

$$\textcircled{1} \quad y = x + \frac{4}{x} - 2$$

hissila

$$y' = 1 - \frac{4}{x^2}$$

$$1 - \frac{4}{x^2} = 0$$

$$1 = \frac{4}{x^2}$$

$x = \pm 2$  - statisianar nughtalar

$$y' = 1 - \frac{4}{x^2}$$

Ishorasini teshiriziz

$$x^2 > 4 \quad x < -2 \quad x > 2$$

$$\frac{4}{x^2} < 1 \quad y' > 0 \quad \text{funksiya ösadi}$$

$$-2 < x < 0 \quad 0 < x < 2 \quad y' < 0 \quad \text{funksiya kamayadi}$$

Local ekstremumlari

$$x = -2 \quad \text{- local maksimum}$$

$$x = 2 \quad \text{local minimum}$$

$$\textcircled{2} \quad y = \frac{4x}{x^2 + 1}$$

$$y = \frac{u(x)}{v(x)} \Rightarrow y' = \frac{u'v - uv'}{v^2}$$

$$u = 4x \quad u' = 4$$

$$v = x^2 + 1 \quad v' = 2x$$

$$y' = \frac{4(x^2 + 1) - 4x(2x)}{(x^2 + 1)^2} = \\ = -\frac{4x^2 + 4}{(x^2 + 1)^2}$$

$$y' = 0 \quad -4x^2 + 4 = 0 \\ x^2 = 1 \quad x = \pm 1 \\ \text{statisianar nughtalar:} \\ -1 ; 1$$

$$|x| < 1 \quad y' > 0 \\ \text{funksiya ösadi}$$

$$|x| > 1 \quad y' < 0$$

kamayadi  $(-\infty, -1) \cup (1, \infty)$

$x = -1$  - local maksimum

$x = 1$  - local minimum

2 ta maksimum

$$③ y = x - 4\sqrt{x} + 2$$

$$y' = 1 - 4 \cdot \frac{1}{2\sqrt{x}} = 1 - \frac{2}{\sqrt{x}}$$

$$\frac{1-2}{\sqrt{x}} = 0 \quad x = 4$$

Statistionar nüqta - 4

$x < 4$  da funktsiya kamayadi

$x > 4$  da ösadi

$x = 4$  lokal minimum

$$y(4) = 2 + 4 - 4\sqrt{4} = -2$$

Lokal maksimum yäq

$$⑤ y = \frac{1-x^2}{x^2-4}$$

$$y' = \frac{(u'v - uv')}{v^2}$$

$$u = 1 - x^2 \quad u' = -2x$$

$$v = x^2 - 4 \quad v' = 2x$$

$$y' = \frac{-2x(x^2-4) - (1-x^2)(2x)}{(x^2-4)^2}$$

$$y' = 0 \quad 6x = 0 \quad x = 0$$

Statistionar nüqta - 0

$x < 0$  da kamayadi

$x > 0$  da ösadi.

$$x = 0 \quad y = -\frac{1}{4} \quad \text{lokal minimum}$$

$$④ y = 3x^5 - 5x^3 + 1$$

$$y' = \frac{d}{dx}(3x^5 - 5x^3 + 1) = 15x^4 - 15x^2$$

$$15x^4 - 15x^2 = 0$$

$$x^2 = 1 \quad x = \pm 1$$

$x = 0$   
statistionar nüqtalar:  
-1; 0; 1

$x < -1$  da ösadi

$-1 < x < 0$  da kamayadi

$0 < x < 1$  da kamayadi

$x > 1$  da ösadi

$x = -1$  lokal maksimum  
 $x = 0$  ekstremum emas  
 $x = 1$  lokal minimum

$$⑥ y = x + \frac{9}{x} + 1$$

$$y' = 1 - \frac{9}{x^2}$$

$$1 - \frac{9}{x^2} = 0 \quad x = \pm 3$$

Statistionar nüqtalar -(-3), 3

$x^2 > 9$  kamayadi

$x^2 < 9$  ösadi

lokal maksimumlar  
-3 va 3

$$⑦ \quad y = \frac{-8x}{x^2+4}$$

$$u = -8x \quad u' = -8 \\ v = x^2 + 4 \quad v' = 2x$$

$$\cdot \quad y' = \frac{-8 \cdot (x^2+4) - (-8x) \cdot 2x}{(x^2+4)^2}$$

$$\cdot \quad y' = \frac{8x^2 - 32}{(x^2+4)^2}$$

$$8x^2 - 32 = 0 \quad x = \pm 2$$

Statsonar nqtalar:  $-2, 2$

$x^2 > 4 \quad x > 2 \quad x < -2$  da össadi

$x^2 < 4 \quad -2 < x < 2$  da kamayadi

$x = -2 \quad y = 2$  (lokal maksimum)

$x = 2 \quad y = -2$  lokal minimum

$$⑨ \quad y = -x^4 + 2x^2 + 3$$

$$y' = 4x - 4x^3 = 4x(1 - x^2)$$

$$y' = 0 \quad 4x(1 - x^2) \quad x = 0 \quad x = \pm 1$$

Statsonar nqtalar:

$$x = -1, 0, 1$$

$y$   $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$  da

kamayadi

$(-1, 0) \cup (0, 1)$

da össadi

$x = -1$  lokal minimum

HONOR X60 Pro Triple Camera

$$⑧ \quad y = 6\sqrt{x} - x - 1$$

$$y' = 6 \cdot \frac{1}{2\sqrt{x}} - 1 = \frac{3}{\sqrt{x}} - 1$$

$$\frac{3}{\sqrt{x}} - 1 = 0 \quad \sqrt{x} = 3 \quad x = 9$$

Statsonar nqta - 9

$x < 9$  da össadi.

$x > 9$  da kamayadi

Lokal maksimum:

$$x = 9$$

$$y = 6\sqrt{9} - 9 - 1 = 8$$

$$⑩ \quad y = \frac{x^2 - 3}{x^2 - 1}$$

$$y = \frac{u}{v} \quad y' = \frac{u'v - uv'}{v^2}$$

$$u = x^2 - 3 \quad u' = 2x \\ v = x^2 - 1 \quad v' = 2x$$

$$y' = \frac{2x(x^2-1) - 2x(x^2-3)}{(x^2-1)^2} = \frac{4x}{(x^2-1)^2}$$

$$\frac{4x}{(x^2-1)^2} = 0 \quad x = 0$$

Statsonar nqta - 0

$(-\infty, -1) \cup (-1, 0)$  kamayadi

$(0, 1) \cup (1, \infty)$  össadi

Lokal minimum  $x = 0, y = 3$

7-savol

VII. Kosila yordamida yechiladigan masalalar

$$① \quad s(t) = 3 + 6t + 2t^2$$

$$v(t) = s'(t)$$

Yechilish:  $s(t) = 3 + 6t + 2t^2$   
 $v(t) = \frac{ds}{dt} = 6 + 4t$   
 $6 + 4t = 30 \quad t = 6$   
 $y: t = 6 \text{ sekund}$

$$③ \quad v(t) = -3t + 5t$$

$$a(t) = v'(t)$$

y:  $a(t) = \frac{dv}{dt} = -3 + 10t -$   
 $-3 + 10t = 17 \quad t = 2$

$$② \quad f(x) = (x^3 - x + 1)^4 \quad x_0 = 1$$

Yech:  $f'(x) = 4(x^3 - x + 1)^3 \cdot (3x^2 - 1)$

$x=1$  da  ~~$f'(t) = 4(x^3 - x + 1)^3 \cdot (3x^2 - 1)$~~   
 $f'(1) = 4(1^3 - 1 + 1)^3 \cdot (3 \cdot 1^2 - 1) = 4(1)^3 \cdot 2 = 8$

$$f(1) = (1)^4 = 1$$

Urinma tenglamasi:

$$y - 1 = 8(x - 1) \quad y = 8x - 7$$

$$④ \quad f(x) = 4\sqrt{6-x} \quad x_0 = 2$$

y:  $f'(x) = 4 \cdot \frac{-1}{2\sqrt{6-x}} = \frac{-2}{\sqrt{6-x}}$

$x=2$  da  $f'(2) = \frac{-2}{\sqrt{4}} = -1$

$$f(2) = 4\sqrt{4} = 8$$

Urinma:

$$y - 8 = -1(x - 2)$$

$$y = 10 - x$$

$$⑤ \quad s(t) = 5 + 8t + t^2$$

$$v = 20 \text{ m/s}$$

y:  $v(t) = s'(t) = 8 + 2t = 20$

$$t = 6$$

y: 6 soniga

$$\textcircled{6} \quad f(x) = (x^2 + x + 1)^3$$

$$y: f'(x) = 3(x^2 + x + 1)^2 \cdot (2x + 1)$$

$$f'(1) = 3(3)^2 \cdot 3 = 81$$

$$f(1) = 3^3 = 27$$

Urinma:

$$y - 27 = 81(x - 1)$$

$$y = 81x - 54$$

$$\textcircled{8} \quad f(x) = 2\sqrt{7-x}$$

$$y: f'(x) = 2 \cdot \frac{-1}{2\sqrt{7-x}} = \frac{-1}{\sqrt{7-x}}$$

$$x = -2$$

$$f'(-2) = \frac{-1}{\sqrt{9}} = -\frac{1}{3}$$

$$f(-2) = 2\sqrt{9} = 6$$

$$\text{Urinma: } y - 6 = -\frac{1}{3}(x + 2)$$

$$y = -\frac{1}{3}x + \frac{16}{3}$$

$$\textcircled{7} \quad v(t) = 40t - 2t^2$$

$$a(t) = v'(t)$$

$$a = 24 \text{ m/s}^2$$

$$t = ?$$

$$y: a(t) = 40 - 4t$$

$$40 - 4t = 24$$

$$t = 4$$

$$J: 4 \text{ soniya}$$

$$\textcircled{9} \quad s(t) = 2 - 6t + t^2$$

$$v = 44 \text{ m/s}$$

$$t = ?$$

$$y: v(t) = -6 + 2t$$

$$-6 + 2t = 44 \quad t = 5$$

$$J: 5 \text{ soniya}$$

$$\textcircled{10} \quad f(x) = (2x^3 - 1)^4$$

$$y: f'(x) = 4(2x^3 - 1)^3 \cdot 6x^2 = 24x^2(2x^3 - 1)$$

$$x = 1 \quad f'(1) = 24(1)^2 \cdot 1^3 = 24$$

$$f(1) = 1^4 = 1$$

$$\text{Urinma: } y - 1 = 24(x - 1)$$

$$y = 24x - 23$$

## 8-savol

VIII. Integrallash qoidalari. Aniq integral.

$$\textcircled{1} \quad S = \int_{-2}^2 (6-x^2), dx = \frac{56}{3}$$

$$\textcircled{2} \quad S = \int_{\sqrt{7}}^{\sqrt{7}} (7-x^2), dx = \cancel{28\sqrt{7}}$$

$$S = 2 \int_0^{\sqrt{7}} (7-x^2) dx = 2 \left[ 7x - \frac{x^3}{3} \right]_0^{\sqrt{7}} = 2 \left( 7\sqrt{7} - \frac{7\sqrt{7}}{3} \right) = \frac{28\sqrt{7}}{3}$$

$$J: \frac{28\sqrt{7}}{3}$$

$$\textcircled{3} \quad y = 8 - x^2$$

$$S = 2 \int_0^2 (8-x^2) dx = 2 \left[ 8x - \frac{x^3}{3} \right]_0^2 = 2 \left( 16 - \frac{8}{3} \right) = \frac{80}{3}$$

$$\textcircled{4} \quad y = x+x^2$$

$$S = \int_0^2 (x+x^2) dx, dx = \left[ \frac{x^2}{2} + \frac{x^3}{3} \right]_0^2 = \frac{4}{2} + \frac{8}{3} = \frac{14}{3}$$

$$\textcircled{5} \quad y = x^2 - 2x \quad S = \int_3^5 (x^2 - 2x) dx, dx = \left[ \frac{x^3}{3} - x^2 \right]_3^5 =$$

$$= \left( \frac{125}{3} - 25 \right) - \left( \frac{27}{3} - 9 \right) = \frac{50}{3}$$

$$\textcircled{6} \quad y = x^2 - x \quad S = \int_2^5 (x^2 - x) dx, dx = \left[ \frac{x^3}{3} - \frac{x^2}{2} \right]_2^5 = \frac{125}{3} - \frac{25}{2} - \left( \frac{8}{3} - 4 \right) =$$

$$= \frac{57}{2}$$

$$\textcircled{7} \quad y = 1+x^3 \quad S = \int_{-1}^1 (1+x^3) dx, dx = \left[ x + \frac{x^4}{4} \right]_{-1}^1 = (1 + \frac{1}{4}) - (-1 + \frac{1}{4}) = 2$$

$$\textcircled{8} \quad y = 1-x^3 \quad S = \int_{-1}^1 (1-x^3) dx, dx = \left[ x - \frac{x^4}{4} \right]_{-1}^1 = (1 - \frac{1}{4}) - (-1 - \frac{1}{4}) = 4$$

$$\textcircled{9} \quad y = 2-x^3 \quad S = \int_{-1}^1 (2-x^3) dx, dx = \left[ 2x - \frac{x^4}{4} \right]_{-1}^1 = (2 - \frac{1}{4}) - (-2 + \frac{1}{4}) = 4$$

$$\textcircled{10} \quad y = 2+x^3$$

$$S = \int_{-1}^1 (2+x^3) dx, dx = \left[ 2x + \frac{x^4}{4} \right]_{-1}^1 = (2 + \frac{1}{4}) - (-2 + \frac{1}{4}) = 4$$

⑥ Jami 10 ta son  
Birinchi uchinishda ochish chetimoli:  $\frac{1}{10}$

$$\text{Endi } \frac{1}{10} + \left( \frac{9}{10} \cdot \frac{1}{10} \right) = \frac{1}{10} + \frac{9}{100} = \frac{19}{100}$$

⑦ Jami uartochular  $12+9+4+5+8+10=48$  ta

"Yolbarslar" chetimoli:  $\frac{10}{48} = \frac{5}{24}$

"Pandalar" chetimoli:  $\frac{4}{48} = \frac{2}{24} = \frac{1}{12}$

"tezkor" yoki "quvnoq" chetimoli:  $\frac{1}{2}$

"tezkor yolbars":  $\frac{10}{48} \cdot \frac{1}{2} = \frac{10}{96} = \frac{5}{48}$

"Quvnoq pandalar":  $\frac{4}{48} \cdot \frac{1}{2} = \frac{1}{24}$

ishkalasi birligalikso:  $\frac{5}{48} + \frac{1}{24} = \frac{7}{48}$

⑧ Sharchalar jami:  $9+10+4+3+8+12=46$  ta

oq sharchi tayloq chetimoli:  $\frac{12}{46} = \frac{6}{23}$

bicerler jozuri chetimoli:  $\frac{1}{4}$

"bicerler" va oq nomi birligalikso:  $\frac{1}{4} \cdot \frac{12}{46} = \frac{3}{46}$

havarang shar chetimoli:  $\frac{9}{46}$

Burgutlar:  $\frac{1}{4}$  Burgutlar va havarang:  $\frac{1}{4} \cdot \frac{9}{46} = \frac{9}{184}$

IX

### Geombinatorika va ehtimoliq

- ① Jutt raqamlar: 2, 4, 6, 8 (4 ta)  
 tog raqamlar: 1, 3, 5, 7, 9 (5 ta) va nol  
 Jani:  $\frac{5 \cdot 4 \cdot 3}{20} = \frac{60}{20} = 3$  Ehtimoli -  $\frac{1}{20}$

- ② 2 va 5 dan iborat. n - necha xonaligi  
 Ehtimoli -  $\frac{1}{2^n}$

- ③ Jani:  $3+2=5$  ta shart  
 qizil bolish ehtimoli:  $\frac{3}{5}$ , 1 ta shart olibdi  
 va 4 ta goldi.  
 undi sarig shart bolish ehtimoli:  $\frac{2}{5} = \frac{1}{2}$   
 turli rangda bolish ehtimoli:  $\frac{1}{2} \cdot \frac{3}{5} = \frac{3}{10} = \frac{3}{5}$

- ④ Jani:  $2+2+1 = 5$  ta  
 juhiton shartni olish:  $C_5^2 = \frac{5!}{2!(5-2)!} = \frac{5 \cdot 4}{1 \cdot 2} = 10$

- Bir xil rangda bolishi. inshaqa qizil  $C_2^2 = 1$   
 ehtimoli  $\frac{1}{10}$   
 Sariglar ham huddisi shu:  $\frac{1}{10}$

$$\text{liknallik} \quad C_2^1 = 0$$

$$\text{Bir xil rang}: \frac{1}{10} + \frac{1}{10} + 0 = \frac{1}{5}$$

$$1 - \frac{1}{5} = \frac{4}{5}$$

- ⑤ Tog raqamlar: 1, 3, 5, 7, 9 (5 ta)

Uchta xar xil tog raqanni tanlash:

$$C_3^3 = \frac{5!}{3!(5-3)!} = \frac{5 \cdot 4}{1 \cdot 2} = 10$$

$$\text{ehtimoli}: \frac{1}{10}.$$

**9-savol**

⑨ va ⑩ bir xil

Qizlar qutisida jani  $9 \times 10 + 4 \times 8 + 8 + 12 = 51 + 9$

Bariq shax ehtimoli:  $\frac{8}{51}$

Qızıl bula "Yölg'arslar" taylashi:  $\frac{1}{4}$

Qız bula qora sharni taylashi:  $\frac{10}{51}$

Qızıl bula lochinar yozalishi taylashi:  $\frac{1}{9}$

"Qora lochinar" hajil hibisti:

$$\frac{1}{4} \cdot \frac{10}{51} = \frac{5}{102}$$

10-savol

X.

Statistik tahlil

- ① 8 fa 6qituvchi - 8 mln dan  
kotiba - 6 mln  
Direktor - 15 mln

$$\text{y: Ort} = (8 \cdot 8 + 1 \cdot 6 + 1 \cdot 15) : (8+1+1) = \\ = 85 : 10 = 8,5$$

Mediana: 6, 8, 8, 8, 8, 8, 8, 8, 15

$$(8+8) : 2 = 8$$

$$\text{Farq} = 8,5 - 8 = 0,5 \quad \text{j: } 0,5 \text{ mln som}$$

- ② 190, 203, 200, 197, 205  $\Rightarrow$  median = 200

$$S = 190 + 203 + 200 + 197 + 205 = 995$$

$$\text{Ort} = 995 : 5 = 199$$

$$\text{Ort}_{(2)} = 199 + 1 = 200$$

$$S_{(2)} = 200 \cdot 5 = 1000$$

$$1000 - (995 - 200) = 205$$

j: 205

$$\textcircled{3} \quad \bar{x} = \frac{190 + 199 + 200 + 201 + 205}{5} = \frac{995}{5} = 199$$

Median - 200

$$S_y = 995 - 199 + x$$

$$\bar{x}_{(2)} = (996 + x) : 5 > 199$$

$$x = 203$$

$$203 - 199 = 4$$

$$\textcircled{4} \quad \bar{x} = (50 + 70 + 80 + 90 + 100) : 5 = 78$$

Altinchı baho =  $\bar{x}$  = 78

$$50, 70, 78, 80, 90, 100$$

$$2\text{-Median} = (78 + 80) : 2 = 79$$

$$1\text{-Median} = 80$$

$79 - 80 = -1$   
Javob: 1 bolga yanaygan.

$$\textcircled{5} \quad \bar{x}_{(1)} = (50 + 70 + 80 + 90 + 100) : 5 = 78$$

$$\bar{x}_{(2)} = 78 + 2 = 80$$

$$S = 80 \cdot 6 = 480 \quad 6\text{-baho} = 480 - 390 = 90$$

$$50, 70, 80, 90, 90, 100 \quad \text{Median} = (80 + 90) : 2 = 85$$

Analogi median: 80

$$85 - 80 = 5$$

Javob: 5 bolga osydr

⑥

55, 70, 80, 80, 85, 90, 100

Median = 80

$$2\text{-Median} = 80 + 3 = 83$$

4-sarı - 83

$$\begin{aligned} S_2 &= 70 + 80 + 80 + 83 + 85 + 90 + 100 = 588 \\ \text{Ort} &= 588 : 7 = 84 \end{aligned}$$

$$S_1 = 55 + 70 + 80 + 80 + 85 + 90 + 100 = 560$$

⑦ 50, 65, 75, 75, 80, 85, 95

Median: 75

Yangi median:  $75 + 3 = 78$

$$\begin{aligned} S_1 &= 50 + 65 + 75 + 75 + 78 + 80 + 85 + 95 = 525 \\ \text{Ort} &= 525 : 7 = 75 \end{aligned}$$

$$S_2 = 65 + 75 + 75 + 78 + 80 + 85 + 95 = 553$$

$$\text{Ort} = 553 : 7 = 79$$

$$79 - 75 = 4$$

Javob: Ortacha 4 ball oshdi

⑧

5, 9, 9, 9, 9, 9, 9, 9, 9, 20

Median:  $(9+9)/2 = 9$

$$\text{Ort} = (8 \cdot 9 + 5 \cdot 1 + 20 \cdot 1) : (8+1+1) = 9,7$$

$$9,7 - 9 = 0,7$$

Javob: 0,7 min son

⑨

197, 197, 199, 199, 203, 205

$$\text{Median} : (199+199) : 2 = 199$$

$$S_1 = 197 + 197 + 199 + 199 + 203 + 205 = 1200$$

$$\bar{x}_1 = 1200 : 6 = 200$$

$$\bar{x}_2 = 200 + 1 = 201$$

$$S_2 = 201 \cdot 6 = 1206$$

$$1206 - 1200 = 6 \quad 199 + 6 = 205$$

Javob: 205 3m

⑩

197, 197, 199, 199, 203, 205

$$\text{Median} = (199+199) : 2 = 199$$

197, 197, 199, 203, 205, 205

$$\text{Median} = (199+203) : 2 = 201$$

$$201 - 199 = 2$$

Javob: Median 2 singa oldi.

11-savol

•  1.

Prizmalar

$$\textcircled{1} \quad a=2 \text{ sm} \quad d=\sqrt{17} \text{ sm}$$

$$d = \sqrt{a^2 + b^2} = \sqrt{2^2 + b^2} = \sqrt{17} \quad b = \sqrt{13}$$

$$S_{\text{asos}} = a \cdot b = 2 \cdot \sqrt{13}$$

•  2.

$$d_1 = 6 \text{ sm} \quad h = 10 \text{ sm}$$

$$AB = 5 \text{ sm}$$

$$AO = 3 \text{ sm}$$

$$BO = x/2$$

$$AB^2 = AO^2 + BO^2$$

$$5^2 = 3^2 + BO^2$$

$$BO = 4 \Rightarrow x = 8$$

$$S_{\text{romb}} = (d_1 \cdot d_2) : 2 = (6 \cdot 8) : 2 = 24 \text{ sm}^2$$

$$V = 24 \cdot 10 = 240 \text{ sm}^3$$

$$\textcircled{3} \quad a = 6 \text{ sm}$$

$$S_{\Delta} = (a^2 \cdot \sqrt{3}) : 4 = (6^2 \cdot \sqrt{3}) : 4 = 9\sqrt{3} \text{ sm}^2$$

$$S_{\text{yon sirti}} = \text{Perimetr} \cdot h = 3 \cdot 6 \cdot h = 90 \Rightarrow h = 5$$

$$V = S_{\text{asos}} \cdot h = 9\sqrt{3} \cdot 5 = 45\sqrt{3} \text{ sm}^3$$

$$\textcircled{4} \quad S_{\square} = 16 \text{ sm}^2$$

$$S_{\square} = a^2 = 16 \Rightarrow a = 4 = AB$$

$$h = 3$$

$$S = 4 \cdot 3 = 12$$

⑤  $c^2 = 5^2 + 12^2 \Rightarrow c = 13$

$$S_{\text{ASOS}} = (5 \cdot 12) : 2 = 30 \text{ sm}^2$$

$$\text{Perimet}r = 5 + 12 + 13 = 30$$

$$S_{\text{yon serti}} = P \cdot h = 30 \cdot 5 = 150 \text{ sm}^2$$

$$S = 2 S_{\text{ASOS}} + S_{\text{yon serti}} = 2 \cdot 30 + 150 = 210 \text{ sm}^2$$

⑥  $a = 4 \quad d = 7$

$$d = \sqrt{4^2 + h^2} = 7 \Rightarrow h = \sqrt{33}$$

$$S_{\text{ASOS}} = 4 \cdot 4 = 16 \text{ sm}^2$$

$$V = S_{\text{ASOS}} \cdot h = 16 \cdot \sqrt{33} = 16\sqrt{33}$$

⑦  $a_{\text{romb}} = 17 \quad d_{\text{romb}} = 16 \text{ sm}$

$$h^2 + \left(\frac{d}{2}\right)^2 = 17^2 \Rightarrow h^2 + 8^2 = 17^2 \Rightarrow h = 15$$

$$S_{\text{romb}} = a \cdot h / 2 \cdot 2 \Rightarrow 17 \cdot 15 = 225$$

$$V = S_{\text{ASOS}} \cdot h = 225 \cdot 20 = 5100 \text{ sm}^3$$

⑧  $a = 8 \text{ sm} \quad S_{\text{yon serti}} = 120 \text{ sm}^2 \quad V = ?$

$$\text{Perimet}r = 8 \cdot 3 = 24 \text{ sm}$$

$$S_{\text{yon serti}} = \text{Perimet}r \cdot h = 120 \\ 24 \cdot h = 120 \Rightarrow h = 5$$

$$V = S_{\text{ASOS}} \cdot h = \left(\frac{8^2 \cdot \sqrt{3}}{4}\right) \cdot 5 = 80\sqrt{3} \text{ sm}^3$$

$$\textcircled{9} \quad S_{\text{ASOS}} = 25 \text{ m}^2 = AB \\ A_1B_1 = \text{yon qirra} = \sqrt{11}$$

$$S_{\text{ASOS}} = a^2 = 25 \Rightarrow a = 5$$

$$S = 5 \cdot \sqrt{11} = 5\sqrt{11}$$

$$\textcircled{10} \quad S_{\text{ASOS}} = \frac{1}{2} \cdot 9 \cdot 12 = 54 \text{ m}^2$$

$$c^2 = 12^2 + 9^2 \quad c = 15$$

$$\text{Perimetr} = 9 + 12 + 15 = 36$$

$$S_{\text{yon sirt}} = \text{Perimetr} \cdot h = 36 \cdot 10 = 360 \text{ m}^2$$

$$S_{\text{töre sirti}} = 2 \cdot S_{\text{ASOS}} + S_{\text{yon sirt}} = 2 \cdot 54 + 360 = 468 \text{ m}^2$$

## 12-savol

**XII.** SILINDR, SHAR, SFERA

$$\textcircled{1} \quad V_1 = V_2 \quad \pi r_1^2 (15) = \pi (2r_1)^2 h_2$$

$$15r_1^2 = 4r_1^2 \cdot h_2$$

$$h_2 = \frac{15}{4} = 3,75$$

$$\textcircled{2} \quad S_{\text{eshi}} = 2\pi r_1 e_{\text{shishi}}$$

$$S_{\text{yangi}} = 2\pi r_1 e_{\text{yangi}} \quad | \text{ yangi} = 2\pi \cdot 1,5 r_1 e_{\text{shishi}} \cdot 2 e_{\text{shishi}} = 6\pi r_1 e_{\text{shishi}}$$

$$\frac{S_{\text{yangi}}}{S_{\text{eshi}}} = \frac{6\pi r_1 e_{\text{shishi}}}{2\pi r_1 e_{\text{shishi}}} = 3$$

Javob: 3 macto uqtaloshgan

$$\textcircled{3} \quad \pi r_1^2 h_1 = \pi r_2^2 \cdot h_2$$

$$r_1^2 \cdot 15 = (3r_1)^2 h_2$$

$$15 = 9h_2 \quad h_2 = \frac{15}{9} = \frac{5}{3} \approx 1,67 \text{ m}$$

$$\textcircled{4} \quad r_{\text{tot}} = \frac{20}{2} = 10 \quad S_{\text{tot}} = \pi r^2 = \pi \cdot 10^2 = 314 \quad S_{\text{yon}} = 2\pi r h = 2 \cdot 314 \cdot 10 \cdot 10 = 628$$

$$\text{Summe: } 314 + 628 = 942$$

$$\textcircled{5} \quad V_{\text{suv}} = \frac{1}{2} \cdot \frac{9}{3} \pi R^3 = \frac{2}{3} \pi \cdot 15^3 = \frac{2}{3} \pi (3375) = 2250 \pi \text{ m}^3$$

$$2250 \pi = \pi \cdot 15^2 \cdot h$$

$$2250 \pi = 225 \pi h$$

$$h = 10 \text{ m}$$

$$\textcircled{6} \quad r^2 + d^2 = R^2$$

$$r^2 + s^2 = 10^2$$

$$r = 5\sqrt{3}$$

$$S_{\text{keil}} = \pi r^2 = \pi \cdot (5\sqrt{3})^2 = 75\pi \text{ m}^2$$

$$\textcircled{7} \quad S_{\text{har}} = 4\pi R^2 = 4\pi \cdot 50^2 = 10000\pi \text{ m}^2$$

$$S_{\text{zylinder}} = 2\pi r^2 + 2\pi r h = 5000\pi + 100\pi h$$

$$10000\pi = 5000\pi + 100\pi h$$

$$5000\pi = 100\pi h$$

$$h = 50 \text{ m}$$

$$\textcircled{8} \quad S_{\text{har}} = 4\pi R^2 = 4 \cdot \pi \cdot 50^2 = 5000\pi \text{ m}^2$$

$$S_{\text{asos}} = \pi R^2 = \pi \cdot 50^2 = 2500\pi \text{ m}^2$$

$$S_{\text{Total}} = 5000\pi + 2500\pi = 7500\pi \text{ m}^2$$

$$S_{\text{zylinder}} = 2\pi r^2 + 2\pi r h = 5000\pi + 100\pi h$$

$$h = \frac{2500\pi}{100\pi} = 25$$

$$\textcircled{9} \quad S_{\text{har}} = 4\pi R^2 = 10000\pi \quad S_{\text{zylinder}} = 5000\pi + 100\pi h$$

$$5000\pi = 100\pi h$$

$$h = 50$$

$$\textcircled{10} \quad V_{\text{zylinder}} = \pi r^2 h = \frac{\pi d^2 h}{4} = \frac{\pi d^3}{4} \quad d = \frac{120}{\pi}$$

$$V_{\text{har}} = \frac{1}{3} \cdot \pi r^3 = \frac{\pi d^3}{6}$$

$$V_{\text{har}} = \frac{\pi}{6} \cdot \frac{120^3}{\pi} = \frac{120^3}{6} = 20 \text{ m}^3$$

13-savol

XIII PIRAMIDALAR

$$\textcircled{1} \quad S_{\text{asos}} = 6 \cdot 8 = 48 \text{ sm}^2$$

$$d = \sqrt{6^2 + 8^2} = \sqrt{100} = 10$$

Margardan ixtiyoriy burchakka masofa -  
 $d/2 \Rightarrow OM = \frac{10}{2} = 5$

$$SM^2 = h^2 + OM^2$$

$$(\sqrt{61})^2 = h^2 + 5^2 = 61 \quad h = 6 \text{ sm}$$

$$V = \frac{1}{3} \cdot S_{\text{asos}} \cdot h = \frac{1}{3} \cdot 48 \cdot 6 = \frac{288}{3} = 96 \text{ sm}^3$$

$$\textcircled{2} \quad S_{\text{asos}} = 4 \cdot 4 = 16 \text{ sm}^2$$

$$\operatorname{tg}(60^\circ) = \frac{h}{2} \Rightarrow \sqrt{3} = \frac{h}{2} \quad h = 2\sqrt{3}$$

$$S_{\text{yon}} = \frac{1}{2} a \cos \cdot h = \frac{1}{2} \cdot 4 \cdot 2\sqrt{3} = 4\sqrt{3}$$

$$S_{\text{yon-tela}} = 4 \cdot 4\sqrt{3} = 16\sqrt{3}$$

$$S_{\text{tela}} = S_{\text{asos}} + S_{\text{yon-tela}} = 16 + 16\sqrt{3} \approx 43,7 \text{ sm}^2$$

$$\textcircled{3} \quad S_{\Delta} = \frac{\sqrt{3}}{4} \cdot a^2 = \frac{\sqrt{3}}{4} \cdot 4^2 = \frac{\sqrt{3}}{4} \cdot 16 = 4\sqrt{3}$$

$$S_{\text{asos}} = 6 \cdot 4\sqrt{3} = 24\sqrt{3} \text{ sm}^2$$

$$h^2 + 2^2 = (2\sqrt{3})^2 \Rightarrow h = h = 4$$

$$S_{\text{yon}} = \frac{1}{2} \cdot 4 \cdot 4 = 8 \quad S_{\text{yon-tela}} = 6 \cdot 8 = 48 \text{ sm}^2$$

$$S_{\text{tela}} = S_{\text{asos}} + S_{\text{yon}} = 24\sqrt{3} + 48 \approx 89,568 \text{ sm}^2$$

$$④ S_{ASOS} = \frac{\sqrt{3}}{4} \cdot a^2 = \frac{\sqrt{3}}{4} \cdot 6^2 = \frac{\sqrt{3}}{4} \cdot 36 = 9\sqrt{3}$$

$$\text{tg } 45^\circ = \frac{h}{3} \Rightarrow h = \frac{h}{3} \cdot 3 = 3$$

$$V = \frac{1}{3} \cdot S_{ASOS} \cdot h = \frac{1}{3} \cdot 9\sqrt{3} \cdot 3 = 9\sqrt{3}$$

$$⑤ S_{ASOS} = \frac{d_1 \cdot d_2}{2} = \frac{4 \cdot 6}{2} = 12$$

$$\frac{d_1}{2} = \frac{4}{2} = 2 \quad \frac{d_2}{2} = \frac{6}{2} = 3$$

$$OM = \sqrt{2^2 + 3^2} = \sqrt{13}$$

$$5^2 = h^2 + 13 \Rightarrow h = \sqrt{5^2 - 13} = 2\sqrt{3}$$

$$V = \frac{1}{3} \cdot S_{ASOS} \cdot h = \frac{1}{3} \cdot 12 \cdot 2\sqrt{3} = 8\sqrt{3}$$

$$⑥ S_{ASOS} = 10 \cdot 24 = 240 \quad D = \sqrt{10^2 + 24^2} = 26$$

$$OM = \frac{26}{2} = 13$$

Yon qirra:  $\sqrt{269}$

$$(\sqrt{269})^2 = h^2 + 13^2 \Rightarrow h = 10$$

$$V = \frac{1}{3} \cdot 240 \cdot 10 = 800 \text{ m}^3$$

$$⑦ a^2 = 100 \quad a = 10 \text{ m}$$

$$\text{tg } 60^\circ = \frac{h}{5} \quad h = 5\sqrt{3}$$

$$S_{yon} = \frac{1}{2} \cdot 10 \cdot 5\sqrt{3} = 25\sqrt{3}$$

$$S_{t\ddot{o}la-yon} = 4 \cdot 25\sqrt{3} = 100\sqrt{3}$$

$$S_{t\ddot{o}la} = 100 + 100\sqrt{3} \approx 273 \text{ m}^2$$

$$⑧ S = \frac{1}{2} \cdot 10 \cdot 12 = 60$$

$$OM = \sqrt{\left(\frac{5}{2}\right)^2 + (6)^2} = \sqrt{61}$$

$$13^2 = h^2 + 61 \Rightarrow h = 6\sqrt{3}$$

$$V = \frac{1}{3} \cdot 60 \cdot 6\sqrt{3} = 120\sqrt{3}$$

$$⑧ S = \frac{\sqrt{3}}{4} \cdot (4\sqrt{3})^2 = \frac{\sqrt{3}}{4} \cdot 48 = 12\sqrt{3}$$

$$S_{ASOS} = 6 \cdot 12\sqrt{3} = 72\sqrt{3}$$

$$(\sqrt{13})^2 = h^2 + (2\sqrt{3})^2 \Rightarrow h = \sqrt{13}$$

$$S_{yon} = \frac{1}{2} \cdot 4\sqrt{3} \cdot \sqrt{3} = 6$$

$$S_{t\ddot{o}la} = 72\sqrt{3} + 36 \approx 160.7 \text{ m}^2$$

$$⑨ S_{ASOS} = \frac{\sqrt{3}}{4} \cdot 12^2 = \frac{\sqrt{3}}{4} \cdot 144 = 36\sqrt{3}$$

$$\text{tg } 45^\circ = \frac{h}{6} \Rightarrow h = 6$$

$$V = \frac{1}{3} \cdot 36\sqrt{3} \cdot 6 = 72\sqrt{3}$$

14-savol

XIV.

Konuslar

$$\textcircled{1} \quad L = 2\pi R \quad R - \text{yasovchi} \\ r - \text{asos radiusi}$$

yay uzuunligi = konus asossi perimetri  $= L = 2\pi r$

$$\frac{90^\circ}{360^\circ} = \frac{1}{4} \quad \frac{1}{4} \cdot 2\pi R = 2\pi r \quad /2\pi$$

$$\frac{1}{4} R = r$$

$$\frac{R}{r} = 4$$

Javob: Yassovichning radiusiga nisbati - 4

$$\textcircled{2} \quad y: \sqrt{6^2 - 3^2} = \sqrt{36 - 9} = \sqrt{27} \approx 5,2$$

$$S_{\text{tolasir}} = \pi r^2 + \pi r l = \pi \cdot 3^2 + \pi \cdot 3 \cdot 6 = 27\pi \approx 84,82 \text{ sm}^2$$

$$\textcircled{3} \quad y: \frac{1}{2} rh = 12 \quad rh = 24$$

$$V = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi r \cdot 24 = 8\pi r$$

$$V \approx 123,12 \text{ sm}^3$$

$$\textcircled{4} \quad h = \sqrt{(2 \cdot \sqrt{10})^2 - 2^2} = \sqrt{40 - 4} = 6 \text{ sm}$$

$$V = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \cdot 4 \cdot 6 = 8\pi \approx 25,13 \text{ sm}^3$$

$$\textcircled{5} \quad \frac{1}{2} rh = 36 \quad rh = 72 \quad r = 3$$

$$V = \frac{1}{3} \pi r^2 h = \frac{1}{3} \cdot 72 \pi r = 24\pi r$$

$$V = 24\pi \cdot 3 = 72\pi \approx 226,08 \text{ sm}^3$$

$$⑥ \frac{\varrho}{r} = \frac{360^\circ}{\alpha} = \frac{360^\circ}{120^\circ} = 3$$

$$⑦ h = \sqrt{r^2 - G^2} = \sqrt{108} \approx 10,39$$

$$r = 6 \quad l = 12$$

$$S = \pi r^2 + \pi r l = \pi(36 + 72) = 108\pi \approx 339,12 \text{ m}^2$$

$$⑧ \frac{1}{2}rh = 60 \quad rh = 120 \quad r = 3 \text{ desah},$$

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi r \cdot 120 = 40\pi r$$

$$V = 40\pi \cdot 3 = 120\pi \approx 376,8 \text{ m}^3$$

$$⑨ h = \sqrt{(r^2)^2 - 3^2} = \sqrt{36 - 9} = 5$$

$$r = 3 \text{ desah},$$

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \cdot 9 \cdot 5 = 15\pi \approx 47,1 \text{ m}^3$$

$$⑩ \frac{1}{2}rh = 81 \quad rh = 162$$

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi r \cdot 162 = 54\pi r$$

$$r = 3 \text{ desah}$$

$$V = 54\pi \cdot 3 = 162\pi \approx 508,68 \text{ m}^3$$

### 15-savol

#### XV Vektorlar

$$\textcircled{1} \quad AB = a \quad AP = b \quad AA_1 = c \quad O = (A_1 + C_1) : 2$$

$$CO = O - C$$

$$C = A + a + b$$

$$O = A + \frac{a}{2} + \frac{b}{2} + c$$

$$CO = O - C = (A + \frac{a}{2} + \frac{b}{2} + c) - (A + a + b) = -\frac{a}{2} - \frac{b}{2} + c$$

$$\text{Javob: } CO = -\frac{1}{2}a - \frac{1}{2}b + c$$

② BC utesma ortası:

$$\begin{aligned}k &= ((-3+11):2, (-4+2):2, ((4+(-6))):2 = \\&= (8:2, -4:2, -2:2) = (4, -2, -1)\end{aligned}$$

Ak vektor koordinatları = k - A

$$AK = (4 - (-1), -2 - 2, -1 - 0) = (5, -4, -1)$$

Javob:  $AK = (5, -4, -1)$

③  $A \rightarrow C = a+b$

k uygası - AA1 qırınlığı ortası:

$$k = A + \frac{C}{2}$$

$$k_C = C - k = (A + a + b) - (A + \frac{C}{2}) = a + b - \frac{C}{2}$$

Javob:  $k_C = a + b - \frac{C}{2}$

④  $O = (A+C):2$

$$O = ((1+5):2, (-3+7):2, (2+(-6))):2 =$$

$$= ((6:2, +4:2, -4:2) = (3, 2, -2)$$

$$OB = B - O = (-5, -3, -1, 0 - (-2)) = (-8, -1, 2)$$

Javob:  $OB = (-8, -1, 2)$

⑤  $AB + AD = AC \quad AD = AC - AB$

$$1) AB = B - A = (-5 - 5, 3 - (-1), 2 - 0) = (-10, 4, 2)$$

$$2) AC = C - A = (2 - 5, 2 - (-1), -2 - 0) = (-3, 3, -2)$$

$$3) AD = AC - AB = (-3 - (-10), 3 - 4, -2 - 2) = (7, -1, -4)$$

$$4) D = A + AD = (5 + 7, -1 + (-1), 0 + (-4)) = (12, -2, -4)$$

HONOR X6s Javob:  $D = (12, -2, -4)$

$$⑥ A \rightarrow P = \frac{a}{2} + \frac{c}{2}$$

$$A \rightarrow c_1 = a+b+c$$

$$PC_1 = C_1 - P = (A+a+b+c) - A + \frac{a}{2} + \frac{c}{2} = \frac{a}{2} + b + \frac{c}{2}$$

$$\text{Jawab: } PC_1 = \frac{a}{2} + b + \frac{c}{2}$$

$$⑦ A(5, 6, 7), B(-1, -2, 0) \quad C(3, 0, -4)$$

N = AB kesuatuannya adalah CN = ?

$$N = ((5+(-1)):2, (6+(-2)):2, (7+0):2) = (2, 2, 1)$$

$$CN = N - C = (2-3, 2-0, 1-(-4)) = (-1, 2, 5)$$

$$\text{Jawab: } CN = (-1, 2, 5)$$

⑧

$$F = A+C + \frac{a}{2} \quad D = b + A$$

$$FD = D - F = (A+b) - (A+C + \frac{a}{2}) = -\frac{a}{2} - C + b$$

$$\text{Jawab: } FD = -\frac{a}{2} + b - c$$

⑨

$$AC - Q = (A+C) : 2 = ((5+(-1)):2, (-1+3):2, (-2+(-4)):2) = 2, 1, -3$$

$$BQ = 2 - B = (2 - (-1), 1 - 1, -3 - 0) = (3, 0, -3)$$

$$\text{Jawab: } BQ = (3, 0, -3)$$

⑩

$$B + D = (-2 + (-3), 3 + 5, 2 + 0) = (-5, 8, 2)$$

$$C = D + B - A = (-5, 8, 2) - (5, 3, 2) = (-5 - 5, 8 - 3, 2 - 2) = (-5, 3, 0)$$

$$\text{Jawab: } C = (-5, 3, 0)$$

## 16-savol

### XVI Geometrik jismlar kombinatsiyasi

$$\textcircled{1} \text{ devorlar } 2 \cdot 2,4 \cdot 2 = 9,6 \text{ m}^2$$

$$\text{old va orqa tomonlar } 2 \cdot (2,4 \cdot 2 + \frac{1}{2} \cdot 2,4 + 0,5) = 10,8$$

$$\text{Tomlar: } 2(4 \cdot 0,5) = 4 \text{ m}^2$$

$$\text{Uzun devorlar } 2 \cdot (4 \cdot 2) = 16 \text{ m}^2$$

$$9,6 + 10,8 + 16 + 4 = 40,4 \text{ m}^2$$

$$\textcircled{2} \text{ Yon devorlar: } 2 \cdot 2 \cdot 2 = 8 \text{ m}^2$$

$$\text{old va orqa tomonlar: } 2 \cdot (2 \cdot 2 + \frac{1}{2} \cdot \pi \cdot 0,5^2) \approx 8,78 \text{ m}^2$$

$$\text{Uzun devorlar } 2 \cdot 4 \cdot 2 = 16 \text{ m}^2$$

$$\text{Yarim silindr form: } \pi \cdot 0,5 \cdot 4 \approx 6,283 \text{ m}^2$$

$$8 + 8,78 + 16 + 6,283 = 39,07 \text{ m}^2$$

$$\textcircled{3} \quad V_{\text{silindr}} = \pi \cdot 2^2 \cdot 10 = 40\pi \approx 125,66 \text{ mm}^3$$

$$V_{\text{sfera}} = \left(\frac{4}{3}\right)\pi \cdot 2^3 = \frac{32}{3}\pi \approx 33,51 \text{ mm}^3$$

$$125,66 + 33,51 = 159,17 \text{ mm}^3$$

$$\textcircled{4} \quad r = \frac{6 \text{ mm}}{2} = 3 \text{ m}$$

$$h = 20 \text{ mm} - 2 \cdot 3 = 14 \text{ mm} \quad V_{\text{silindr}} = \pi r^2 h = \pi \cdot 3^2 \cdot 14 = 126 \pi \text{ mm}^3$$

$$\frac{14}{3} \quad r_{\text{sfera}} = 3 \quad V_{\text{sfera}} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \cdot 3^3 = 36\pi \text{ mm}^3$$

$$V_{\text{ukapsula}} = 126\pi \text{ mm}^3 + 36\pi \text{ mm}^3 = 162\pi \text{ mm}^3$$

$$\textcircled{5} \text{ cub yon sirti } (10 \text{ sm})^2 = 100 \text{ sm}^2 \\ \text{yon sirti } 4 \cdot 100 = 400 \text{ sm}^2$$

$$h^2 + s^2 = 10^2 \Rightarrow h = \sqrt{75} = 5\sqrt{3}$$

$$S_{\text{yongog}} = \frac{1}{2} \cdot 10 \cdot 5\sqrt{3} = 25\sqrt{3}$$

$$S_{\text{piramida}} = 4 \cdot 25\sqrt{3} = 100\sqrt{3} \approx 173,2 \text{ sm}^2$$

$$\text{Fonarsha taban sirti} - 400 + 100\sqrt{3} \approx 573,2 \text{ sm}^2$$

$$\textcircled{6} \text{ Syon devorlar} = 2,8 \cdot 5 = 14 \text{ iklalasi } 2 \cdot 14 = 28$$

$$S_{\text{orga old devorlar}} = 2 \cdot 3 = 6 \text{ iklalasi } 6 \cdot 2 = 12$$

$$S_{\text{oyunlar}} = 4 \cdot 1 \cdot 5 = 20 \text{ m}^2$$

$$S_{\text{oyunali sirt}} = 28 + 12 = 40 \text{ m}^2$$

$$\textcircled{7} \text{ h yon devorlar } 2,5 - 1 = 1,5 \\ S_{\text{yon devorlar}} = 3 \cdot 1,5 = 4,5 \text{ m}^2 \text{ iklalasi } - 9 \\ \text{old ra orga devorlar yuzesi } 2 \cdot 1,5 = 3 \text{ m}^2 \\ \text{iklalasi } 2 \cdot 3 = 6 \text{ m}^2$$

$$r_{\text{silindr}} = \frac{3}{2} = 1.5 = 3 \quad S_{\text{silindr yon sirti}} = 2\pi r = 2 \cdot 1.5 = 6\pi$$

$$Syarin silindr = \frac{1}{2} \cdot 6\pi = 9,42 \text{ m}^2$$

Issiqxona sirtining unumiy yuzi:

$$9 + 6 + 3\pi = 24,42 \text{ m}^2$$

$$\textcircled{8} \text{ Oltedek qirrossi: } \frac{5\sqrt{2}}{2} \Rightarrow \frac{5\sqrt{2}}{2} = 3\sqrt{2}$$

$$V_{\text{ub}} = S^3 = 6^3 = 216 \text{ dm}^3$$

$$⑨ \text{S yon yoq} - (20\text{sm})^2 = 400\text{sm}^2$$

$$\text{ununig } 4 \cdot 400 = 1600 \text{ sm}^2$$

$$h^2 + 10^2 = 20^2 \Rightarrow h = 10\sqrt{3}$$

$$\text{yon yoq yarzi} - \frac{1}{2} \cdot 20 \cdot 10\sqrt{3} = 100\sqrt{3}$$

$$\text{ununig} - 4 \cdot 100\sqrt{3} = 400\sqrt{3} \approx 692,8 \text{ sm}^2$$

$$\text{Fonarcha fela sirti} = 1600 + 692,8 = 2292,8 \text{ sm}^2$$

$$⑩ S \cdot \frac{\sqrt{2}}{2} = 4 \quad S\sqrt{2} = 8 \quad S = 4\sqrt{2}$$

$$V = S^3 = (4\sqrt{2})^3 = 128\sqrt{2} \text{ dm}^3$$

**Barcha Imtihon javoblarini bizning botimiz orqali bepul yuklab oling:**

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### Ma'lumot

💎 Imtihon javoblarini olish uchun botga start bosing !

🔗 Asosiy kanalimiz: [@Talabalar](https://t.me/Talabalar)  
 ➡ Murojaat uchun: [@Imtihon\\_admin](https://t.me/Imtihon_admin)

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 Foydalanuvchi nomi

