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ihtisoslik fanidan laboratoriya ishlari to'plami

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Annotatsiya: Mazkur to'plam trigonometriya qonuniyatlari, qoidalari va munosabatlarning talabalar ongida shakllanish va rivojlanishini ta'minlaydi va bo'lagak kasbiy faoliyatga tayyorlaydi.

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SÖZ BOSHI

Böljak maktab matematika o'qituvchilarining maktab matematikasini atroflicha va chuqurroq o'rganish maqsadida ixtisoslik fani trigonometriyaga bag'ishlangan bo'lib, bir tomondan maktab matematikasining asosiy masalalarini chuqurroq o'rgansa, ikkinchi tomondan talabalarni turli qiyinlikdagi testlarni yechish malaka va ko'nikmalarini shakllantiradi va rivojlantiradi.

Böljak matematika o'qituvchilarini tayyorlashning muhim jihatlaridan biri bu ularni trigonometriyadan testlarni yechishga o'rgatishdir. Buning uchun talaba qo'yilgan misolni

- a) turlarga ajrata bilish;
- b) yechish usulini tanlay bilish;
- c) zaruriy qo'shimcha yasashlarni bajarish;
- d) test yechimlarini tahlil qila bilishlari zarur.

Bu to'plam 16 ta laboratoriya ishidan iborat. Har bor laboratoriya ishining maqsadi trigonometriyaning asosiy tushunchalariga oid testlarni yechish va tahlil qilishdan iborat.

Har bir ish 10 testdan iborat bo'lib, unga 5 ball ajratiladi. Har bir savol quyidagicha baholanadi:

1. Test yechish va tahlil qilishda matematik xatolar yo'q, u asoslanib berilgan; mantiqiy fikrlashda kamchiliklar va xatolar yo'q. (0,5 ball)
2. Yechim qadamlarini asoslash yetarli emas; amallarda, chizma, formula yoki grafiklarda bitta xato, yoki ikkita-uchta kamchilikka yo'l qo'yilgan, ammo javob to'g'ri topilgan. (0,4 ball)
3. Talaba belgillangan ko'nikmalarni tuliq egalamaganligini ko'rsatuvchi ikkita-uchta xatoga yo'l quygan, ammo javob to'g'ri topilgan. (3 ball)
4. Talaba belgillangan ko'nikmalarni to'la egalamaganligini ko'rsatuvchi muhim xatolarga yo'l quygan; , to'g'ri javob topilmagan, talabaning savol bo'yicha majburiy bilim va ko'nikmalarning umuman yo'qligini ko'rsatgan, yoki ishning katta qismi mustaqil bajarilmagan. (0 – 2 ball)

1-laboratoriya ishi. Trigonometriyaning boshlang'ich tushunchalari.

1. α radiandan gradusga o'tish: $\frac{180^\circ}{\pi} \cdot \alpha$ 2. n° gradusdan radianga o'tish: $\frac{\pi}{180} \cdot n$

3. $\sin(-x) = -\sin x$, $\cos(-x) = \cos x$; $\operatorname{tg}(-x) = -\operatorname{tg} x$, $\operatorname{ctg}(-x) = -\operatorname{ctg} x$;

α	0°	30°	45°	60°	90°	180°	270°
$\sin \alpha$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	0	-1
$\cos \alpha$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1	0
$\operatorname{tg} \alpha$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	-	0	-
$\operatorname{ctg} \alpha$	-	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	-	0

4. Trigonometrik funktsiyalarning ishoralari.

Funktsiya	I-chorak	II-chorak	III-chorak	IV-chorak
$\sin \alpha$	+	+	-	-
$\cos \alpha$	+	-	-	+
$\operatorname{tg} \alpha$	+	-	+	-
$\operatorname{ctg} \alpha$	+	-	+	-

Misol: (00-2-32) Quyidagilardan qaysi biri musbat?

A) $\cos 3$ B) $\sin 4$ C) $\sin 2$ D) $\operatorname{tg} 2$ E) $\cos 9$

Yechish: $\frac{\pi}{2} < 2 < \pi$ bo'lgani uchun 2 soni II chorakda yotadi. Shuning uchun $\sin 2$ musbat bo'ladi.

j: $\sin 2$ (C)

1.(96-6-31) 240° ning radian o'lchovini toping.

A) $5\pi/4$ B) $2\pi/3$ C) $4\pi/3$ D) $6\pi/3$ E) $3\pi/4$

2.(97-2-31) $5\pi/4$ radian necha gradus bo'ladi?

A) 220° B) 230° C) 225° D) 240° E) 235°

3.(97-12-30) $4\pi/3$ radian necha gradusga teng?

A) 230° B) 220° C) 250° D) 240° E) 210°

4.(97-12-32) Quyidagi sonlardan qaysi biri manfiy?

A) $\sin 122^\circ \cos 322^\circ$ B) $\cos 148^\circ \cos 289^\circ$ C) $\operatorname{tg} 196^\circ \operatorname{ctg} 189^\circ$ D) $\operatorname{tg} 220^\circ \sin 100^\circ$ E) $\operatorname{ctg} 320^\circ \cos 186^\circ$

5. (96-11-58) Ifodaning qiymatini hisoblang. $\sin 180^\circ + \sin 270^\circ - \operatorname{ctg} 90^\circ + \operatorname{tg} 180^\circ - \cos 90^\circ$

A) -1 B) 0 C) 1 D) -2 E) 2

6. (96-12-11) Hisoblang. $3\operatorname{tg} 0^\circ + 2\cos 90^\circ + 3\sin 270^\circ - 3\cos 180^\circ$

A) 6 B) 0 C) -6 D) 9 E) -9

7.(98-11-101) Agar $\sin x - \frac{1}{\sin x} = -3$ bo'lsa, $\sin^2 x + \frac{1}{\sin^2 x}$ ning qiymati qanchaga teng bo'ladi?

A) 7 B) 8 C) 9 D) 11 E) 6

8.(00-10-78) To'g'ri tengsizlikni aniqlang.

A) $\cos(\sin \alpha) > 0$ B) $\cos 2 > 0$ C) $-\frac{\pi}{2} + 2 \leq 0$ D) $|\cos \alpha| + |\sin \alpha| < 1$ E) $\sin 5 - \operatorname{tg} 4 > 0$

9.(01-9-29) Qaysi ko'paytma musbat?

1) $\sin 4,11 \cdot \operatorname{tg} 3,52$; 2) $\cos 2,53 \cdot \log_{1/2} \frac{\pi}{3}$; 3) $\operatorname{ctg} 5,73 \cdot \cos 1,19$

A) 1 B) 1; 2 C) 2 D) 1; 3 E) 2; 3

10. (02-2-48) Agar $\frac{1}{2}x = (\sin 30^\circ + \operatorname{tg} 60^\circ \cdot \cos 30^\circ)^2$ bo'lsa, $x = ?$

A) 8 B) 4 C) 2 D) 16 E) 1

2-laboratoriya ishi. Asosiy trigonometrik ayniyatlar.

1. $tgx = \frac{\sin x}{\cos x}$ 2. $ctgx = \frac{\cos x}{\sin x}$ 3. $tgx \cdot ctgx = 1$ 4. $\sin^2 x + \cos^2 x = 1$ 5. $1 + tg^2 x = \frac{1}{\cos^2 x}$

6. $1 + ctg^2 x = \frac{1}{\sin^2 x}$

1.(98-5-48) Agar $\sin \alpha = \frac{3}{5}$ va $\frac{\pi}{2} < \alpha < \pi$ bo'lsa, $tg \alpha$ ni toping.

A) $-4/5$ B) $-3/4$ C) $3/4$ D) $-3/5$ E) $3/5$

2.(99-7-47) Agar $\alpha \in \left(\frac{\pi}{2}; \pi\right)$ va $\sin \alpha = \frac{1}{4}$ bo'lsa, $ctg \alpha$ ni hisoblang.

A) -4 B) $-\sqrt{17}$ C) $-1/\sqrt{15}$ D) $-\sqrt{13}$ E) $-\sqrt{15}$

3.(00-8-61) Agar $0 < \alpha < \frac{\pi}{2}$ va $tg \alpha = 2$ bo'lsa, $\cos \alpha$ ni hisoblang.

A) $5/\sqrt{5}$ B) $2/\sqrt{5}$ C) $\sqrt{5}/5$ D) $\sqrt{5}$ E) $-1/\sqrt{5}$

4.(98-4-17) Agar $tg \alpha = 3$ bo'lsa, $\frac{3 \sin \alpha}{5 \sin^3 \alpha + 10 \cos^3 \alpha}$ ning qiymati qanchaga teng bo'ladi?

A) $16/39$ B) $4/9$ C) $8/15$ D) $15/32$ E) $18/29$

5.(98-5-52) Ifodani soddalashtiring. $\sin^2 \alpha + \cos^2 \alpha + ctg^2 \alpha$

A) $\cos^2 \frac{\alpha}{2}$ B) $\frac{\cos 2\alpha}{2}$ C) $tg \frac{\alpha}{2}$ D) $\frac{1}{\sin^2 \alpha}$ E) $\frac{1}{\cos^2 \alpha}$

6.(98-6-52) Agar $\sqrt{1 - \cos^2 x} - \sqrt{1 + \sin^2 x} = k$ bo'lsa, $\sqrt{1 - \cos^2 x} + \sqrt{1 + \sin^2 x}$ ni toping.

7. (98-8-55) Soddalashtiring. $\frac{1 + \cos^2 \alpha + \cos^4 \alpha}{3 \cos^2 \alpha + \sin^4 \alpha}$

A) 3 B) 2 C) $1\frac{1}{2}$ D) $1/3$ E) 1

8. (99-1-8) Agar $\sin \alpha = \sqrt{3}/2$ va $\pi/2 < \alpha < \pi$ bo'lsa, $\frac{|-1 + \cos \alpha| + 2 \cos \alpha}{\left| \frac{tg \alpha}{\sqrt{3}} - 0,5 \right|}$ ni hisoblang.

A) $1/3$ B) 1 C) 3 D) -1 E) -3

9. (03-8-55) Agar $\cos x = \frac{1}{\sqrt{10}}$ bo'lsa, $(1 + tg^2 x)(1 - \sin^2 x) - \sin^2 x$ ifodaning qiymatini toping.

A) 0,1 B) 0,2 C) 0,3 D) $2/\sqrt{10}$ E) $\sqrt{10}/10$

10. (03-12-25) $1 + \frac{\sin^4 \alpha + \sin^2 \alpha \cdot \cos^2 \alpha}{\cos^2 \alpha}$ ni soddalashtiring.

A) $tg^2 \alpha$ B) $1 + tg^2 \alpha$ C) $ctg^2 \alpha$ D) $1 + ctg^2 \alpha$

E) $tg^2 \alpha + ctg^2 \alpha$

3-laboratoriya ishi. Keltirish formulalari.

x	$\sin x$	$\cos x$	$\operatorname{tg} x$	$\operatorname{ctg} x$
$\frac{\pi}{2} - \alpha$	$\cos \alpha$	$\sin \alpha$	$\operatorname{ctg} \alpha$	$\operatorname{tg} \alpha$
$\frac{\pi}{2} + \alpha$	$\cos \alpha$	$-\sin \alpha$	$-\operatorname{ctg} \alpha$	$-\operatorname{tg} \alpha$
$\pi - \alpha$	$\sin \alpha$	$-\cos \alpha$	$-\operatorname{tg} \alpha$	$-\operatorname{ctg} \alpha$
$\pi + \alpha$	$-\sin \alpha$	$-\cos \alpha$	$\operatorname{tg} \alpha$	$\operatorname{ctg} \alpha$
$\frac{3\pi}{2} - \alpha$	$-\cos \alpha$	$-\sin \alpha$	$\operatorname{ctg} \alpha$	$\operatorname{tg} \alpha$
$\frac{3\pi}{2} + \alpha$	$-\cos \alpha$	$\sin \alpha$	$-\operatorname{ctg} \alpha$	$-\operatorname{tg} \alpha$
$2\pi - \alpha$	$-\sin \alpha$	$\cos \alpha$	$-\operatorname{tg} \alpha$	$-\operatorname{ctg} \alpha$

1.(96-1-54) Ushbu $2\operatorname{tg}(-765^\circ)$ ifodaning qiymatini aniqlang.

- A) $-\sqrt{2}$ B) $2/\sqrt{3}$ C) -2 D) 4 E) $-2\sqrt{3}$

2.(00-5-31) $\sin 2010^\circ$ ni hisoblang.

- A) $-1/2$ B) $-\sqrt{3}/2$ C) $\sqrt{3}/2$ D) 1 E) $-1/4$

3.(97-1-44) Hisoblang. $\sin(1050^\circ) - \cos(-90^\circ) + \operatorname{ctg}(660^\circ)$

- A) $\sqrt{3} - 1$ B) $-\frac{3\sqrt{3}}{2}$ C) $-\frac{3+2\sqrt{3}}{6}$ D) $0,5 + \sqrt{3}$ E) $2\sqrt{3}$

4.(97-6-43) Hisoblang. $\sin(-45^\circ) + \cos(405^\circ) + \operatorname{tg}(-945^\circ)$

- A) 1 B) -1 C) $-2\sqrt{2}$ D) $\sqrt{2} - 1$ E) $\sqrt{2} + 1$

5.(97-11-43) Hisoblang. $\cos(-45^\circ) + \sin(315^\circ) + \operatorname{tg}(-885^\circ)$

- A) 0 B) $\sqrt{2} - 1$ C) $1 + \sqrt{3}$ D) -1 E) 1

6.(98-10-36) Hisoblang. $\operatorname{tg} \frac{\pi}{6} \cdot \sin \frac{\pi}{3} \cdot \operatorname{ctg} \frac{5\pi}{4}$

- A) $1,5$ B) $0,5$ C) $-1/2$ D) $\sqrt{3}/4$ E) $3/4$

7.(00-1-25) Keltirilgan sonlardan eng kattasini toping.

- A) $\sin 1$ B) $\cos\left(\frac{\pi}{2} - \frac{1}{2}\right)$ C) $\sin 4$ D) $\cos\left(\frac{3\pi}{2} + \frac{1}{4}\right)$ E) $\operatorname{tg} \frac{\pi}{4}$

8.(96-6-34) Soddalashtiring. $\frac{\sin(2\pi - \alpha)}{\operatorname{ctg}\left(\frac{3\pi}{2} - \beta\right)}$

- A) $\frac{\sin \alpha}{\operatorname{tg} \beta}$ B) $-\frac{\sin \alpha}{\operatorname{ctg} \beta}$ C) $-\frac{\sin \alpha}{\operatorname{tg} \beta}$ D) $-\frac{\cos \alpha}{\operatorname{tg} \beta}$ E) $-\frac{\cos \alpha}{\operatorname{ctg} \beta}$

9.(97-8-33) Soddalashtiring.

$$\sin\left(\frac{3\pi}{2} + \alpha\right) \cdot \operatorname{ctg}(\pi + \beta)$$

- A) $\cos \alpha \cdot \operatorname{ctg} \beta$ B) $-\cos \alpha \cdot \operatorname{ctg} \beta$ C) $-\cos \alpha \cdot \operatorname{tg} \beta$ D) $\sin \alpha \cdot \operatorname{tg} \beta$ E) $-\sin \alpha \cdot \operatorname{ctg} \beta$

10. (03-2-43) $\operatorname{ctg} 37^\circ \operatorname{ctg} 38^\circ \operatorname{ctg} 39^\circ \dots \operatorname{ctg} 52^\circ \operatorname{ctg} 53^\circ$ ni hisoblang.

- A) 0 B) 1 C) -1 D) $-\sqrt{3}$ E) 2

4-laboratoriya ishi. Qo'shish formulalari.

1. $\sin(x+y)=\sin x \cos y + \cos x \sin y$ $\sin(x-y)=\sin x \cos y - \cos x \sin y$
2. $\cos(x+y)=\cos x \cos y - \sin x \sin y$ $\cos(x-y)=\cos x \cos y + \sin x \sin y$
3. $\operatorname{tg}(x+y)=\frac{\operatorname{tg} x + \operatorname{tg} y}{1 - \operatorname{tg} x \operatorname{tg} y}$ $\operatorname{tg}(x-y)=\frac{\operatorname{tg} x - \operatorname{tg} y}{1 + \operatorname{tg} x \operatorname{tg} y}$

1.(96-3-111) Agar $\operatorname{tg}\left(\frac{\pi}{4}-\alpha\right)=2$ bo'lsa, $\operatorname{tg}\alpha$ ning qiymatini toping.

- A) 3 B) -3 C) 1/3 D) -1/3 E) 1/2

2. (01-1-42) Agar $\operatorname{tg}\alpha = \frac{1}{2}$, $\operatorname{tg}\beta = \frac{1}{3}$ va $\pi < \alpha + \beta < 2\pi$ bo'lsa, $\alpha + \beta$ ning qiymatini toping.

- A) $\frac{7\pi}{3}$ B) $\frac{5\pi}{3}$ C) $\frac{5\pi}{4}$ D) $\frac{7\pi}{4}$ E) $\frac{11\pi}{6}$

3. (97-6-60) Agar $\begin{cases} \operatorname{tg}(\alpha + \beta) = 5 \\ \operatorname{tg}(\alpha - \beta) = 3 \end{cases}$ bo'lsa, $\operatorname{tg}2\beta$ ni hisoblang.

- A) 15 B) 8 C) 1/8 D) 1 E) 2

4. (98-8-61) Agar $b=\sin(40^\circ+\alpha)$ va $0^\circ < \alpha < 45^\circ$ bo'lsa, $\cos(70^\circ+\alpha)$ ni b orqali ifodalang.

- A) $-\frac{1}{2}\left(\sqrt{3(1-b^2)}+b\right)$ B) $\frac{1}{2}\left(b-\sqrt{3(1-b^2)}\right)$ C) $\frac{1}{2}\left(\sqrt{3(1-b^2)}-b\right)$ D) $\frac{1}{2}\left(\sqrt{3(1-b^2)}+b\right)$

- E) $\frac{1}{2}\left(\sqrt{3(1-b^2)}\right)$

5.(97-3-54) Soddashtiring. $\frac{\sin 56^\circ \sin 124^\circ - \sin 34^\circ \cos 236^\circ}{\cos 28^\circ \cos 88^\circ + \cos 178^\circ \sin 208^\circ}$

- A) $2/\sqrt{3}$ B) $\operatorname{tg}28^\circ$ C) 2 D) $\frac{1}{\sin 26^\circ}$ E) -2

6. (96-1-57) Ifodani soddashtiring. $\frac{\cos(\alpha + \beta) + 2 \sin \alpha \sin \beta}{\sin(\alpha + \beta) - 2 \cos \beta \sin \alpha}$

- A) $\operatorname{ctg}(\beta - \alpha)$ B) $\operatorname{tg}(\alpha - \beta)$ C) $2\operatorname{tg}(\alpha + \beta)$ D) $2\operatorname{ctg}(\alpha - \beta)$ E) $\sin \alpha \cdot \cos \beta$

7.(01-11-24) Soddashtiring. $\frac{\sin \alpha + \cos \alpha}{\sqrt{2} \cos\left(\frac{\pi}{4}-\alpha\right)}$

- A) 1,6 B) $\operatorname{ctg}\left(\frac{\pi}{4}+\alpha\right)$ C) 1,5 D) 1 E) $\operatorname{tg}\left(\frac{\pi}{4}+\alpha\right)$

8.(02-3-71) α, β, γ o'tkir burchaklar bo'lib, $\operatorname{tg}\alpha = \frac{1}{2}$, $\operatorname{tg}\beta = \frac{1}{5}$ va $\operatorname{tg}\gamma = \frac{7}{9}$ bo'lsa,

γ ni α va β lar orqali ifodalang.

- A) $\gamma = \alpha + \beta$ B) $\gamma = 2\alpha - \beta$ C) $\gamma = \alpha + 2\beta$ D) $\gamma = \alpha - \beta$ E) $\gamma = 2(\alpha + \beta)$

9. (02-3-72) $\frac{2\cos\left(\frac{\pi}{4}-\alpha\right) + \sqrt{2}\sin\alpha\left(\frac{3\pi}{2}-\alpha\right)}{2\sin\left(\frac{2\pi}{3}+\alpha\right) - \sqrt{3}\cos\alpha(2\pi-\alpha)}$ ni soddashtiring.

10. (03-12-77) $\left(\left(\operatorname{tg}^2\frac{7\pi}{24} - \operatorname{tg}^2\frac{\pi}{24}\right) : \left(1 - \operatorname{tg}^2\frac{7\pi}{24} \cdot \operatorname{tg}^2\frac{\pi}{24}\right)\right)^2$ ni hisoblang.

- A) 1/9 B) 9 C) 1/3 D) 1 E) 3

5-laboratoriya ishi. Ikkilangan burchak formulalari.

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

$$\sin 2x = \frac{2 \operatorname{tg} x}{1 + \operatorname{tg}^2 x} \quad \cos 2x = \frac{1 - \operatorname{tg}^2 x}{1 + \operatorname{tg}^2 x} \quad \operatorname{tg} 2x = \frac{2 \operatorname{tg} x}{1 - \operatorname{tg}^2 x}$$

Misol: (97-6-51) $\sin \frac{\pi}{8} \cdot \cos^3 \frac{\pi}{8} - \sin^3 \frac{\pi}{8} \cdot \cos \frac{\pi}{8}$ ni hisoblang.

- A) 0 B) 1 C) 2 D) 1/2 E) 1/4

Yechish: $\sin \alpha \cdot \cos \alpha = \frac{1}{2} \sin 2\alpha$ va $\cos^2 \alpha - \sin^2 \alpha = \cos 2\alpha$ ekanligidan

$$\begin{aligned} \sin \frac{\pi}{8} \cdot \cos^3 \frac{\pi}{8} - \sin^3 \frac{\pi}{8} \cdot \cos \frac{\pi}{8} &= \sin \frac{\pi}{8} \cdot \cos \frac{\pi}{8} \left(\cos^2 \frac{\pi}{8} - \sin^2 \frac{\pi}{8} \right) = \\ &= \frac{1}{2} \sin \frac{\pi}{4} \cos \left(2 \frac{\pi}{8} \right) = \frac{1}{2} \sin \frac{\pi}{4} \cdot \cos \frac{\pi}{4} = \frac{1}{4} \sin \frac{\pi}{2} = \frac{1}{4} \end{aligned}$$

ni hosil qilamiz: $\frac{1}{4}$ (E)

1. (00-10-13) Hisoblang. $\cos \frac{\pi}{5} \cos \frac{2\pi}{5}$

- A) 1/2 B) 1/3 C) 1/8 D) 1/12 E) 3/4

2. (96-9-47) Soddalashtiring. $\frac{1 + \sin 2\alpha}{\sin \alpha + \cos \alpha} - \sin \alpha$

- A) $\cos \alpha$ B) $\sin \alpha$ C) $-\cos \alpha$ D) $-2 \sin \alpha$ E) $\cos \alpha - 2 \sin \alpha$

3. (96-12-85) Soddalashtiring. $\frac{2}{\operatorname{tg} \alpha + \operatorname{ctg} \alpha}$

- A) $\cos 2\alpha$ B) $1/\cos 2\alpha$ C) $1/\sin 2\alpha$ D) 2 E) $\sin 2\alpha$

4. (98-8-57) Hisoblang. $\sin^4 \left(\frac{23\pi}{12} \right) - \cos^4 \left(\frac{13\pi}{12} \right)$

- A) $\sqrt{3}/2$ B) $1/2$ C) $-\sqrt{3}/2$ D) $-\sqrt{2}/2$ E) $-1/2$

5. (98-9-22) Quyida keltirilgan ifodalardan qaysi birining qiymati 1 ga teng emas?

1) $2 \cos^2 \alpha - \cos 2\alpha$; 2) $2 \sin^2 \alpha + \cos 2\alpha$; 3) $\operatorname{tg}(90^\circ + \alpha) \operatorname{tg} \alpha$; 4) $\left(\frac{1}{\cos^2 \alpha} - 1 \right) \left(\frac{1}{\sin^2 \alpha} - 1 \right)$;

(3 va 4 ifodalar α ning qabul qilishi mumkin бўlgan qiymatlarida qaraladi)

- A) 1 B) 2 C) 3 D) 4 E) bunday son yo'q

6. (98-12-90) Hisoblang. $\frac{\sqrt{3}}{\sin 100^\circ} + \frac{1}{\cos 260^\circ}$

- A) 2 B) -4 C) -3 D) -1 E) -2

7. (99-3-32) Soddalashtiring. $\sin^6 \alpha + \cos^6 \alpha + \frac{3}{4} \sin^2 2\alpha$

- A) 1 B) -1 C) $\sin^2 \alpha$ D) $\cos^2 \alpha$ E) to'g'ri javob berilmagan

8. (99-9-32) Soddalashtiring. $\frac{\sqrt{3} \cos 2\alpha + \sin 2\alpha}{\cos \alpha + \sqrt{3} \sin \alpha}$

- A) $2 \cos \left(\alpha + \frac{\pi}{3} \right)$ B) $2 \cos \left(\alpha - \frac{\pi}{3} \right)$ C) $2 \cos \left(\alpha + \frac{\pi}{3} \right)$ D) $\frac{1}{2} \cos \left(\alpha + \frac{\pi}{6} \right)$ E) $\frac{1}{2} \sin \left(\alpha + \frac{\pi}{6} \right)$

9. (01-1-43) Agar $\operatorname{tg} \alpha = -\frac{4}{3}$ bo'lsa, $\sin 2\alpha$ ning qiymatini toping.

- A) 0,96 B) -0,96 C) 0,25 D) -0,5 E) 0,5

10. (01-1-50) Ifodaning qiymatini toping. $1 - \sqrt{3} \operatorname{ctg} 40^\circ + \frac{1}{\cos 20^\circ}$

- A) $\sin 20^\circ$ B) $1/2$ C) 0 D) $\sqrt{3}/2$ E) $\cos 20^\circ$

6-laboratoriya ishi. Yig'indi va ayirmalar uchun formulalar.

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2} \quad \sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}$$

$$\cos x + \cos y = 2 \cos \frac{x+y}{2} \cos \frac{x-y}{2} \quad \cos x - \cos y = -2 \sin \frac{x+y}{2} \sin \frac{x-y}{2}$$

1.(00-8-59) Hisoblang. $\sin 10^0 + \sin 50^0 - \cos 20^0$

- A) 0 B) -1 C) 1 D) $\cos 20^0$ E) $\sin 20^0$

2.(96-6-35) Soddalashtiring. $\frac{\cos \alpha - \cos 3\alpha}{\sin \alpha}$

- A) $-2\cos 2\alpha$ B) $2\cos 2\alpha$ C) $\sin 2\alpha$ D) $-2\sin 2\alpha$ E) $2\sin 2\alpha$

3. (99-5-54) Hisoblang. $\sqrt[3]{8 + \left(\cos \frac{\pi}{5} + \cos \frac{2\pi}{5} + \cos \frac{3\pi}{5} + \cos \frac{4\pi}{5} \right)^3}$

- A) 1 B) 2 C) 3 D) 4 E) 2,5

4. (01-7-40) Soddalashtiring. $\frac{\sin \alpha + \sin 2\alpha - \sin(\pi + 3\alpha)}{2 \cos \alpha + 1}$

- A) $\sin \alpha$ B) $\cos \alpha$ C) $\sin 2\alpha$ D) $\cos 2\alpha$ E) $1 + \sin \alpha$

5.(02-2-47) $\left(\frac{\sin 100^0 + \sin 20^0}{\sin 50^0} \right)^2$ ni hisoblang.

- A) 3 B) $3/4$ C) $3/2$ D) 1 E) $1/4$

6.(00-1-28) Hisoblang. $\frac{\sin 35^0 + \cos 65^0}{2 \cos 5^0}$

- A) 0,25 B) 0,75 C) 0,5 D) 0,6 E) 0,3

7.(00-9-58) Hisoblang. $\frac{2^{\cos \frac{\pi}{7} + \cos \frac{2\pi}{7} + \cos \frac{5\pi}{7} + \cos \frac{6\pi}{7}}}{3^{\cos \frac{3\pi}{7} + \cos \frac{4\pi}{7}}}$

- A) 1 B) 2 C) $2/3$ D) $4/9$ E) 3

8. (98-1-58) Soddalashtiring. $\frac{\sin 2\alpha + 2 \sin \alpha \cos 2\alpha}{1 + \cos \alpha + \cos 2\alpha + \cos 3\alpha}$

- A) $2\operatorname{tg} \alpha$ B) $2\sin \alpha$ C) $4\operatorname{tg} \alpha$ D) $\operatorname{ctg} \alpha$ E) $\operatorname{tg} \alpha$

9. (02-5-33) $\frac{\sin \alpha + \sin 2\alpha - \sin(\pi + 3\alpha)}{1 + 2 \cos \alpha}$ ni soddalashtiring.

- A) $\sin \alpha$ B) $\cos \alpha$ C) $1 + \cos \alpha$ D) $1 + \sin \alpha$ E) $\sin 2\alpha$

10. (03-7-55) $\sin 87^0 - \sin 59^0 - \sin 93^0 + \sin 61^0$ ni soddalashtiring.

- A) $\sqrt{3} \sin 1^0$ B) $\sin 8^0$ C) $-\sqrt{2} \sin 1^0$ D) 0 E) $\sin 2^0$

7-laboratoriya ishi. Ko'paytma uchun formulalar. Yarim burchak formulari.

$$\sin x \cdot \sin y = \frac{1}{2} (\cos(x-y) - \cos(x+y)) ; \quad \cos x \cdot \cos y = \frac{1}{2} (\cos(x-y) + \cos(x+y));$$

$$\sin x \cdot \cos y = \frac{1}{2} (\sin(x-y) + \sin(x+y)) ; \quad \sin^2 x = \frac{1 - \cos 2x}{2} ; \quad \cos^2 x = \frac{1 + \cos 2x}{2} ; \quad \sin^2 \frac{x}{2} = \frac{1 - \cos x}{2} ;$$

$$\cos^2 \frac{x}{2} = \frac{1 + \cos x}{2} ; \quad \operatorname{tg} \frac{x}{2} = \frac{\sin x}{1 + \cos x} = \frac{1 - \cos x}{\sin x} ; \quad \operatorname{ctg} \frac{x}{2} = \frac{\sin x}{1 - \cos x} = \frac{1 + \cos x}{\sin x} ;$$

$$\operatorname{tg}^2 \frac{\alpha}{2} = \frac{1 - \cos \alpha}{1 + \cos \alpha} ; \quad \operatorname{ctg}^2 \frac{\alpha}{2} = \frac{1 + \cos \alpha}{1 - \cos \alpha} ;$$

Misol: (00-8-48) $\cos \frac{2\pi}{7} + \cos \frac{4\pi}{7} + \cos \frac{6\pi}{7}$ ni hisoblang.

A) $-1/2$ B) $1/4$ C) $1/3$ D) $\sqrt{2}/3$ E) $-\sqrt{3}/2$

Yechish: Berilgan ifodani A bilan belgilaymiz. $A = \cos \frac{2\pi}{7} + \cos \frac{4\pi}{7} + \cos \frac{6\pi}{7}$ Bu tenglikni $2 \sin \frac{\pi}{7}$ ga

ko'paytirib, har bir qo'shiluvchiga $2 \sin \alpha \cos \beta = \sin(\alpha - \beta) + \sin(\alpha + \beta)$ formulani qo'llaymiz:

$$2A \sin \frac{\pi}{7} = 2 \sin \frac{\pi}{7} \cos \frac{2\pi}{7} + 2 \sin \frac{\pi}{7} \cos \frac{4\pi}{7} + 2 \sin \frac{\pi}{7} \cos \frac{6\pi}{7} = -\sin \frac{\pi}{7} + \sin \frac{3\pi}{7} - \sin \frac{3\pi}{7} +$$

$$+\sin \frac{5\pi}{7} - \sin \frac{5\pi}{7} + \sin \frac{7\pi}{7} = -\sin \frac{\pi}{7}$$

U holda $A = -1/2$ j: $-1/2$ (A)

1.(96-3-57) Hisoblang. $\sin 20^\circ \sin 40^\circ \sin 80^\circ$

A) $1/2$ B) $1/3$ C) $1/4$ D) $\sqrt{3}/8$ E) $5\sqrt{3}$

2.(00-10-79) Hisoblang. $\cos 5^\circ \cos 55^\circ \cos 65^\circ$

A) $\frac{\sqrt{6}+\sqrt{2}}{16}$ B) $\frac{\sqrt{6}-\sqrt{2}}{16}$ C) $\frac{\sqrt{2}+1}{8}$ D) $\frac{\sqrt{2}}{2}$ E) $\frac{\sqrt{3}}{2}$

3.(98-3-54) Hisoblang. $\frac{4 \cdot \sin 40^\circ \cdot \sin 50^\circ}{\cos 10^\circ}$

A) 4 B) 2 C) 1,5 D) 3 E) 2,5

4.(01-5-15) Hisoblang. $\operatorname{tg} 10^\circ \operatorname{tg} 50^\circ \operatorname{tg} 70^\circ$

A) $1/\sqrt{3}$ B) $\sqrt{3}$ C) 0 D) 1 E) $1/\sqrt{2}$

5.(03-9-30) $\cos 55^\circ \cos 65^\circ \cos 75^\circ$ ni hisoblang.

A) $-1/8$ B) $-\sqrt{3}/8$ C) $\sqrt{3}/8$ D) $-\frac{1}{8}\sqrt{2-\sqrt{3}}$ E) $-\frac{1}{8}\sqrt{2+\sqrt{3}}$

6.(98-10-100) Hisoblang. $\sin 105^\circ + \sin 75^\circ$

A) $\frac{\sqrt{2+\sqrt{3}}}{2}$ B) $\frac{\sqrt{2-\sqrt{3}}}{2}$ C) $\sqrt{\sqrt{3}-\sqrt{2}}$ D) $\sqrt{2+\sqrt{3}}$ E) $\frac{\sqrt{\sqrt{2}+\sqrt{3}}}{2}$

7.(96-1-55) Agar $\cos 2\alpha = \frac{1}{2}$ bo'lsa, $\cos^2 \alpha$ ni hisoblang.

A) $1/4$ B) $\sqrt{3}/4$ C) $3/4$ D) $3/8$ E) $1/8$

8.(97-3-55) Hisoblang. $\cos \frac{\pi}{12}$

A) $\frac{\sqrt{2+\sqrt{3}}}{3}$ B) $\sqrt{2-\sqrt{2}}$ C) $\frac{\sqrt{\sqrt{3}-1}}{2}$ D) $\frac{\sqrt{2-\sqrt{3}}}{2}$ E) $\frac{\sqrt{2+\sqrt{3}}}{2}$

9.(97-5-28) Hisoblang. $8\cos 30^\circ + \operatorname{tg}^2 15^\circ$

A) 5 B) 6 C) 7 D) 8 E) 9

10. (97-6-44) Agar $\cos \alpha = \frac{1}{2}$ va $\frac{3\pi}{2} < \alpha < 2\pi$ bo'lsa, $\sin\left(\pi - \frac{\alpha}{2}\right)$ ni toping.

A) $-1/2$ B) $-\sqrt{3}/2$ C) $1/4$ D) $1/2$ E) $\sqrt{3}/2$

8-laboratoriya ishi. Arksinus, arkkosinus, arktangens va arkkotangenslarning qiymatlari.

a	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$\arcsin a$	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
$\arccos a$	$\frac{\pi}{2}$	$\frac{\pi}{3}$	$\frac{\pi}{4}$	$\frac{\pi}{6}$	0

b	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$
$\arctg b$	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$
$\operatorname{arcctg} b$	$\frac{\pi}{2}$	$\frac{\pi}{3}$	$\frac{\pi}{4}$	$\frac{\pi}{6}$

1. $\arcsin a$ $\arccos a$ sonlar $-1 \leq a \leq 1$ da ma'noga ega
2. $\arcsin(-a) = -\arcsin a$, $\arccos(-a) = \pi - \arccos a$
3. $\arctg(-a) = -\arctg a$, $\operatorname{arcctg}(-a) = \pi - \arctg a$,
4. $\arcsin(\sin a) = a$, $-\frac{\pi}{2} \leq a \leq \frac{\pi}{2}$
5. $\arccos(\cos a) = a$, $0 \leq a \leq \pi$
6. $\arctg(\tg b) = b$, $-\frac{\pi}{2} < a < \frac{\pi}{2}$
7. $\operatorname{arcctg}(\ctg b) = b$, $0 < a < \pi$

Misol. (98-3-57) Hisoblang. $\arcsin\left(\sin\frac{5\pi}{8}\right) + \arccos\left(\cos\frac{8\pi}{7}\right)$

A) $\frac{99\pi}{56}$ B) $\frac{83\pi}{56}$ C) $\frac{85\pi}{56}$ D) $\frac{69\pi}{56}$ E) $\frac{13\pi}{15}$

Yechish: $\sin \alpha = \sin(\pi - \alpha)$ formuladan foydalanib 1) $\sin\frac{5\pi}{8} = \sin\left(\pi - \frac{5\pi}{8}\right) = \sin\frac{3\pi}{8}$ ni hosil

qilamiz. $-\frac{\pi}{2} \leq \alpha \leq \frac{\pi}{2}$ oraliqda $\arcsin(\sin \alpha) = \alpha$ ekanligidan foydalanamiz. $-\frac{\pi}{2} < \frac{3\pi}{8} < \frac{\pi}{2}$ munosabatlarni

tekshirish qiyin emas. Shuning uchun $\arcsin(\sin\frac{5\pi}{8}) = \arcsin(\sin\frac{3\pi}{8}) = \frac{3\pi}{8}$

$\cos \alpha = \cos(\pi - \alpha)$ ekanligidan 2) $\cos\frac{8\pi}{7} = \cos\left(2\pi - \frac{8\pi}{7}\right) = \cos\frac{6\pi}{7}$ bo'ladi. $0 \leq \alpha \leq \pi$ oraliqda $\arccos(\cos \alpha) = \alpha$ bo'lgani uchun

$\arccos(\cos\frac{8\pi}{7}) = \arccos(\cos\frac{6\pi}{7}) = \frac{6\pi}{7}$ bo'ladi, chunki $0 < \frac{6\pi}{7} < \pi$

Shuning uchun berilgan ifoda $\frac{3\pi}{8} + \frac{6\pi}{7} = \frac{69\pi}{56}$ ga teng.

j: $\frac{69\pi}{56}$ (D)

1. (98-2-22) Hisoblang. $\arccos\left(-\frac{\sqrt{2}}{2}\right) - \arctg\frac{1}{\sqrt{3}}$

A) -75° B) 75° C) -105° D) 165° E) 105°

2. (00-10-37) Hisoblang. $\sin(2\arctg 0,75)$

A) $12/25$ B) $24/25$ C) $22/25$ D) $11/15$ E) $9/25$

3. (97-9-30) Soddashtiring. $\text{arccctg}(\text{ctg}(-3))$

- A) $\pi+3$ B) $2\pi-3$ C) $\frac{2\pi}{3}-3$ D) $\frac{3\pi}{2}-3$ E) $\pi-3$

4. (99-3-36) Hisoblang. $\cos\left(\arcsin\frac{40}{41}-\arcsin\frac{4}{5}\right)$

- A) 151/205 B) -151/205 C) 121/205 D) -150/205 E) 187/205

5. (98-11-42) Hisoblang. $\text{tg}\left(\frac{1}{2}\arcsin\frac{5}{13}\right)$

- A) 1/25 B) 1/15 C) 1/10 D) 1/5 E) 5

6. (01-1-47) Ifodaning qiymatini toping. $\text{arctg}3 - \arcsin\frac{\sqrt{5}}{5}$

- A) 0 B) $\pi/6$ C) $\pi/3$ D) $\pi/2$ E) $\pi/4$

7. (01-5-14) Hisoblang. $\text{arctg}\frac{1}{3} + \text{arctg}\frac{1}{9} + \text{arctg}\frac{7}{19}$

- A) $\pi/4$ B) $\pi/6$ C) $\pi/3$ D) 0 E) $\pi/2$

8. (02-5-36) $\text{arctg}\sqrt{2} - \text{arctg}\frac{1}{\sqrt{2}}$ ni hisoblang.

- A) $\text{arctg}\frac{\sqrt{2}}{4}$ B) $\pi/4$ C) $\text{arctg}\sqrt{2}$ D) $\pi/3$ E) $\pi/6$

9. (03-6-66) $\sin\left(\arcsin\frac{1}{2} + \arccos\frac{1}{2}\right)$ ni hisoblang.

- A) $\sqrt{3}/2$ B) $\sqrt{2}/2$ C) 1 D) 1/2 E) 1/4

10. (03-9-35) $\text{tg}\left(\arcsin\left(-\frac{1}{3}\right) + \frac{\pi}{2}\right)$ ning qiymatini toping.

- A) $\sqrt{2}/4$ B) $-\sqrt{2}/4$ C) $2\sqrt{2}$ D) $-2\sqrt{2}$ E) $\sqrt{3}/4$

9-laboratoriya ishi. Eng sodda trigonometrik tenglamalar.

1. $\sin x = a, |a| \leq 1$, yechim: $x = (-1)^n \arcsin a + \pi n$
2. $\sin x = 0$, yechim: $x = \pi n$
3. $\sin x = -1$, yechim: $x = -\frac{\pi}{2} + 2\pi n$
4. $\sin x = 1$, yechim: $x = \frac{\pi}{2} + 2\pi n$
5. $\cos x = a, |a| \leq 1$, yechim: $x = \pm \arccos a + 2\pi n$
6. $\cos x = 0$, yechim: $x = \frac{\pi}{2} + \pi n$
7. $\cos x = -1$, yechim: $x = \pi + 2\pi n$
8. $\cos x = 1$, yechim: $x = 2\pi n$
9. $\operatorname{tg} x = a$, yechim: $x = \operatorname{arctg} a + \pi n$
10. $\operatorname{ctg} x = a$, yechim: $x = \operatorname{arcctg} a + \pi n$

1) $\sin^m x + \cos^n x = 1$ tenglama $m > 0$, $n > 0$ yoki $0 < m < 2$, $0 < n < 2$ bo'lsa, u holda 1) $\sin^m x = 1$

2) $\cos^n x = 1$ tenglamalarga ajraydi.

2) Ayrim tenglamalarning aniqlanish sohasiga e'tibor berisha mahsadga muvofiq.

(98-1-56) Tenglamani yeching. $\frac{\sin 2x}{\operatorname{tg} x - 1} = 0$

A) $\frac{\pi k}{2}$, $k \in \mathbb{Z}$ B) $\frac{\pi k}{2} + \pi k$, $k \in \mathbb{Z}$

C) $2\pi k$, $k \in \mathbb{Z}$ D) $\pi + 2\pi k$, $k \in \mathbb{Z}$ E) πk , $k \in \mathbb{Z}$

Yechish: Ushbu $\frac{\sin 2x}{\operatorname{tg} x - 1} = 0$ tenglama $\operatorname{tg} x - 1 \neq 0$, $\cos x \neq 0$ bo'lganda aniqlangan. Berilgan tenglamadan

$\sin 2x = 0$ ni hosil qilamiz. Bu tenglamani $\sin 2\alpha = 2 \sin \alpha \cos \alpha$ ekanligidan foydalanib $2 \sin x \cos x = 0$ ko'rinishda yozamiz. Bu erdan $\cos x \neq 0$ ni e'tiborga olib, $\sin x = 0$ tenglamani. Undan esa $x = \pi k$ ekanini hosil qilamiz.

j: πk , $k \in \mathbb{Z}$ (E)

1.(96-6-43) Tenglamani yeching. $2\sin 2x = -1$

A) $-\frac{\pi}{6} + 2\pi k$, $k \in \mathbb{Z}$ B) $-\frac{\pi}{6} + \pi k$, $k \in \mathbb{Z}$

C) $(-1)^k \frac{\pi}{6} + \pi k$, $k \in \mathbb{Z}$ D) $\pm \frac{2\pi}{3} + 2\pi k$, $k \in \mathbb{Z}$

E) $(-1)^{k+1} \frac{\pi}{6} + \pi k$, $k \in \mathbb{Z}$

2.(96-11-60) Tenglamani yeching. $\sin\left(3x - \frac{\pi}{2}\right) = 0$

A) $\frac{\pi}{3}n, n \in Z$ B) $\frac{\pi}{6} + \frac{\pi}{3}n, n \in Z$ C) $3\pi, n \in Z$ D) $\frac{\pi}{2} + \frac{\pi}{3}n, n \in Z$ E) $\frac{\pi}{6}n, n \in Z$

3.(96-12-44) Tenglamani yechimini toping. $\cos\left(2x - \frac{\pi}{2}\right) = 0$

A) $\frac{\pi}{2}n, n \in Z$ B) $\pi/2$ C) $\pi, n \in Z$ D) $\frac{\pi}{2} + \frac{\pi}{4}n, n \in Z$ E) $\frac{\pi}{4} + \frac{\pi}{2}, n \in Z$

4.(97-2-43) Tenglamani yeching. $2\cos x = -\sqrt{3}$

A) $\pm \frac{\pi}{6} + \pi k, k \in Z$ B) $(-1)^k \frac{\pi}{3} + \pi k, k \in Z$ C) $\pm \frac{5\pi}{6} + 2\pi k, k \in Z$ D) $\pm \frac{\pi}{4} + 2\pi k, k \in Z$

E) $\pm \frac{3\pi}{4} + 2\pi k, k \in Z$

5. (99-5-32)* Tenglamani yeching.

$$\operatorname{tg}\left(\frac{\pi}{2} + \frac{\sqrt{2}\pi}{4} \cdot \cos 2x\right) = 1$$

A) $\pm \frac{3\pi}{4} + 2\pi, n \in Z$ B) $\pm \frac{3\pi}{8} + \pi, n \in Z$ C) $\pm \frac{\pi}{4} + \pi, n \in Z$ D) $\pm \frac{3\pi}{8} + 2\pi, n \in Z$

E) $\pm \frac{\pi}{8} + \pi, n \in Z$

6. (01-5-17) Ushbu $\sin \frac{\pi}{x} = 1$ tenglamaning $[0,05; 0,1]$ oraliqda nechta ildizi bor?

A) 5 B) 1 C) 2 D) 3 E) 4

7. (97-5-32) Tenglamani yeching.

$$\sin^{1995} x + \cos^{1995} x = 1$$

A) $2\pi; \frac{\pi}{2} + 2\pi, n \in Z$ B) $\pi; \frac{\pi}{3} + 2\pi, n \in Z$

C) $2\pi, n \in Z$ D) $\frac{\pi}{2} + 2\pi, n \in Z$ E) $\pi, n \in Z$

8.(02-8-42) $\sin(\pi \cos 3x) = 1$ tenglamani yeching.

A) $\pm \frac{\pi}{9} + \frac{2\pi}{3}, n \in Z$ B) $\pm \frac{\pi}{6} + \frac{\pi}{3}, n \in Z$ C) $\pm \frac{\pi}{9} + \frac{\pi}{3}, n \in Z$ D) $\pm \frac{\pi}{3} + 2\pi, n \in Z$

E) $\pm \frac{\pi}{3} + \frac{2\pi}{3}, n \in Z$

9.(02-9-40) $\operatorname{ctg}\left(\frac{\pi}{2}(x-1)\right) = 0$ tenglamaning $(1; 5)$ oraliqda nechta ildizi bor?

A) 1 B) 2 C) 3 D) 4 E) 5

10. (96-7-59)* tenglama $[-\pi, 3\pi]$ kesmada nechta ildizga ega? $\frac{\operatorname{tg} x}{1 - \cos x} = 0$

A) 7 B) 2 C) 3 D) 5 E) 4

10-laboratoriya ishi. Qo'shish formulalari yordamida yechiladigan va ko'paytmaga keltiriladigan trigonometrik tenglamalar.

$$\begin{aligned}\sin(x+y) &= \sin x \cos y + \cos x \sin y & \sin(x-y) &= \sin x \cos y - \cos x \sin y \\ \cos(x+y) &= \cos x \cos y - \sin x \sin y & \cos(x-y) &= \cos x \cos y + \sin x \sin y\end{aligned}$$

$$\begin{aligned}tg(x+y) &= \frac{tgx + tgy}{1 - tgx tgy} & tg(x-y) &= \frac{tgx - tgy}{1 + tgx tgy}\end{aligned}$$

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2} \quad \sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}$$

$$\cos x + \cos y = 2 \cos \frac{x+y}{2} \cos \frac{x-y}{2} \quad \cos x - \cos y = -2 \sin \frac{x+y}{2} \sin \frac{x-y}{2}$$

1.(96-1-58) Tenglamani ildizlarini ko'rsating. $\cos 3x \cdot \cos x + 0,5 = \sin 3x \cdot \sin x$

A) $\frac{\pi}{4} + 2\pi k, k \in Z$ B) $\frac{\pi}{6} + 2\pi k, k \in Z$ C) $\frac{\pi}{6} + \pi k, k \in Z$ D) $\pm \frac{\pi}{6} + \frac{\pi k}{2}, k \in Z$ E) $-\frac{\pi}{6} + \pi k, k \in Z$

2.(96-3-60) Tenglamani yechimini toping. $\sin x \cdot \cos 2x + \cos x \cdot \sin 2x = 0$

A) $\frac{\pi}{4}n, n \in Z$ B) $\frac{\pi}{3}n, n \in Z$ C) $\frac{\pi}{2}n, n \in Z$ D) $\frac{\pi}{5}n, n \in Z$ E) $\frac{\pi}{8}n, n \in Z$

3.(96-10-28) Tenglamani ildizlarini ko'rsating. $\sin 5x \cdot \cos 2x = \cos 5x \cdot \sin 2x - 1$

A) $\pm \frac{\pi}{3} + 2\pi k, k \in Z$ B) $\frac{\pi}{3} + \frac{2\pi k}{3}, k \in Z$ C) $-\frac{\pi}{6} + \frac{2\pi k}{3}, k \in Z$ D) $\frac{\pi}{4} + \pi k, k \in Z$ E) $\frac{\pi}{6} + \pi k, k \in Z$

4. (97-9-102) k ning quyida ko'rsatilgan qiymatlaridan qaysi birida

$$\cos kx \cdot \cos 4x - \sin kx \cdot \sin 4x = \frac{\sqrt{3}}{2} \text{ tenglamaning ildizlari } \pm \frac{\pi}{60} + \frac{\pi m}{5} \quad (n \in Z) \text{ bo'ladi?}$$

A) 2 B) 3 C) 4 D) 5 E) 6

5. (99-9-34) Tenglamani yeching. $tgx - tg \frac{\pi}{3} - tgx \cdot tg \frac{\pi}{3} = 1$

A) $\frac{7\pi}{6} + \pi k, k \in Z$ B) $\frac{5\pi}{6} + 2\pi k, k \in Z$ C) $\frac{7\pi}{12} + 2\pi k, k \in Z$ D) $\frac{7\pi}{12} + \pi k, k \in Z$ E) $\frac{5\pi}{6} + \pi k, k \in Z$

6. (97-1-51) Tenglamaning eng kichik musbat ildizini toping. $(3 \cos \pi x - \pi)(2 \sin \pi x - \sqrt{3}) = 0$

A) $\pi/6$ B) $1/4$ C) $1/3$ D) $1/2$ E) to'g'ri javob berilmagan

7. (97-6-49) Tenglamaning $(90^0; 180]$ oraliqdagi ildizini toping. $\cos 2x \sin x - \cos 2x = 0$

A) 120^0 B) 135^0 C) 150^0 D) 180^0 E) $\emptyset$

8. (97-8-42) Tenglamani yeching. $tgx \cdot \cos x = 0$

A) $2\pi k, k \in Z$ B) $\pi k, k \in Z$ C) $\frac{\pi}{4} + k\pi; \frac{\pi}{2} + 2k\pi, k \in Z$ D) $\frac{\pi}{2} + k\pi, k \in Z$ E) $\frac{\pi}{2} + k\pi, k \in Z$

9.(98-2-27) Tenglama yechimga ega bo'ladigan b ning barcha qiymatlarini toping.

$$\cos x + \cos(120^0 - x) = b$$

A) $0 \leq b \leq 1$ B) $-1 \leq b \leq 1$ C) $-1 < b < 1$ D) $b \leq 1$ E) $0 < b < 1$

10. (01-7-39) Ushbu $\sin x + \sin 2x + \sin 3x + \sin 4x = 0$ tenglamaning $[0^0; 180^0]$ kesmaga tegishli ildizlari yig'indisini toping.

A) 360^0 B) 450^0 C) 144^0 D) 486^0 E) 524^0

11-laboratoriya ishi. Algebraik tenglamalarga keltiriladigan trigonometrik tenglamalar.

1.(97-1-46) Tenglamani yeching. $2\cos^2(x - \pi) + 3\sin(\pi + x) = 0$

A) $\frac{\pi}{2} + \pi n, n \in \mathbb{Z}$ B) $(-1)^n \frac{\pi}{6} + \pi n, n \in \mathbb{Z}$ C) $\pm \frac{\pi}{3} + 2\pi n, n \in \mathbb{Z}$ D) $\pm \frac{\pi}{6} + 2\pi n, n \in \mathbb{Z}$ E) $\pi n, n \in \mathbb{Z}$

2.(97-1-50) Tenglamaning $(0^0; 90^0]$ oralig'idagi ildizini toping. $2\sin^2 x - \sqrt{3}\sin 2x = 0$

A) 30^0 B) 45^0 C) 60^0 D) 90^0 E) 75^0

3.(97-6-45) Tenglamani yeching. $2\sin^2 x + 5\sin(1,5\pi - x) = 2$

A) $\frac{\pi}{2} + \pi n, n \in \mathbb{Z}$ B) $(-1)^n \frac{\pi}{6} + \pi n, n \in \mathbb{Z}$

C) $\pi n, n \in \mathbb{Z}$ D) $\pi n, n \in \mathbb{Z}$ E) $\pm \frac{\pi}{3} + 2\pi n, n \in \mathbb{Z}$

5. (02-10-61) $4\sin^2 x + \sin 2x = 3$ tenglamani yeching.

A) $-\arctg 3 + k\pi; \frac{\pi}{4} + \pi n, k, n \in \mathbb{Z}$ B) $\pm \frac{\pi}{4} + \pi n, n \in \mathbb{Z}$ C) $(-1)^n \arcsin(\frac{1}{3}) + \pi n, n \in \mathbb{Z}$

D) $\pm \arccos(\frac{1}{3}) + 2\pi n, n \in \mathbb{Z}$ E) $\pm \frac{\pi}{4} + 2\pi n, n \in \mathbb{Z}$

5. (02-11-43) $3\sin^2 2x + 7\cos 2x - 3 = 0$ tenglamaning $(-90^0; 180^0)$ intervalga tegishli ildizlari yig'indisini toping.

A) 90^0 B) 105^0 C) 180^0 D) 135^0 E) 150^0

6. (02-11-44) $\cos 2x + 5\cos x = 6$ tenglamaning $[-4\pi, 4\pi]$ kesmaga tegishli ildizlari yig'indisini toping.

A) 4 B) 5 C) 6 D) 8 E) 9

7. (02-12-40) $1 + \cos 2x - 2\sin^2 x = 1$ tenglamaning $[0; 2\pi]$ kesmadagi ildizlari yig'indisini toping.

A) $3,5\pi$ B) $3\frac{1}{6}\pi$ C) 4π D) $3\frac{1}{3}\pi$ E) $4\frac{1}{6}\pi$

8. (03-3-43) $\cos^2 x + \sin x \cos x = 1$ tenglamaning

$[-320^0; 50^0]$ oralig'iga tegishli ildizlari yig'indisini toping.

A) -535^0 B) -270^0 C) -315^0 D) -240^0 E) -585^0

9. (03-4-25) $1 - \sin x - \cos 2x = 0$ ($x \in [0; 2\pi]$) tenglamani ildizlari yig'indisini toping.

A) $3,5\pi$ B) $4,2\pi$ C) 4π D) $3,8\pi$ E) $4,3\pi$

10. (03-6-65)* $\cos^6 x + \sin^6 x = 4\sin^2 2x$ tenglamani yeching.

A) $\pm \arcsin \frac{\sqrt{2}}{\sqrt{19}} + k\pi, k \in \mathbb{Z}$ B) $\pm \arcsin \frac{2}{\sqrt{17}} + k\pi, k \in \mathbb{Z}$ C) $\pm \arcsin \frac{3}{\sqrt{19}} + k\pi, k \in \mathbb{Z}$

D) $\pm \frac{1}{2} \arcsin \frac{2}{\sqrt{19}} + \frac{k\pi}{2}, k \in \mathbb{Z}$ E) $\pm \frac{1}{2} \arcsin \frac{3}{\sqrt{19}} + \frac{k\pi}{2}, k \in \mathbb{Z}$

12-laboratoriya ishi. Darajani pasaytirish formulalari yordamida yechiladigan trigonometrik tenglamalar

$$\sin^2 x = \frac{1 - \cos 2x}{2} \text{ yoki } 1 - \cos 2x = 2\sin^2 x; \cos^2 x = \frac{1 + \cos 2x}{2} \text{ yoki } 1 + \cos 2x = 2\cos^2 x$$

$$\operatorname{tg} \frac{x}{2} = \frac{1 - \cos x}{\sin x}; \operatorname{ctg} \frac{x}{2} = \frac{1 + \cos x}{\sin x}$$

1. (98-2-26) Tenglamani yeching. $2\cos^2 x - 1 = -\frac{1}{2}$

A) $(-1)^k \frac{\pi}{6} + \frac{\pi}{2}k, k \in \mathbb{Z}$ B) $(-1)^{(k+1)} \frac{\pi}{6} + \pi k, k \in \mathbb{Z}$ C) $\pm \frac{\pi}{6} + \pi k, k \in \mathbb{Z}$ D) $\pm \frac{\pi}{3} + \pi k, k \in \mathbb{Z}$

E) $\pm \frac{2\pi}{3} + \pi k, k \in \mathbb{Z}$

2. (96-9-50) $4\sin \frac{x}{2} + \cos x + 1 = 0$ tenglamaning $[0; 2\pi]$ kesmada nechta ildizi bor?

A) 0 B) 2 C) 3 D) 1 E) 4

3. (99-3-37) Tenglamani yeching. $\sin^2 x + \sin^2 2x = 1$

A) $\frac{\pi}{2} + \pi k, k \in \mathbb{Z}$ B) $\frac{\pi}{6} + \frac{\pi}{3}k, k \in \mathbb{Z}$

C) $\frac{\pi}{2} + 2\pi k, k \in \mathbb{Z}$

D) $\frac{\pi}{12} + \frac{\pi}{6}k, k \in \mathbb{Z}$ E) $\frac{\pi}{4} + \frac{\pi}{2}k, k \in \mathbb{Z}$

4. (99-10-34) Tenglamani yeching. $(1 + \cos x)\operatorname{tg} \frac{x}{2} = 0$

A) $\pi k, k \in \mathbb{Z}$ B) $\pi + 2\pi k, k \in \mathbb{Z}$ C) $2\pi k, k \in \mathbb{Z}$

D) $\pi + \pi k, k \in \mathbb{Z}$ E) $\frac{\pi}{2} + 2\pi k, k \in \mathbb{Z}$

5. (00-2-47) Agar $|a|=1$ bo'lsa, $a \cdot \operatorname{ctgx} - 1 = \cos 2x$ tenglama $[0; 2\pi]$ kesmada nechta ildizga ega bo'ladi?

A) 4 B) 2 C) 3 D) 5 E) 6

6. (01-2-81) Ushbu $7\cos 2x - 6 = \cos 4x$ tenglamaning $[0; 628]$ kesmaga tegishli ildizlari yig'indisini toping.

A) 200π B) 199π C) 20100π D) 1990π E) 19900π

7. (01-2-84) Tenglamani yeching. $3\cos x - 4\sin x = -3$

A) $\arctg \frac{3}{4} + \pi n, n \in \mathbb{Z}$ B) $2\arctg \frac{3}{4} + 2\pi n, n \in \mathbb{Z}$ C) $\pi + 2\pi n, n \in \mathbb{Z}$

D) $\pi + 2\pi n, \arctg \frac{3}{4} + \pi n, n \in \mathbb{Z}$ E) $\pi + 2\pi n, 2\arctg \frac{3}{4} + 2\pi n, n \in \mathbb{Z}$

8. (02-6-43)* $8\cos^6 x = 3\cos 4x + \cos 2x + 4$ tenglamani yeching.

A) $\frac{\pi}{4} + \pi n; \pi n, n \in \mathbb{Z}$ B) $\frac{\pi}{4} + \frac{\pi n}{2}; 2\pi n, n \in \mathbb{Z}$ C) $\frac{\pi}{2} + \pi n; \frac{\pi}{4}, n \in \mathbb{Z}$ D) $\pm \frac{\pi}{4} + 2\pi n; \pi n, n \in \mathbb{Z}$

E) $\frac{\pi}{4} + \frac{\pi n}{2}; \pi n, n \in \mathbb{Z}$

9. (02-6-44) $3\sin 2x - 2\cos 2x = 2$ tenglama $[0; 2\pi]$ kesmada nechta ildizga ega?

A) 5 B) 1 C) 2 D) 3 E) 4

10. (03-10-41) $\sin^2 x + \sin^2 4x = \sin^2 2x + \sin^2 3x$ tenglamani yeching.

A) $\frac{\pi n}{2}, n \in \mathbb{Z}$ B) $\frac{\pi}{5} + \frac{2\pi n}{5}, n \in \mathbb{Z}$ C) $\frac{\pi}{10} + \frac{2\pi n}{5}, n \in \mathbb{Z}$ D) $\frac{\pi n}{2}; \pm \frac{\pi}{3} + \frac{2\pi n}{3}, n \in \mathbb{Z}$ E) $\frac{\pi}{10} + \frac{\pi n}{5}; \frac{\pi n}{2}, n \in \mathbb{Z}$

13-laboratoriya ishi. Trigonometrik tengsizliklar.

1. $\sin x \geq a, -1 \leq a \leq 1 \quad 2n\pi + \arcsin a \leq x \leq -\arcsin a + (2n+1)\pi, n \in \mathbb{Z}$
2. $\sin x \leq a, -1 \leq a \leq 1 \quad 2(n-1)\pi - \arcsin a \leq x \leq \arcsin a + 2n\pi, n \in \mathbb{Z}$
3. $\cos x \geq a, -1 \leq a \leq 1 \quad 2n\pi - \arccos a \leq x \leq \arccos a + 2n\pi, n \in \mathbb{Z}$
4. $\cos x \leq a, -1 \leq a \leq 1 \quad 2n\pi + \arccos a \leq x \leq -\arccos a + (2n+1)\pi, n \in \mathbb{Z}$
5. $\operatorname{tg} x \geq b, \operatorname{arctg} b + n\pi \leq x < \frac{\pi}{2} + n\pi, n \in \mathbb{Z}$
6. $\operatorname{tg} x \leq b, \frac{\pi}{2} + n\pi < x \leq \operatorname{arctg} b + n\pi, n \in \mathbb{Z}$
7. $\operatorname{ctg} x \geq b, n\pi < x \leq \operatorname{atcctg} b + n\pi, n \in \mathbb{Z}$
8. $\operatorname{ctg} x \leq b, \operatorname{atcctg} b + n\pi \leq x < b, n \in \mathbb{Z}$

Misol: (97-6-47) Ushbu $y = \sqrt{2\sin x - 1}$ funktsiyaning aniqlanish sohasini toping.

- A) $\left(-\frac{\pi}{6} + 2\pi m; \frac{\pi}{6} + 2\pi m\right), n \in \mathbb{Z}$ B) $\left[\frac{\pi}{6} + 2\pi m; \frac{5\pi}{6} + 2\pi m\right], n \in \mathbb{Z}$
C) $\left(\frac{\pi}{6} + 2\pi m; \frac{5\pi}{6} + 2\pi m\right), n \in \mathbb{Z}$ D) $\left[-\frac{\pi}{6} + 2\pi m; \frac{\pi}{6} + 2\pi m\right], n \in \mathbb{Z}$
E) $\left[\frac{\pi}{3} + \pi m; \frac{2\pi}{3} + \pi m\right], n \in \mathbb{Z}$

Yechish: $y = \sqrt{2\sin x - 1}$ funktsiya $2\sin x - 1 \geq 0$ bo'lganda aniqlangan. Bu tengsizlikni $\sin x \geq \frac{1}{2}$

ko'rinishda yozamiz.

j: $\left[\frac{\pi}{6} + 2\pi m; \frac{5\pi}{6} + 2\pi m\right], n \in \mathbb{Z}$ (B)

1.(96-9-51) Ushbu $\sin^2 x - \frac{5}{2}\sin x + 1 < 0$ tengsizlik x ($x \in [0; 2\pi]$) ning qanday qiymatlarida o'rinli?

- A) $\left[0; \frac{\pi}{6}\right] \cup \left[\frac{5\pi}{6}; 2\pi\right], n \in \mathbb{Z}$ B) $\left(\frac{\pi}{6}; \frac{5\pi}{6}\right)$
C) $\left(0; \frac{\pi}{3}\right) \cup \left(\frac{2\pi}{3}; 2\pi\right]$ D) $\left[0; \frac{\pi}{3}\right] \cup \left(\frac{2\pi}{3}; 2\pi\right]$ E) $\emptyset$

2.(96-9-105) Tengsizlikni yeching. $2\sin 2x \geq \operatorname{ctg} \frac{\pi}{4}$

- A) $\left(\frac{\pi}{6} + 2\pi m; \frac{5\pi}{6} + 2\pi m\right), n \in \mathbb{Z}$ B) $\left(\frac{\pi}{12} + \pi m; \frac{5\pi}{12} + \pi m\right), n \in \mathbb{Z}$
C) $\left(\frac{\pi}{12} + \pi m; \frac{5\pi}{12} + \pi m\right), n \in \mathbb{Z}$ D) $\left(\frac{\pi}{12} + 2\pi m; \frac{5\pi}{12} + 2\pi m\right), n \in \mathbb{Z}$
E) $\left(-\frac{\pi}{3} + 2\pi m; \frac{\pi}{3} + 2\pi m\right), n \in \mathbb{Z}$

3. (98-2-28) Ushbu $|\sin x + 1| > 1,5$ tengsizlik x ning $(0; \pi)$ kesmaga tegishli qanday qiymatlarida o'rinli bo'ladi?

- A) $\frac{\pi}{6} \leq x \leq \frac{5\pi}{6}$ B) $\frac{\pi}{6} < x < \frac{5\pi}{6}$ C) $\frac{\pi}{3} < x < \frac{2\pi}{3}$ D) $\frac{\pi}{3} \leq x \leq \frac{2\pi}{3}$ E) $0 < x < \frac{\pi}{6}$

4. (98-5-51) Tengsizlikni yeching. $\sin 5x \cos 4x + \cos 5x \sin 4x > \frac{1}{2}$

A) $\frac{\pi}{6} + 2\pi n < x < \frac{5\pi}{6} + 2\pi n, n \in \mathbb{Z}$ B) $\frac{\pi}{54} + 2\pi n < x < \frac{5\pi}{54} + 2\pi n, n \in \mathbb{Z}$

C) $\frac{\pi}{36} + \frac{2\pi n}{9} < x < \frac{5\pi}{36} + \frac{2\pi n}{9}, n \in \mathbb{Z}$ D) $\frac{\pi}{36} + \frac{2\pi n}{9} < x < \frac{5\pi}{54} + \frac{2\pi n}{9}, n \in \mathbb{Z}$

E) $\frac{\pi}{54} + \frac{2\pi n}{9} < x < \frac{5\pi}{54} + \frac{2\pi n}{9}, n \in \mathbb{Z}$

5. (98-8-60) Tengsizlikni yeching. $1 - 2 \sin 4x < \cos^2 4x$

A) $\left(\pi k; \frac{\pi}{2} + \pi k\right), k \in \mathbb{Z}$ B) $\left(-\frac{\pi}{2} + 2\pi k; \frac{\pi}{2} + 2\pi k\right), k \in \mathbb{Z}$ C) $\left(\frac{\pi k}{2}; \frac{\pi}{4} + \frac{\pi k}{2}\right), k \in \mathbb{Z}$

D) $\left(-\frac{\pi}{4} + 2\pi k; \frac{\pi}{4} + 2\pi k\right), k \in \mathbb{Z}$ E) $\left(\frac{\pi}{8} + 2\pi k; \frac{5\pi}{8} + 2\pi k\right), k \in \mathbb{Z}$

6. (96-12-111) x ning qaysi qiymatlarida tengsizlik to'g'ri? ($x \in [0; 2\pi]$)

$$\cos^2 x - \frac{5}{2} \cos x + 1 > 0$$

A) $\left[0; \frac{\pi}{3}\right) \cup \left(\frac{5\pi}{3}; 2\pi\right]$ B) $\left(\frac{\pi}{3}; \frac{\pi}{2}\right] \cup \left[\frac{3\pi}{2}; \frac{5\pi}{3}\right)$ C) $\left(\frac{\pi}{3}; \frac{5\pi}{3}\right)$ D) $\left(\frac{\pi}{3}; \frac{\pi}{2}\right]$ E) $\left[\frac{3\pi}{2}; \frac{5\pi}{3}\right)$

7. (98-1-60) Tengsizlikni yeching. $1 - 2 \cos 2x > \sin^2 2x$

A) $\left(\frac{\pi}{2} + \pi k; \pi + 2\pi k\right), k \in \mathbb{Z}$ B) $\left(\frac{\pi}{3} + 2\pi k; \frac{2\pi}{3} + 2\pi k\right), k \in \mathbb{Z}$

C) $\left(\frac{\pi}{4} + 2\pi k; \frac{3\pi}{4} + 2\pi k\right), k \in \mathbb{Z}$ D) $\left(-\frac{\pi}{2} + 2\pi k; \frac{\pi}{2} + 2\pi k\right), k \in \mathbb{Z}$ E)

$\left(-\frac{\pi}{3} + 2\pi k; \frac{\pi}{3} + 2\pi k\right), k \in \mathbb{Z}$

8. (98-6-55) Ushbu $\cos 2x \leq -\frac{1}{2}$ tengsizlikning $[0; \pi]$ kesmadagi yechimini toping.

A) $\left[\frac{\pi}{3}; \frac{2\pi}{3}\right]$ B) $\left[0; \frac{2\pi}{3}\right]$ C) $\left[-\frac{2\pi}{3}; \frac{4\pi}{3}\right]$ D) $\left[\frac{4\pi}{3}; 2\pi\right]$ E) $\left[\frac{2\pi}{3}; \frac{4\pi}{3}\right]$

9. (00-6-56) Tengsizlikni yeching. $\cos x < \sin x$

A) $\left(\frac{\pi}{4} + \pi k; \frac{3\pi}{4} + \pi k\right), k \in \mathbb{Z}$ B) $\left(\frac{\pi}{4} + \pi k; \frac{5\pi}{4} + \pi k\right), k \in \mathbb{Z}$ C) $\left(\frac{\pi}{4} + 2\pi k; \frac{3\pi}{4} + 2\pi k\right), k \in \mathbb{Z}$ D) $(2\pi k; \pi + 2\pi k), k \in \mathbb{Z}$

E) $\left(\frac{\pi}{4} + \pi k; \frac{5\pi}{4} + \pi k\right), k \in \mathbb{Z}$

10. (96-1-59) Tengsizlikni yeching. $\operatorname{tg}\left(x + \frac{\pi}{4}\right) \geq 1$

A) $\left[-\frac{\pi}{4} + \pi k; \frac{\pi}{2} + \pi k\right], k \in \mathbb{Z}$ B) $[\pi k; \infty], k \in \mathbb{Z}$ C) $\left[\frac{\pi}{4} + 2\pi k; \frac{\pi}{2} + 2\pi k\right], k \in \mathbb{Z}$ D) $\left[\pi k; \frac{\pi}{4} + \pi k\right], k \in \mathbb{Z}$

E) $\left[\frac{\pi}{4} + \pi k; \frac{\pi}{2} + \pi k\right], k \in \mathbb{Z}$

14-laboratoriya ishi. Arkfunksiya qantnashgan tenglama va tengsizliklar .

1. $\arcsin x + \arccos x = \frac{\pi}{2}, x \in [-1; 1]$

2. $\arcsin a > \arcsin b \Leftrightarrow \begin{cases} a > b \\ b \geq -1 \\ a \leq 1 \end{cases}; \quad \arccos a > \arccos b \Leftrightarrow \begin{cases} a < b \\ b \geq -1 \\ b \leq 1 \end{cases}$

3. $\arctg a > \arctg b \Leftrightarrow a > b; \quad \operatorname{arcctg} a > \operatorname{arcctg} b \Leftrightarrow a < b$

Misol: (98-6-51) Tengsizlikni yeching. $\arcsin x < \arcsin(1-x)$

A) $[0; \frac{1}{2})$ B) $[-1; 1]$ C) $[-\infty; \frac{1}{2}]$ D) $[0; 2]$ E) $\emptyset$

Yechish: $y = \arcsin x, -1 \leq x \leq 1$ funktsiya o'suvchi ekanligi ma'lum. U holda berilgan tengsizlik

quyidagi $\begin{cases} x < 1-x \\ -1 \leq x \leq 1 \\ -1 \leq 1-x \leq 1 \end{cases}$ sistemaga ekvivalent bo'ladi. Uni yechamiz $\begin{cases} 2x < 1 \\ -1 \leq x \leq 1 \\ 0 \leq x \leq 2 \end{cases}$ Demak, $0 \leq x < \frac{1}{2}$

j: $[0; \frac{1}{2})$ (A)

1.(98-6-53) Tenglamaning eng kichik musbat ildizini toping. $\arcsin(2 \sin x) = \frac{\pi}{2}$

A) $1/3$ B) $5\pi/6$ C) $1/2$ D) $\pi/6$ E) $2/\pi$

2.(98-11-30) Tenglamaning yechimi nechta? $\arctg |x| = -\frac{\pi}{6}$

A) 1 B) $\emptyset$ C) 2 D) cheksiz ko'p E) 3

3.(98-11-74) Tengsizlikni yeching. $\arccos x > \arccos x^2$

A) $(0; 1)$ B) $[-1; 0)$ C) $[-1; 1]$ D) $(-\infty; 0) \cup (1; \infty)$ E) $(1; \infty)$

4. (99-5-26) Agar $4 \arcsin x + \arccos x = \pi$ bo'lsa, $3x^2$ ning qiymatini hisoblang.

A) 0 B) 1 C) 3 D) 0,75 E) 1,5

5. (00-1-33) Tenglamaning ildizlari yig'indisini toping. $2(\arccos x)^2 + \pi^2 = 3\pi \arccos x$

A) $\sqrt{2}/2$ B) -1 C) 1 D) $-\sqrt{2}/2$ E) $-1/2$

6. (01-4-4) Ushbu $\arccos^2 x - \frac{5\pi}{6} \arccos x + \frac{\pi^2}{6} \leq 0$ tengsizlik o'rinli bo'ladigan kesmaning o'rtasini toping.

A) 0,5 B) 0,4 C) 0,25 D) $\pi/4$ E) $\pi/2$

7. (01-5-18) Ushbu $x \cdot \arctg x = 1$ tenglama nechta ildizga ega?

A) 2 B) 1 C) 0 D) 3 E) 4

8. (01-5-19) Ushbu $\cos(10 \arctg x) = 1$ tenglama nechta ildizga ega?

A) 5 B) cheksiz ko'p C) 1 D) 3 E) ildizga ega emas

9. (01-9-14) Ushbu $4 \arctg(x^2 - 3x + 3) - \pi = 0$ tenglama ildizlarining ko'paytmasini toping.

A) 2 B) 3 C) -3 D) 1 E) 0

10. (01-12-21) Tengsizlikni yeching. $\arcsin x < \sqrt{x^2 - 1}$

A) $\{1\}$ B) $\{-1\}$ C) $\{-1; 1\}$ D) $(0; \pi/2]$ E) $[-\pi/2; 0)$

15-laboratoriya ishi. Trigonometrik funktsiyalar va ularning xossalari.

1. $y = \sin x$ va $y = \cos x$ funktsiyalarning eng kichik musbat davri 2π ga teng.
2. $y = \operatorname{tg} x$ va $y = \operatorname{ctg} x$ funktsiyalarning eng kichik musbat davri π ga teng.
3. $y = \cos x$ juft funktsiya, $y = \sin x$, $y = \operatorname{tg} x$ va $y = \operatorname{ctg} x$ -toq funktsiyalar.
1. $y = \sin x$ funktsiya $[-\frac{\pi}{2}; \frac{\pi}{2}]$ oraliqda o'suvchi
2. $y = \cos x$ funktsiya $[0; \pi]$ oraliqda kamayuvchi
3. $y = \operatorname{tg} x$ funktsiya $(-\frac{\pi}{2}; \frac{\pi}{2})$ oraliqda o'suvchi
4. $y = \operatorname{ctg} x$ funktsiya $(0; \pi)$ oraliqda kamayuvchi
5. $y = \sin x$ va $y = \cos x$ funktsiyalarning qiymatlari sohasi $[-1; 1]$ oraliqdan iborat
6. $y = \operatorname{tg} x$ va $y = \operatorname{ctg} x$ funktsiyalarning qiymatlari sohasi $(-\infty; \infty)$ oraliqdan iborat
- 1.(96-9-48) Ushbu $y = \operatorname{tg} \frac{x}{3} - 2 \sin \frac{x}{2} + 3 \cos \frac{2}{3} x$ funktsiyaning eng kichik davrini toping.
A) 4π B) 6π C) 3π D) 12π E) 15π
- 2.(03-10-43)* $y = \sin^6 x + \cos^6 x$ funktsiyaning eng kichik musbat davrini aniqlang.
A) 2π B) π C) $\pi/2$ D) $\pi/4$ E) $\pi/3$
3. (98-8-37) Quyidagi funktsiyalardan qaysi biri toq?
A) $f(x) = x^4 \cos \frac{x}{2}$ B) $f(x) = |x \operatorname{ctg} x|$ C) $f(x) = \sin 2x \operatorname{tg} \frac{x}{3}$ D) $f(x) = |x| \operatorname{ctg} x$ E) $f(x) = e^{x^2}$
4. (96-7-57) Ushbu $x = \cos \frac{11\pi}{12}$, $y = \cos(-\frac{\pi}{3})$, $z = \sin \frac{11\pi}{12}$ sonlar uchun quyidagi munosabatlarning qaysi biri ʻrinli?
A) $x < y < z$ B) $x < z < y$ C) $y < z < x$ D) $z < y < x$ E) $y < x < z$
- 5.(98-11-98) Quyidagi sonlarning eng kattasini toping.
A) $\sin 170^\circ$ B) $\sin 20^\circ$ C) $\sin(-30^\circ)$ D) $\sin(-250^\circ)$ E) $\sin 100^\circ$
6. (98-12-57)* $m = \sin 75^\circ$, $n = \cos 75^\circ$, $p = \operatorname{tg} 75^\circ$, $q = \operatorname{ctg} 75^\circ$ sonlarini kamayish tartibida yozing.
A) $p > m > q > n$ B) $p > m > n > q$ C) $p > n > m > q$ D) $m > p > q > n$ E) $q > p > m > n$
7. (97-8-31) $\sin^2 \alpha + 2 \cos^2 \alpha$ ning eng katta qiymatini toping.
A) 1,2 B) 1,4 C) 1,6 D) 2 E) 1,8
8. (00-5-71) Funktsiyaning qiymatlar sohasini toping. $y = \operatorname{ctg} x \cdot \operatorname{ctg}\left(\frac{\pi}{2} + x\right) + \frac{\operatorname{tg} x \cdot (1 + \cos 2x)}{2 \cos x}$
A) $[-2; 0]$ B) $(-2; -1) \cup (-1; 0)$ C) $(-2; 0)$ D) $[-2; 1) \cup (-1; 0]$ E) $[0; 2]$
- 9.(03-11-15) $y = \sin(\sin x)$ funktsiyaning qiymatlar to'plamini aniqlang.
A) $\sin 1$ B) 1 C) $1/2$ D) $\arcsin 1$ E) $\pi/2$
- 10.(03-11-80)* $y = \sin^4 2x + \cos^4 2x$ funktsiyaning eng katta qiymatini ko'rsating.
A) 2 B) 1,5 C) 1 D) 0,5 E) 0,75

16-laboratoriya ishi. Teskari trigonometrik funksiyalar xossalari.

1. $y = \arcsin x$ funktsiyaning aniqlanish sohasi $[-1; 1]$; qiymatlar sohasi esa $[-\pi/2; \pi/2]$.
 $y = \arcsin x$ funktsiya $[-1; 1]$ da o'suvchi
 2. $y = \arccos x$ funktsiyaning aniqlanish sohasi $[-1; 1]$ qiymatlar sohasi esa $[0; \pi]$.
 $y = \arccos x$ funktsiya $[-1; 1]$ da kamayuvchi.
 3. $y = \arctg x$ funktsiyaning aniqlanish sohasi $(-\infty; \infty)$ qiymatlar sohasi esa $(-\pi/2; \pi/2)$
 $y = \arctg x$ funktsiya $(-\infty; \infty)$ da o'suvchi
 4. $y = \text{arcctg} x$ funktsiyaning aniqlanish sohasi $(-\infty; \infty)$ qiymatlar sohasi esa $(0; \pi)$
 $y = \text{arcctg} x$ funktsiya $(-\infty; \infty)$ da kamayuvchi.
 5. $y = \arcsin x$ va $y = \arctg x$ - toq funksiyalar, $y = \arccos x$ va $y = \text{arcctg} x$ - funksiyalar esa juft ham emas, toq ham emas.
-
1. (99-8-35) Ushbu $y = \arcsin x + \frac{\pi}{2}$ funktsiyaning qiymatlari to'plamini toping.
A) $[0; \pi]$ B) $[-\pi/2; \pi/2]$ C) $[\frac{\pi}{2}-1; \frac{\pi}{2}+1]$ D) $(0; \frac{\pi}{2}]$ E) $(0; \pi)$
 2. (03-5-33) $y = 4 + \frac{16}{\pi} \arcsin(3x - 2)$ funktsiyaning eng kichik qiymatini toping.
A) -4 B) 4 C) -2 D) 0 E) -6
 3. (03-5-36) Nechta butun son $y = \arcsin \frac{2x-5}{3}$ funktsiyaning aniqlanish sohasiga tegishli?
A) 4 B) 3 C) 2 D) 1 E) 5
 4. (03-6-62) $2x = \arcsin \frac{2}{2 + \sin x}$ funktsiyaning aniqlanish sohasini toping.
A) $-\pi + 2\pi k \leq x \leq \pi + 2\pi k, k \in Z$ B) $x \leq \pi + 2\pi k, k \in Z$ C) $x > 2\pi k, k \in Z$
D) $2\pi k \leq x \leq \pi/2 + 2\pi k, k \in Z$ E) $2\pi k \leq x \leq \pi + 2\pi k, k \in Z$
 5. (00-9-61) Ushbu $y = \arcsin \sqrt[4]{3-2x-x^2}$ Funktsiyaning aniqlanish sohasiga tegishli butun sonlar nechta?
A) 1 B) 2 C) 3 D) 4 E) 5
 6. (98-6-49) Ushbu $x = \arccos 0,9$; $y = \arccos(-0,7)$ va $z = \arccos(-0,2)$ sonlarni o'sib borish tartibida yozing.
A) $y < z < x$ B) $x < y < z$ C) $y < x < z$ D) $x < z < y$ E) $z < y < x$
 7. (02-4-36) $y = (x-2) \arcsin x$ funktsiyaning grafigining Ox o'qi bilan kesishish nuqtasi abstsissasining eng kichik qiymatini toping.
A) -2 B) -1 C) 0 D) 1 E) 2
 8. (02-7-5) $y = \arcsin(3x-7)$ funktsiyaning aniqlanish sohasiga tegishli x ning butun qiymatlari nechta?
A) 2 B) 3 C) 1 D) -1 E) -2
 9. (03-5-33) $y = 4 + \frac{16}{\pi} \arcsin(3x - 2)$ funktsiyaning eng kichik qiymatini toping.
A) -4 B) 4 C) -2 D) 0 E) -6
 10. (03-6-62) $2x = \arcsin \frac{2}{2 + \sin x}$ funktsiyaning aniqlanish sohasini toping.
A) $-\pi + 2\pi k \leq x \leq \pi + 2\pi k, k \in Z$ B) $x \leq \pi + 2\pi k, k \in Z$ C) $x > 2\pi k, k \in Z$
D) $2\pi k \leq x \leq \pi/2 + 2\pi k, k \in Z$ E) $2\pi k \leq x \leq \pi + 2\pi k, k \in Z$