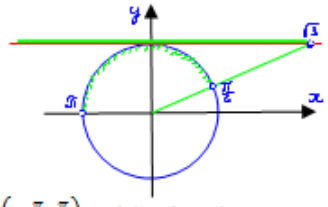
# Triqonometrik tənliklər və bərabərsizliklər

**1.** $ctg\,x < \sqrt{3}$ bərabərsizliyinin $(0;\pi)$ aralığından olan həllərini tapın.

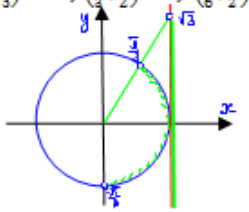
A) $\left(\frac{\pi}{6};\pi\right)$ B) $\left(\frac{\pi}{6};\frac{\pi}{3}\right)$ C) $\left(0;\frac{\pi}{6}\right)$ D) $\left(0;\frac{\pi}{3}\right)$ E) $\left(\frac{\pi}{3};\pi\right)$



$\left(\frac{\pi}{6};\pi\right)$

**2.** $tgx < \sqrt{3}$ bərabərsizliyinin $\left(-\frac{\pi}{2};\frac{\pi}{2}\right)$ aralığından olan həllərini tapın.

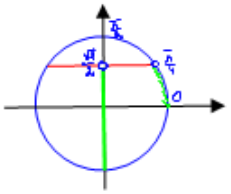
A) $\left(-\frac{\pi}{2};\frac{\pi}{3}\right)$ B) $\left(-\frac{\pi}{2};\frac{\pi}{6}\right)$ C) $\left(\frac{\pi}{6};\frac{\pi}{3}\right)$ D) $\left(\frac{\pi}{3};\frac{\pi}{2}\right)$ E) $\left(\frac{\pi}{6};\frac{\pi}{2}\right)$



$\left(-\frac{\pi}{2};\frac{\pi}{3}\right)$

**3.** $\sin x < \frac{\sqrt{2}}{2}$ bərabərsizliyinin $\left[0;\frac{\pi}{2}\right]$ aralığından olan həllərini tapın.

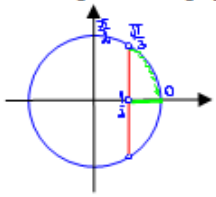
A) $\left[0;\frac{\pi}{4}\right)$ B) $\left[0;\frac{\pi}{4}\right]$ C) $\left[\frac{\pi}{4};\frac{\pi}{2}\right]$ D) $\left(\frac{\pi}{4};\frac{\pi}{2}\right)$ E) $\left[0;\frac{\pi}{2}\right]$



$\left[0;\frac{\pi}{4}\right)$

**4.** $\cos x > \frac{1}{2}$ bərabərsizliyinin $\left[0;\frac{\pi}{2}\right]$ aralığından olan həllərini tapın.

A) $\left[0;\frac{\pi}{3}\right)$ B) $\left[0;\frac{\pi}{3}\right]$ C) $\left(\frac{\pi}{3};\frac{\pi}{2}\right)$ D) $\left[0;\frac{\pi}{6}\right)$ E) $\left(\frac{\pi}{6};\frac{\pi}{3}\right)$



$\left[0;\frac{\pi}{3}\right)$

**5.** Tənliyi həll edin: $\sin^2 x + \sqrt{2}\sin x = 0$.

A) $2\pi k, k \in Z$ B) $\pi$ C) $\pi k, k \in Z$

D) $0$ E) $\frac{\pi}{2} + 2\pi k, k \in Z$

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

1) $\sin x = 0$ $x = \pi k, k \in Z$.

2) $\sin x + \sqrt{2} = 0$ $\sin x = -\sqrt{2} < -1$ $\emptyset$

**6.** **Tənliyi həll edin: $\cos^2 x + \sqrt{2}\cos x = 0$.**

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

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

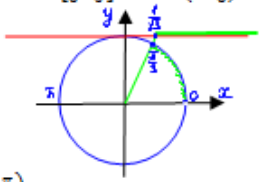
$\cos x\left(\cos x + \sqrt{2}\right) = 0$

1) $\cos x = 0$ $x = \frac{\pi}{2} + \pi k, k \in Z$.

2) $\cos x + \sqrt{2} = 0$ $\cos x = -\sqrt{2} < 0$ $\emptyset$

**7.** $ctg\,x \geq \frac{1}{\sqrt{3}}$ bərabərsizliyinin $(0;\pi)$ aralığından olan həllərini tapın.

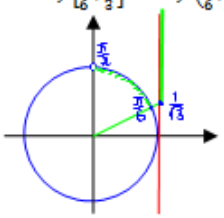
A) $\left(0;\frac{\pi}{3}\right]$ B) $\left(0;\frac{\pi}{3}\right)$ C) $\left[\frac{\pi}{3};\pi\right)$ D) $\left[\frac{\pi}{6};\frac{\pi}{3}\right]$ E) $\left(0;\frac{\pi}{6}\right)$



$\left(0;\frac{\pi}{3}\right]$

**8.** $tgx \geq \frac{1}{\sqrt{3}}$ bərabərsizliyinin $\left(-\frac{\pi}{2};\frac{\pi}{2}\right)$ aralığından olan həllərini tapın.

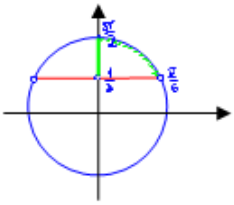
A) $\left[\frac{\pi}{6};\frac{\pi}{2}\right)$ B) $\left(-\frac{\pi}{2};\frac{\pi}{6}\right]$ C) $\left(-\frac{\pi}{2};\frac{\pi}{3}\right]$ D) $\left[\frac{\pi}{6};\frac{\pi}{3}\right]$ E) $\left(\frac{\pi}{6};\frac{\pi}{2}\right)$



$\left[\frac{\pi}{6};\frac{\pi}{2}\right)$

**9.** $\sin x > \frac{1}{2}$ bərabərsizliyinin $\left[0;\frac{\pi}{2}\right]$ aralığına daxil olan həllərini tapın.

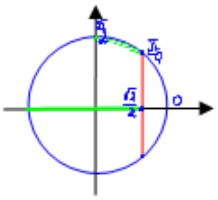
A) $\left[0;\frac{\pi}{6}\right)$ B) $\left(\frac{\pi}{6};\frac{\pi}{3}\right)$ C) $\left(\frac{\pi}{6};\frac{\pi}{2}\right)$ D) $\left(\frac{\pi}{6};\frac{\pi}{2}\right]$ E) $\left(\frac{\pi}{6};\pi\right]$



$\left(\frac{\pi}{6};\frac{\pi}{2}\right]$

**10.** $\cos x \leq \frac{\sqrt{2}}{2}$ bərabərsizliyinin $\left[0;\frac{\pi}{2}\right]$ aralığına daxil olan həllərini tapın.

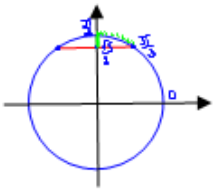
A) $\left[\frac{\pi}{4};\frac{\pi}{2}\right]$ B) $\left(\frac{\pi}{4};\frac{\pi}{2}\right]$ C) $\left(\frac{\pi}{4};\frac{\pi}{2}\right)$ D) $\left[\frac{\pi}{3};\frac{\pi}{2}\right]$ E) $\left[0;\frac{\pi}{2}\right]$



$\left[\frac{\pi}{4};\frac{\pi}{2}\right]$

**11.** $\sin x \geq \frac{\sqrt{3}}{2}$ bərabərsizliyinin $\left[0;\frac{\pi}{2}\right]$ aralığına daxil olan həllərini tapın.

A) $\left[\frac{\pi}{3};\frac{\pi}{2}\right]$ B) $\left(\frac{\pi}{3};\frac{\pi}{2}\right]$ C) $\left(\frac{\pi}{6};\frac{\pi}{2}\right]$ D) $\left[0;\frac{\pi}{3}\right)$ E) $\left(\frac{\pi}{6};\frac{\pi}{3}\right)$



$\left[\frac{\pi}{3};\frac{\pi}{2}\right]$

**12.** Aşağıdakı ədədlərdən hansı $tgx > \sqrt{3}$ bərabərsizliyini ödəyir?

A) $\frac{\pi}{3}$ B) $3$ C) $3,14$ D) $1,1$ E) $1$

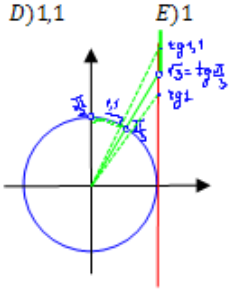
A) $tg\frac{\pi}{3} = \sqrt{3} > \sqrt{3}$ —

B) $tg3 \approx tg\,3,573^\circ = tg\,171,9^\circ < 0$ —

C) $tg\,3,14 \approx tg\,180^\circ = 0$ —

D) $tg\,1,1 \approx tg\,63,03^\circ > \sqrt{3}$ +

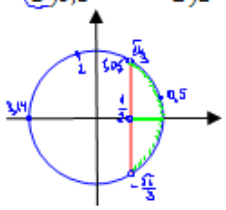
E) $tg\,1 \approx tg\,57,3^\circ < \sqrt{3}$



# Triqonometrik tənliklər və bərabərsizliklər

**13.** Aşağıdakı ədədlərdən hansı $\cos x > \frac{1}{2}$ bərabərsizliyini ödəyir?

A) $\frac{\pi}{3}$ B) 3,14 C) 1,07 D) 0,5 E) 2




**14.** Tənliyi həll edin: $\sin x \cdot \cos x + 2\cos x = 0$.

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

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

1) $\cos x = 0$ 2) $\sin x + 2 = 0$
$x = \frac{\pi}{2} + \pi n, n \in Z$. $\sin x = -2 < -1$.
$\emptyset$

**15.** Tənliyi həll edin: $\sin x \cdot \cos x + 2\sin x = 0$.

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

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

1) $\sin x = 0$ 2) $\cos x + 2 = 0$
$x = \pi n, n \in Z$. $\cos x = -2 < -1$
$\emptyset$

**16.** Tənliyi həll edin: $4\sin x \cdot \cos x = 1$.

A) $(-1)^k \frac{\pi}{6} + \pi k, k \in Z$ B) $(-1)^k \frac{\pi}{3} + \pi k, k \in Z$
C) $(-1)^k \frac{\pi}{12} + \frac{\pi k}{2}, k \in Z$ D) $(-1)^{k+1} \frac{\pi}{6} + \pi k, k \in Z$
E) $(-1)^{k+1} \frac{\pi}{3} + \pi k, k \in Z$

$2 \cdot 2\sin x \cdot \cos x = 1$
$2\sin 2x = 1$
$\sin 2x = \frac{1}{2}$
$2x = (-1)^k \frac{\pi}{6} + \pi k, k \in Z$.
$x = (-1)^k \frac{\pi}{12} + \frac{\pi}{2} k, k \in Z$.

**17.** Tənliyi həll edin: $\sin 2x \cos 3x = \sin 3x \cos 2x$.

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

$\sin 3x \cos 2x - \sin 2x \cos 3x = 0$
$\sin(3x - 2x) = 0$
$\sin x = 0$
$x = \pi k, k \in Z$.

**18.** Tənliyi həll edin: $\sin 2x \sin 5x = \cos 2x \cos 5x$.

A) $\frac{\pi}{14} + \frac{\pi k}{7}, k \in Z$ B) $\frac{\pi}{14} + \pi k, k \in Z$
C) $\frac{\pi}{7} + \frac{\pi k}{7}, k \in Z$ D) $\frac{\pi}{2} + \pi k, k \in Z$
E) $\frac{\pi}{14} + \frac{2\pi k}{7}, k \in Z$

$\cos 2x \cdot \cos 5x - \sin 2x \sin 5x = 0$
$\cos(2x + 5x) = 0$
$\cos 7x = 0$
$7x = \frac{\pi}{2} + \pi k$
$x = \frac{\pi}{14} + \frac{\pi k}{7}, k \in Z$.

**19.** Tənliyi həll edin: $\cos\left(x + \frac{\pi}{4}\right) = 1$.

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

$x + \frac{\pi}{4} = 2\pi k$
$x = -\frac{\pi}{4} + 2\pi k, k \in Z$.

**20.** Tənliyi həll edin: $5\sin x - \sin^5 x = 0$.

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

$\sin x (5 - \sin^4 x) = 0$

1) $\sin x = 0$ 2) $5 - \sin^4 x = 0$
$x = \pi k, k \in Z$. $\sin^4 x = 5$
$\emptyset$

**21.** Tənliyi həll edin: $6\cos x + \cos^5 x = 0$.

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

$\cos x (6 + \cos^4 x) = 0$

1) $\cos x = 0$ 2) $6 + \cos^4 x = 0$
$x = \frac{\pi}{2} + \pi k, k \in Z$. $\cos^4 x = -6$
$\emptyset$

**22.** Tənliyi həll edin: $3\sin^2 x + \cos x + 1 = 0$.

A) $(2k + 1)\pi, k \in Z$ B) $\frac{\pi}{2} + 2\pi k, k \in Z$ C) $\pi k, k \in Z$
D) $2\pi k, k \in Z$ E) $\frac{\pi}{2} + \pi k, k \in Z$

$3(1 - \cos^2 x) + \cos x + 1 = 0$, $\cos x = t$ qəbul etsək
$3 \cdot (1 - t^2) + t + 1 = 0$
$3 - 3t^2 + t + 1 = 0$
$3t^2 - t - 4 = 0$
$D = 1 + 48 = 49$
$t = \frac{1 \pm 7}{6}$
$t_1 = -1$
$t_2 = \frac{4}{3} > 1$ k.k.

$\cos x = -1$
$x = \pi + 2\pi k, k \in Z$.
$x = \pi(1 + 2k), k \in Z$.

# Triqonometrik tənliklər və bərabərsizliklər

**23.** Tənliyi həll edin: $\cos 4x = \frac{\sqrt{2}}{2}$.

A) $\pm\frac{\pi}{4} + 2\pi k, k \in Z$  B) $\pm\frac{\pi}{8} + 2\pi k, k \in Z$

(C) $\pm\frac{\pi}{16} + \frac{\pi k}{2}, k \in Z$  D) $\frac{\pi}{2} + 2\pi k, k \in Z$  E) $-\frac{\pi}{2} + 2\pi k, k \in Z$

$4x = \pm \arccos\frac{\sqrt{2}}{2} + 2\pi k,\ k \in Z.$

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

$x = \pm\frac{\pi}{16} + \frac{\pi k}{2},\ k \in Z.$

**24.** Tənliyi həll edin: $\cos^2 x + 3\sin x = 3.$

A) $\frac{\pi}{2} + 2\pi k, (-1)^k \arcsin 2 + \pi k; k \in Z$

B) $(-1)^k \arcsin 2 + \pi k; k \in Z$  C) $-\frac{\pi}{2} + 2\pi k; k \in Z$

(D) $\frac{\pi}{2} + 2\pi k; k \in Z$  E) $\pi(2k+1); k \in Z$

$(1-\sin^2 x) + 3\sin x = 3,$  $\sin x = t$

$1 - t^2 + 3t = 3$

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

$t_1 = 1$

$t_2 = 2$ k.k

$\sin x = 1$

$x = \frac{\pi}{2} + 2\pi k,\ k \in Z.$

**25.** Tənliyi həll edin: $2\sin^2 x = 3\cos x.$

A) $2\pi k \pm \frac{\pi}{3};\ \pm\arccos(-2) + 2\pi k; k \in Z$

B) $\pi k \pm \frac{\pi}{3}; k \in Z$  (C) $2\pi k \pm \frac{\pi}{3}; k \in Z$

D) $\pm\arccos(-2) + 2\pi k; k \in Z$  E) $\pi k \pm \frac{2\pi}{3}; k \in Z$

$2(1-\cos^2 x) = 3\cos x,$  $\cos x = t$

$2(1-t^2) = 3t$

$2 - 2t^2 = 3t$

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

$D = 9 + 16 = 25$

$t = \frac{-3 \pm 5}{4}$

$t_1 = -2$ k.k  $t_2 = \frac{1}{2}$

$\cos x = \frac{1}{2}$

$x = \pm\frac{\pi}{3} + 2\pi k,$

**26.** Tənliyi həll edin: $6\cos^2 x - \cos 2x = 5.$

(A) $\pi k, k \in Z$  B) $2\pi k, k \in Z$  C) $(2k-1)\pi, k \in Z$

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

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

$6\cos^2 x - (2\cos^2 x - 1) = 5$

$6\cos^2 x - 2\cos^2 x + 1 = 5$

$4\cos^2 x = 4$

$\cos^2 x = 1$

$\cos x = \pm 1$

$x = \pi k,\ k \in Z.$

**27.** Tənliyi həll edin: $4\cos^2 x + \cos 2x = 5.$

A) $2\pi k, k \in Z$  B) $(2k+1)\pi, k \in Z$  (C) $\pi k, k \in Z$

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

$4\cos^2 x + 2\cos^2 x - 1 = 5$

$6\cos^2 x = 6$

$\cos^2 x = 1$

$\cos x = \pm 1$

$x = \pi k,\ k \in Z.$

**28.** Tənliyi həll edin: $4\sin^2 x - \cos 2x = 5.$

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

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

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

$4\sin^2 x - (1 - 2\sin^2 x) = 5$

$4\sin^2 x - 1 + 2\sin^2 x = 5$

$6\sin^2 x = 6$

$\sin^2 x = 1$

$\sin x = \pm 1$

$x = \frac{\pi}{2} + \pi k,\ k \in Z.$

**29.** Tənliyi həll edin: $\cos 2x - \cos 6x = 0.$

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

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

$-2\sin\frac{2x+6x}{2} \cdot \sin\frac{2x-6x}{2} = 0$

$\sin 4x \cdot \sin 2x = 0$

1) $\sin 4x = 0$

$4x = \pi k$

$x = \frac{\pi k}{4}, k \in Z$

2) $\sin 2x = 0$

$2x = \pi k$

$x = \frac{\pi k}{2},\ k \in Z.$

$\frac{\pi k}{4}$ ümumi həll olduğundan $x = \frac{\pi k}{4}, k \in Z$

**30.** Tənliyi həll edin: $2\sin^2 x + \cos x + 1 = 0.$

A) $-\frac{\pi}{2} + 2\pi k, k \in Z$  B) $2\pi k, \pm\arccos\left(-\frac{3}{2}\right) + 2\pi k, k \in Z$

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

$2(1-\cos^2 x) + \cos x + 1 = 0,$  $\cos x = t$

$2(1-t^2) + t + 1 = 0$

$2 - 2t^2 + t + 1 = 0$

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

$D = 1 + 24 = 25$

$t = \frac{1 \pm 5}{4}$

$t_1 = \frac{3}{2}$ k.k.  $t_2 = -1$

$\cos x = -1$

$x = \pi + 2\pi k, k \in Z.$

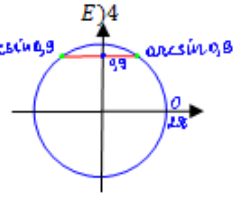
**31.** $\sin x = 0{,}9$ tənliyinin $[0; 2\pi]$ parçasında neçə həlli vardır?

A) $\varnothing$  B) 1  (C) 2  D) 3  E) 4

$x_1 = \arcsin 0{,}9$

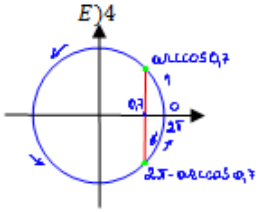
$x_2 = \pi - \arcsin 0{,}9$

} 2 həlli var.




**32.** $\cos x = 0{,}7$ tənliyinin $[0; 2\pi]$ parçasında neçə həlli vardır?

A) $\varnothing$  B) 1  C) 2  D) 3  E) 4




**33.** Tənliyi həll edin: $\sin 2x \cdot \sin 4x = 0.$

(A) $\frac{\pi n}{4}; n \in Z$  B) $\frac{\pi n}{2}; n \in Z$  C) $\frac{\pi}{2}$; və $\frac{\pi}{4}$

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

1) $\sin 2x = 0$

$2x = \pi n$

$x = \frac{\pi n}{2}, n \in Z$

2) $\sin 4x = 0$

$4x = \pi n$

$x = \frac{\pi n}{4}, n \in Z$

$x = \frac{\pi n}{4}, n \in Z$ daha ümumi həlldir.

# Triqonometrik tənliklər və bərabərsizliklər

**34.** Tənliyi həll edin: $tg\,x \cdot tg\,2x = 0$.

(A) $\pi n, n \in Z$ B) $\pi$; və $\frac{\pi}{2}$ C) $\frac{\pi n}{2}; n \in Z$

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

$\frac{\sin x}{\cos x} \cdot \frac{\sin 2x}{\cos 2x} = 0$

$\frac{\sin x \cdot 2\sin x \cdot \cos x}{\cos x \cdot \cos 2x} = 0$

$\sin x = 0 \qquad \cos 2x \neq 0$

$x = \pi n,\ n \in Z$

**35.** Tənliyi həll edin: $\sin^2 3x + \cos^2 3x = \cos 3x$.

(A) $\frac{2\pi k}{3}; k \in Z$ B) $\frac{\pi k}{3}; k \in Z$ C) $\pm\frac{\pi}{6} + \frac{2\pi k}{3}, k \in Z$

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

$1 = \cos 3x$

$\cos 3x = 1$

$3x = 2\pi k$

$x = \frac{2\pi k}{3},\ k \in Z$

**36.** Tənliyi həll edin: $\sin^2 2x + \cos^2 2x = \sin 2x$.

(A) $\frac{\pi}{4} + \pi k, k \in Z$ B) $\frac{\pi}{4} + 2\pi k, k \in Z$ C) $\frac{\pi}{2} + 2\pi k, kZ$

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

$\sin 2x = 1$

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

$x = \frac{\pi}{4} + \pi k,\ k \in Z.$

**37.** Tənliyi həll edin: $tg\,5x = 0$.

A) $\frac{2\pi k}{5}, k \in Z$ B) $\frac{3\pi k}{5}, k \in Z$ (C) $\frac{\pi k}{5}, k \in Z$

D) $\frac{\pi k+1}{5}, k \in Z$ E) $\frac{\pi k-1}{5}, k \in Z$

$5x = \pi k$

$x = \frac{\pi k}{5},\ k \in Z$

**38.** $2\cos(3x + 24^\circ) = -1$ tənliyinin $0^\circ < x < 45^\circ$ intervalındakı həllini tapın.

A) $2^\circ$ B) $7^\circ$ C) $22^\circ$ (D) $32^\circ$ E) $37^\circ$

$\cos(3x+24^\circ) = -\frac{1}{2}$

$3x + 24^\circ = \pm 120^\circ + 360^\circ k$

$x + 8^\circ = \pm 40^\circ + 120^\circ k$

$x = \pm 40^\circ - 8^\circ + 120^\circ k$

$x_1 = 40^\circ - 8^\circ + 120^\circ k = 32^\circ + 120^\circ k,\ k = 0$ olduqda $x_1 = 32^\circ$

$x_2 = -40^\circ - 8^\circ + 120^\circ k = -48^\circ + 120^\circ k$

**39.** $\sin(9x + 18^\circ) = -1$ tənliyinin $0^\circ < x < 30^\circ$ şərtini ödəyən həllini tapın.

A) $18^\circ$ B) $22^\circ$ (C) $28^\circ$ D) $30^\circ$ E) $12^\circ$

$9x + 18^\circ = 270^\circ + 360^\circ k$

$x + 2^\circ = 30^\circ + 40^\circ k$

$x = 28^\circ + 40^\circ k,\ k = 0$ olduqda $x = 28^\circ$

**40.** Aşağıdakı tənliklərdən hansının həlli **yoxdur**?

I. $\sin x \cos x = \frac{3}{7}$; (II) $\sin x \cos x = \frac{3}{5}$; III. $\sin x \cos x = \frac{1}{2}$

IV. $\sin x \cos x = -\frac{1}{2}$ V. $tgx = 3$?

A)I (B)II C)III D)IV E)V

$\sin x \cos x = \frac{1}{2} \cdot 2\sin x \cos x = \frac{1}{2} \sin 2x$

I. $\sin x \cos x = \frac{3}{7} \cdot 1$ II. $2\sin x \cos x = \frac{3}{5} \cdot 2$

$\sin 2x = \frac{6}{7} < 1$ $\sin 2x = \frac{6}{5} > 1$

həlli var. həlli yoxdur.

**41.** $\sin x + \cos x = 0$ tənliyinin $[-2\pi; \pi]$ parçasında neçə həlli var?

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

$\frac{\sin x}{\cos x} + \frac{\cos x}{\cos x} = \frac{0}{\cos x}$

$tgx + 1 = 0$

$tgx = -1$

$x = -\frac{\pi}{4} + \pi k = -45^\circ + 180^\circ k$

$[-360^\circ; 180^\circ]$

$k = -1,\ x = -225^\circ$ 1

$k = 0,\ x = -45^\circ$ 2

$k = 1,\ x = 135^\circ$ (3)

**42.** Tənliyin ən kiçik müsbət kökünü tapın:

$3 - \cos x = 3\cos^2 x + 3\sin^2 x.$

A)$\pi$ (B)$\frac{\pi}{2}$ C)0 D)1 E)$\frac{\pi}{4}$

$3 - \cos x = 3$

$\cos x = 0$

$x = \frac{\pi}{2} + \pi k,\ k \in Z.$

$k = 0,\ x = \frac{\pi}{2}$

**43.** Tənliyi həll edin: $\sin 2x = \cos^2\frac{x}{2} - \sin^2\frac{x}{2}$.

(A) $x = \frac{\pi}{2} + k\pi, x = (-1)^k\frac{\pi}{6} + k\pi, k \in Z$

B) $x = \frac{\pi}{2} + 2k\pi, x = (-1)^k\frac{\pi}{6} + 2k\pi, k \in Z$

C) $x = \frac{\pi}{4} + 2k\pi, x = (-1)^k\frac{\pi}{3} + 2k\pi, k \in Z$

D) $x = \frac{\pi}{4} + k\pi, x = (-1)^k\frac{\pi}{3} + 2k\pi, k \in Z$

E) $x = \frac{\pi}{6} + k\pi, k \in Z$

$\sin 2x = \cos x$

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

$\cos x(2\sin x - 1) = 0$

1) $\cos x = 0$ $x = \frac{\pi}{2} + \pi k, k \in Z$

2) $2\sin x - 1 = 0$ $\sin x = \frac{1}{2}$ $x = (-1)^k\frac{\pi}{6} + \pi k, k \in Z.$

**44.** $a$-parametrinin hansı qiymətlərində $1 + \cos^4 x - \sin^4 x = a$ tənliyinin həlli var?

(A)$[0; 2]$ B)$[-2; 2]$ C)$[-2; 0]$ D)$[-1; 3]$ E)$[2; 4]$

$1 + (\cos^2 x - \sin^2 x)(\cos^2 x + \sin^2 x) = a$

$1 + \cos 2x \cdot 1 = a$

$\cos 2x = a - 1$

$-1 \le \cos 2x \le 1$

$-1 \le a - 1 \le 1$

$-1 + 1 \le a \le 1 + 1$

$0 \le a \le 2$

$[0; 2]$

# Triqonometrik tənliklər və bərabərsizliklər

**45.** Aşağıdakı tənliklərdən hansının həlli ***yoxdur***?

A) $\sin x \cos x = -\frac{1}{3}$; V  B) $\sin x \cos x = -\frac{3}{4}$; Y

C) $2\sin x \cos x = -\frac{6}{7}$ V  D) $3\sin x \cos x = -\frac{2}{5}$ V

E) $\sin x \cos x = \frac{1}{4}$ V

**46.** Tənliyi həll edin: $3\cos^2 x = 4\sin x + 3$.

A) $\pi k; k \in Z$  B) $(-1)^k \arcsin\frac{4}{3} + \pi k$ və $\pi k, k \in Z$

C) $2\pi k; k \in Z$  D) $\frac{\pi}{2} + \pi k; k \in Z$  E) 0

$3(1-\sin^2 x) = 4\sin x + 3$, $\sin x = t$ ilə əvəz edək.

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

$3t^2 + 4t = 0$

$t(3t+4) = 0$

1) $t = 0$

2) $3t + 4 = 0$, $t = -\frac{4}{3}$

1) $\sin x = 0$, $x = \pi k, k \in Z$.

2) $\sin x = -\frac{4}{3} < -1$, $\varnothing$.

**47.** Tənliyi həll edin: $2\sin^2 x = 3\cos x + 2$.

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

C) $\frac{\pi}{2} + \pi k$ və $\arccos\frac{2}{3} + \pi k; k \in Z$  D) $\frac{\pi}{2} + 2\pi k; k \in Z$

E) $\pi k, k \in Z$

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

$2 - 2\cos^2 x = 3\cos x + 2$

$2\cos^2 x + 3\cos x = 0$

$\cos x(2\cos x + 3) = 0$

1) $\cos x = 0$, $x = \frac{\pi}{2} + \pi k, k \in Z$.

2) $2\cos x + 3 = 0$, $\cos x = -\frac{3}{2} < -1$, $\varnothing$

**48.** $a$-parametrinin hansı müsbət qiymətlərində $tgx + ctgx = a$ tənliyinin həlli var?

A) $[2; +\infty)$  B) $[1; +\infty)$  C) $(0; 2]$  D) $(0; 1]$  E) $(0; 2)$

$\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x} = a$

$\frac{2(\sin^2 x + \cos^2 x)}{2\sin x \cdot \cos x} = a$

$\frac{2}{\sin 2x} = a$

$\sin 2x \to 0+$, $a = \frac{2}{\sin 2x} = +\infty$

$\sin 2x = 1$, $a = \frac{2}{1} = 2$

$[2; \infty)$

**49.** $\cos 2x = \frac{\sqrt{3}}{2}$ tənliyinin $[-\pi; \pi]$ aralığındakı köklərinin sayını tapın. $[-180^\circ; 180^\circ]$

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

$2x = \pm 30^\circ + 360^\circ \cdot k$

$x = \pm 15^\circ + 180^\circ \cdot k, k \in Z$.

$x_1 = 15^\circ + 180^\circ \cdot k$

$x_2 = -15^\circ + 180^\circ \cdot k$

1. $k = -1$, $x_1 = 15^\circ - 180^\circ = -165^\circ$
2. $k = 0$, $x_1 = 15^\circ$
3. $k = 0$, $x_2 = -15^\circ$
4. $k = 1$, $x_2 = -15^\circ + 180^\circ = 165^\circ$

**50.** $\sin 4x = \frac{1}{2}$ tənliyinin $[0; \frac{\pi}{2}]$ aralığındakı köklərinin sayını tapın.

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

$[0; 90^\circ]$

$4x = (-1)^n 30^\circ + 180^\circ \cdot n$

$x = (-1)^n 7{,}5^\circ + 45^\circ \cdot n, n \in Z$.

1. $n = 0$, $x = (-1)^0 \cdot 7{,}5^\circ + 45^\circ \cdot 0 = 7{,}5^\circ$
2. $n = 1$, $x = (-1)^1 \cdot 7{,}5^\circ + 45^\circ \cdot 1 = -7{,}5 + 45^\circ = 37{,}5^\circ$

CFR

**51.** Tənliyi həll edin: $\frac{1-\cos 2x}{\sin 2x} = 0$. $\Rightarrow \begin{cases} 1-\cos 2x = 0 \\ \sin 2x \neq 0 \end{cases} \Rightarrow \begin{cases} \cos 2x = 1 \\ \sin 2x \neq 0 \end{cases}$ $\varnothing$

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

II-cü üçb

**52.** $ctg\,x = 1$ tənliyinin $[\frac{\pi}{2}; \pi]$ aralığındakı köklərinin sayını tapın.

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

II rübdə $ctgx = 1$ ola bilməz.

IV rüb.

**53.** $tg\,x = 1$ tənliyinin $[-\frac{\pi}{2}; 0]$ aralığındakı köklərinin sayını tapın.

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

IV rübdə $tgx < 0$

**54.** Tənliyi həll edin: $\sin 2x = \sqrt{3}\cos x$.

A) $\frac{\pi}{12} + \pi n$; $\pm\frac{\pi}{3} + 2\pi n, n \in Z$

B) $\frac{\pi}{6} + 2\pi n$; $\frac{\pi}{2} + \pi n, n \in Z$

C) $\pm\frac{\pi}{11} + 2\pi n$; $(-1)^n\frac{\pi}{3} + \pi n, n \in Z$

D) $\frac{\pi}{17} + 2\pi n$; $(-1)^n\frac{\pi}{6} + \pi n, n \in Z$

E) $\frac{\pi}{2} + \pi n$; $(-1)^n\frac{\pi}{3} + \pi n, n \in Z$

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

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

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

1) $\cos x = 0$, $x = \frac{\pi}{2} + \pi n, n \in Z$.

2) $2\sin x - \sqrt{3} = 0$, $\sin x = \frac{\sqrt{3}}{2}$, $x = (-1)^n\frac{\pi}{3} + \pi n, n \in Z$.

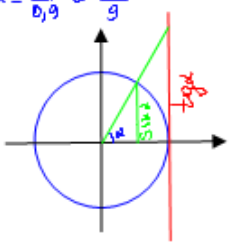
**55.** $0 < \alpha < \frac{\pi}{2}$ olduqda $a = tg\alpha$ və $b = \sin\alpha$ ədədləri arasında aşağıdakı münasibətlərin hansı doğrudur?

A) $a < b$  B) $a > b$  C) $a = b$  D) $2a = b$  E) $a^2 + b^2 = ab$

$a = tg\alpha = \frac{\sin\alpha}{\cos\alpha} = \frac{b}{\cos\alpha}$, $0 < \alpha < \frac{\pi}{2}$, $0 < \cos\alpha < 1$

$a = \frac{b}{0{,}1} = 10b$

$a = \frac{b}{0{,}9} = \frac{10b}{9}$, $a > b$



# Triqonometrik tənliklər və bərabərsizliklər

[0; 90°]

**56.** Tənliyin $0 \le x \le \frac{\pi}{2}$ şərtini ödəyən kökləri hasilini tapın:

$\cos 2x + \sin^2 x = \cos x$.

(A)0 B)1 C)$\frac{\pi}{2}$ D)$\frac{\pi}{6}$ E)-1

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

$\cos x(\cos x - 1) = 0$

1) $\cos x = 0$
$x = 90° + 180°k$
$k = 0,\ x = 90°$

2) $\cos x - 1 = 0$
$\cos x = 1$
$x = 360°k$
$k = 0,\ x = 0$

$90° \cdot 0° = 0$

**57.** $\sqrt{3}\sin x + \cos x = -\sqrt{2}$ tənliyinin $-90° < x < 0$ aralığında həllini tapın.

(A)$-75°$ B)$-60°$ C)$-45°$ D)$-30°$ E)$-15°$

$\frac{\sqrt{3}}{2}\sin x + \frac{1}{2}\cos x = \frac{-\sqrt{2}}{2}$

$\sin x \cos 30° + \cos x \sin 30° = -\frac{\sqrt{2}}{2}$

$\sin(x + 30°) = -\frac{\sqrt{2}}{2}$

$x + 30° = (-1)^{n+1} 45° + 180°n$

$x = (-1)^{n+1} 45° - 30° + 180°n,\ n \in \mathbb{Z}$

$n = 0$
$x = (-1)^1 45° - 30° = -45° - 30° = -75°$

**58.** $\cos 2x + \sqrt{3}\sin x + 2 = 0$ tənliyinin ən böyük mənfi həllini tapın.

A)$-180°$ (B)$-60°$ C)$-30°$ D)$-600°$ E)$-200°$

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

$1 - 2\sin^2 x + \sqrt{3}\sin x + 2 = 0$

$\sin x = t$

$2t^2 - \sqrt{3}t - 3 = 0$

$D = 3 + 24 = 27$

$t = \frac{\sqrt{3} \pm 3\sqrt{3}}{4}$

$t_1 = \sqrt{3},\ t_2 = -\frac{\sqrt{3}}{2}$

1) $\sin x = \sqrt{3} > 1$
$\emptyset$

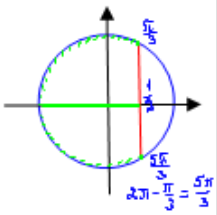
2) $\sin x = -\frac{\sqrt{3}}{2}$

Cavab: $x = -60°$

**59.** Bərabərsizliyi həll edin: $1 - 2\cos x \ge 0$.

A)$\frac{\pi}{3} - 2\pi k \le x \le \frac{\pi}{6} - 2\pi k, k \in Z$
(B)$\frac{\pi}{3} + 2\pi k \le x \le \frac{5\pi}{3} + 2\pi k, k \in Z$
C)$\frac{\pi}{2} + 2\pi k \le x \le \frac{\pi}{2} - 2\pi k, k \in Z$
D)$\frac{\pi}{3} - 2\pi k \le x \le \frac{\pi}{6} + 2\pi k, k \in Z$
E)$\frac{\pi}{6} + 2\pi k \le x \le \frac{\pi}{3} + 2\pi k, k \in Z$

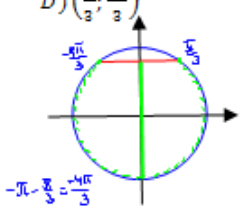
$1 \ge 2\cos x$
$2\cos x \le 1$
$\cos x \le \frac{1}{2}$




**60.** Bərabərsizliyi həll edin: $\sqrt{3} - 2\sin x \ge 0$.

(A)$\left[-\frac{4\pi}{3} + 2\pi k; \frac{\pi}{3} + 2\pi k\right], k \in Z$ B)$\left[-\frac{4\pi}{3}; \frac{\pi}{3}\right]$
C)$\left(\frac{\pi}{6}; \frac{5\pi}{6}\right)$ D)$\left(\frac{\pi}{3}; \frac{2\pi}{3}\right)$
E)$\left(\frac{\pi}{3} + \pi k; \frac{2\pi}{3} + \pi k\right), k \in Z$

$\sqrt{3} \ge 2\sin x$
$2\sin x \le \sqrt{3}$
$\sin x \le \frac{\sqrt{3}}{2}$




**61.** $3\cos^2 5x + 7\cos 5x = 0$ *tənliyinin* $20° < x < 180°$ aralığına daxil olan köklərinin cəmini tapın.

A)90° B)270° (C)432° D)450° E)180°

$\cos 5x(3\cos 5x + 7) = 0$

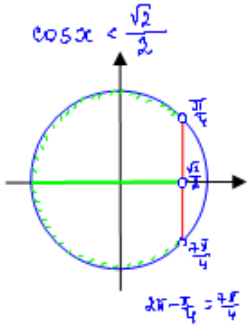
1) $\cos 5x = 0$
$5x = 90° + 180°k$
$x = 18° + 36°k,\ k \in Z.$
$k = 1,\ x = 54°$
$k = 2,\ x = 90°$
$k = 3,\ x = 126°$
$k = 4,\ x = 162°$

$54° + 90° + 126° + 162° = 432°$

**62.** $2\cos x - \sqrt{2} < 0$ bərabərsizliyini həll edin.

A)$\left(-\frac{\pi}{4} + 2\pi k; \frac{\pi}{4} + 2\pi k\right), k \in Z$
(B)$\left(\frac{\pi}{4} + 2\pi k; \frac{7\pi}{4} + 2\pi k\right), k \in Z$
C)$\left(\frac{\pi}{6} + 2\pi k; \frac{11\pi}{6} + 2\pi k\right), k \in Z$
D)$\left(-\frac{\pi}{3} + 2\pi k; \frac{\pi}{3} + 2\pi k\right), k \in Z$
E)$\left(\frac{\pi}{2} + \pi k; \frac{3\pi}{4} + \pi k\right), k \in Z$

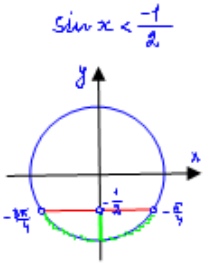
$\cos x < \frac{\sqrt{2}}{2}$




**63.** Bərabərsizliyi həll edin: $2\sin x + 1 < 0$.

A)$\left(-\frac{5\pi}{6} + 2\pi k; -\frac{\pi}{6} + 2\pi k\right), k \in Z$
(B)$\left(-\frac{3\pi}{4} + 2\pi k; -\frac{\pi}{4} + 2\pi k\right), k \in Z$
C)$\left(-\frac{2\pi}{3} + 2\pi k; -\frac{\pi}{3} + 2\pi k\right), k \in Z$
D)$\left(-\frac{\pi}{6} + 2\pi k; \frac{7\pi}{6} + 2\pi k\right), k \in Z$
E)$\left(-\frac{\pi}{3} + 2\pi k; \frac{4\pi}{3} + 2\pi k\right), k \in Z$

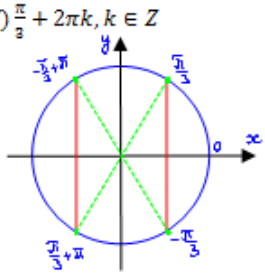
$\sin x < \frac{-1}{2}$




**64.** $\sin^2 x - 3\cos^2 x = 0$ tənliyini həll edin.

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

$1 - \cos^2 x - 3\cos^2 x = 0$
$1 - 4\cos^2 x = 0$
$4\cos^2 x = 1$
$\cos^2 x = \frac{1}{4}$
$\cos x = \pm\frac{1}{2}$
$x = \pm\frac{\pi}{3} + \pi x,\ x \in Z.$



# Triqonometrik tənliklər və bərabərsizliklər

**65.** Tənliyi həll edin: $\sin^2 x - 2\cos^2 x + \frac{1}{2} = 0$.

A) $(-1)^k \frac{\pi}{4} + \pi k, k \in Z$ B) $(-1)^{k+1} \frac{\pi}{4} + \pi k, k \in Z$

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

$\sin^2 x - 2(1 - \sin^2 x) + \frac{1}{2} = 0$

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

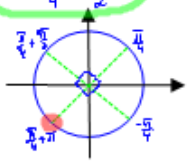
$3\sin^2 x = 2 - \frac{1}{2} = \frac{4-1}{2} = \frac{3}{2}$

$\sin^2 x = \frac{3}{2} \cdot \frac{1}{3} = \frac{1}{2}$

$\sin x = \pm \frac{1}{\sqrt{2}} = \pm \frac{\sqrt{2}}{2}$

$\sin x = \pm \frac{\sqrt{2}}{2}$

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



**66.** Tənliyi həll edin: $(1 + ctgx)\sin x = 0$.

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

D) $-\frac{\pi}{4} + \pi n, n \in Z$ B) $2\pi n, n \in Z$

$\sin x = 0$ ola bilməz, çünki $ctgx = \frac{\cos x}{\sin x} \neq 0$.

$1 + ctgx = 0$

$ctgx = -1$

$x = -\frac{\pi}{4} + \pi n, n \in Z$

**67.** $\cos^2 3x = 1 + \sin^2 x$ tənliyinin $(0; 2\pi]$ aralığına daxil olan köklərinin cəmini tapın.

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

$0 = 1 - \cos^2 3x + \sin^2 3x$

$\sin^2 3x + \sin^2 x = 0$

$\begin{cases} \sin 3x = 0 \\ \sin x = 0 \end{cases} \quad \begin{cases} 3x = \pi k \\ x = \pi n \end{cases} \quad \begin{cases} x = \frac{\pi k}{3} \\ x = \pi n \end{cases} \quad k, n \in Z. \quad \frac{\pi k}{3} = \pi n$

$x = \pi n, n \in Z.$ $n = 1,\ x = \pi$ $n = 2,\ x = 2\pi$ $\pi + 2\pi = 3\pi$

**68.** $0{,}5\sin 6x = \cos\left(\frac{\pi}{2} - 2x\right)$ tənliyinin $0 < x < \frac{\pi}{3}$ aralığına daxil olan kökünü tapın.

$0 < x < 60^\circ$

A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{8}$ D) $\frac{\pi}{12}$ E) $\frac{\pi}{15}$

$\frac{1}{2}\sin 6x = \sin 2x$

$\sin(4x + 2x) = 2\sin 2x$

$\sin 4x \cos 2x + \cos 4x \sin 2x = 2\sin 2x$

$2\sin 2x \cdot \cos^2 2x + \cos 4x \sin 2x - 2\sin 2x = 0$

$\sin 2x (2\cos^2 2x + 2\cos^2 2x - 1 - 2) = 0$

1) $\sin 2x = 0$ $2x = \pi k$ $x = \frac{\pi k}{2}$

2) $4\cos^2 2x = 3$ $\cos^2 2x = \frac{3}{4}$ $\cos 2x = \pm\frac{\sqrt{3}}{2}$ $2x = \pm 30^\circ + 360^\circ k$

$x = \pm 15^\circ + 180^\circ k, k \in Z.$

$k = 0$ $x = 15^\circ = \frac{\pi}{12}$

**69.** Tənliyi həll edin: $2\cos(x - \pi) + 1 = 0$.

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

C) $\pi \pm \frac{\pi}{6} + 2\pi k, k \in Z$ D) $\pm \frac{\pi}{6} + \pi k, k \in Z$

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

$\cos(x - \pi) = -\frac{1}{2}$

$x - \pi = \pm \frac{2\pi}{3} + 2\pi k, k \in Z.$

$x = \pi \pm \frac{2\pi}{3} + 2\pi k, k \in Z.$

**70.** $2\sin^2 3x - 5\sin 3x = 0$ tənliyinin $90^\circ < x < 270^\circ$ aralığına daxil olan köklərinin cəmini tapın.

A) $540^\circ$ B) $600^\circ$ C) $900^\circ$ D) $300^\circ$ E) $640^\circ$

$\sin 3x (2\sin 3x - 5) = 0$

1) $\sin 3x = 0$ $3x = \pi k$ $x = \frac{\pi k}{3} = 60^\circ k, k \in Z$

$k = 1,\ x = 60 \cdot 2 = 120^\circ$

$k = 3,\ x = 60 \cdot 3 = 180^\circ$

$k = 4,\ x = 60 \cdot 4 = 240^\circ$

$120^\circ + 180^\circ + 240^\circ = 540^\circ$

2) $2\sin 3x - 5 = 0$ $\sin 3x = \frac{5}{2} > 1$ $\emptyset$

**71.** $\sin(2x + 1) = 1$ tənliyini həll edin.

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

C) $\frac{\pi}{2} + \pi k - \frac{1}{2}, k \in Z$ D) $-\frac{\pi}{2} + \pi k - \frac{1}{2}, k \in Z$

E) $\frac{\pi}{4} + \pi k - \frac{1}{2}, k \in Z$

$2x + 1 = \frac{\pi}{2} + 2\pi k$

$2x = \frac{\pi}{2} - 1 + 2\pi k,$

$x = \frac{\pi}{4} - \frac{1}{2} + \pi k, k \in Z.$

**72.** Tənliyi həll edin: $\cos(2x - 1) = -1$.

A) $\frac{\pi+1}{2} + \pi k, k \in Z$ B) $\frac{\pi}{2} + \pi k, k \in Z$

C) $-\frac{\pi}{2} + 2\pi k, k \in Z$ D) $\frac{\pi-1}{2} + 2\pi k, k \in Z$ E) $2\pi k, k \in Z$

$2x - 1 = \pi + 2\pi k$

$2x = \pi + 1 + 2\pi k$

$x = \frac{\pi + 1}{2} + \pi k, k \in Z.$

**73.** Tənliyi həll edin: $(1 + tgx)\cos x = 0$.

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

C) $\frac{\pi}{4} + \pi n, n \in Z$ D) $-\frac{\pi}{4} + \pi n, n \in Z$

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

1) $\cos x \neq 0$ çünki $tgx = \frac{\sin x}{\cos x \neq 0}$.

2) $1 + tgx = 0$

$tgx = -1$

$x = -\frac{\pi}{4} + \pi n, n \in Z.$

**74.** $\sin x = \cos 2x - 1$ tənliyinin $\left[-\frac{\pi}{2}; \frac{\pi}{2}\right]$ parçasına daxil olan köklərinin sayını tapın.

A) sonsuz sayda B) 1 C) 3 D) 2 E) 4

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

$2\sin^2 x + \sin x = 0$

$\sin x (2\sin x + 1) = 0$

1) $\sin x = 0$ $x = \pi n$ $n = 0,\ x = 0 \in [-90^\circ; 90^\circ]$ (1)

2) $2\sin x + 1 = 0$ $\sin x = -\frac{1}{2}$ $x = -30^\circ \in [-90^\circ; 90^\circ]$ (2)

# Triqonometrik tənliklər və bərabərsizliklər

**75.** $\cos^2 3x - 2\sin 3x + 2 = 0$ tənliyinin $[-\pi;\pi]$ parçasına daxil olan köklərinin sayını tapın. $[-180°; 180°]$

A)1 B)2 C)3 D)sonsuz sayda E)4

$1-\sin^2 3x - 2\sin 3x + 2 = 0$, $\sin 3x = t$

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

$t_1 = -3$ k.x.

$t_2 = 1$

$\sin 3x = 1$

$3x = \frac{\pi}{2} + 2\pi k$

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

$x = 30° + 120°\cdot k, k \in Z.$

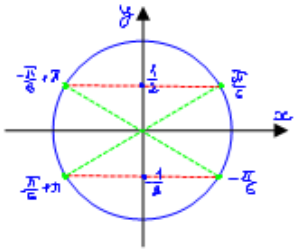
| 1 | 2 | 3 |
|---|---|---|
| $k=-1$ | $k=0$ | $k=1$ |
| $x=-90°$ | $x=30°$ | $x=150°$ |

**76.** Tənliyi həll edin: $5\sin^2 x = 2 - \cos^2 x.$

A) $(-1)^n \arcsin\frac{1}{4} + \pi n, n \in Z$ B) $\frac{\pi}{2} + 2\pi n, n \in Z$

C) $(-1)^n \frac{\pi}{3} + \pi n, n \in Z$ D) $\pi(2n+1), n \in Z$

E) $\pm\frac{\pi}{6} + \pi n, n \in Z$



$5\sin^2 x = 1 + 1 - \cos^2 x$

$5\sin^2 x = 1 + \sin^2 x$

$4\sin^2 x = 1$

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

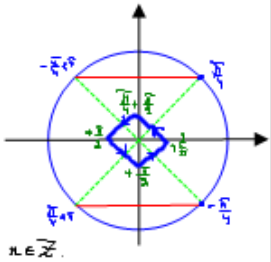
$\sin x = \pm\frac{1}{2}$

$x = \pm\frac{\pi}{6} + \pi k, k \in Z.$

**77.** Tənliyi həll edin: $3\sin^2 x - \cos^2 x - 1 = 0.$

A) $\frac{\pi}{4} + 2\pi n, n \in Z$ B) $(-1)^n\frac{\pi}{6} + \pi n, n \in Z$ C) $\pi n, n \in Z$

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



$3\sin^2 x - (1 - \sin^2 x) - 1 = 0$

$3\sin^2 x - 1 + \sin^2 x - 1 = 0$

$4\sin^2 x = 2$

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

$\sin x = \pm\frac{1}{\sqrt{2}}$

$x = \pm\frac{\pi}{4} + \pi n$ və ya $x = \frac{\pi}{4} + \frac{\pi n}{2}, n \in Z.$

**78.** Tənliyi həll edin: $\cos^4 x - \sin^4 x = \frac{\sqrt{3}}{2}.$

A) $\frac{\pi}{3} + \pi n, n \in Z$ B) $\pm\frac{\pi}{2} + 2\pi n, n \in Z$ C) $\pm\frac{\pi}{12} + \pi n, n \in Z$

D) $\frac{\pi}{6} + 2\pi n, n \in Z$ E) $\pm\frac{\pi}{4} + 2\pi n, n \in Z$

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

$\cos 2x \cdot 1 = \frac{\sqrt{3}}{2}$

$2x = \pm\frac{\pi}{6} + 2\pi k$

$x = \pm\frac{\pi}{12} + \pi k, k \in Z.$

**79.** Tənliyi həll edin: $\cos^4 x - \sin^4 x = -\frac{1}{2}.$

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

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

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

$\cos 2x \cdot 1 = -\frac{1}{2}$

$2x = \pm\frac{2\pi}{3} + 2\pi k$

$x = \pm\frac{\pi}{3} + \pi k, k \in Z$

**80.** Bərabərsizliyi həll edin: $\sin x \cdot \cos x > \frac{1}{4}.$

A) $\frac{\pi}{3}(6k-1) < x < \frac{\pi}{3}(6k-2), k \in Z$

B) $\frac{\pi}{3}(6k+1) < x < \frac{\pi}{3}(6k+2), k \in Z$

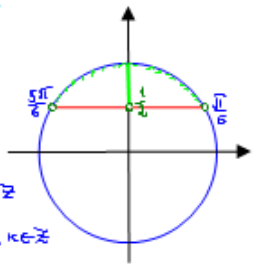
C) $\frac{\pi}{12}(12k+1) < x < \frac{\pi}{12}(12k+5), k \in Z$

D) $\frac{\pi}{6}(12k-1) < x < \frac{\pi}{6}(12k-5), k \in Z$

E) $\frac{\pi}{6} < x < \frac{\pi}{3}$

$2\cdot\sin x\cos x > \frac{1}{4}\cdot 2$

$\sin 2x > \frac{1}{2}$



$\frac{\pi}{6} + 2\pi k < 2x < \frac{5\pi}{6} + 2\pi k$

$\frac{\pi}{12} + \pi k < x < \frac{5\pi}{12} + \pi k, k \in Z$

$\frac{\pi}{12}(1+12k) < x < \frac{\pi}{12}(5+12k), k \in Z$

**81.** $\sin x \cdot \cos x \cdot \cos 2x \cdot \cos 4x = \frac{1}{8}$ tənliyinin $\left[0;\frac{\pi}{2}\right]$ parçasına daxil olan köklərinin sayını tapın. $[0°, 90°]$

A)sonsuz sayda B)2 C)4 D)1 E)16

$8\sin x\cdot\cos x\cdot\cos 2x\cdot\cos 4x = 1$

$4\sin 2x\cdot\cos 2x\cdot\cos 4x = 1$

$2\sin 4x\cdot\cos 4x = 1$

$\sin 8x = 1$

$8x = 90° + 360°\cdot k$

$x = \frac{90°}{8} + 45°\cdot k$

$x = 11{,}25° + 45°\cdot k, k \in Z$

$k=0,\ x = 11{,}25°$ (1)

$k=1,\ x = 56{,}25°$ (2)

**82.** Bərabərsizliyi həll edin: $tgx \le \sqrt{3}.$

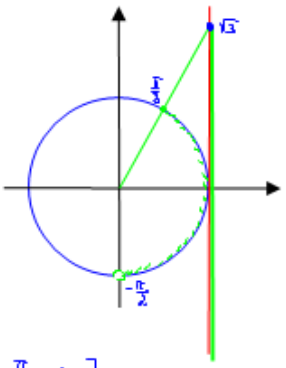
A) $\left(-\frac{\pi}{2} + 2\pi n; \frac{\pi}{6} + 2\pi n\right), n \in Z$

B) $\left(-\frac{\pi}{2} + \pi n; \frac{\pi}{6} + \pi n\right), n \in Z$

C) $\left(-\frac{\pi}{2} + 2\pi n; \frac{\pi}{3} + 2\pi n\right], n \in Z$

D) $\left(-\frac{\pi}{2} + \pi n; \frac{\pi}{3} + \pi n\right], n \in Z$

E) $\left(-\frac{\pi}{2} + \pi n; \frac{\pi}{6} + \pi n\right], n \in Z$



$\left(-\frac{\pi}{2}; \frac{\pi}{3}\right]$

$\left(-\frac{\pi}{2} + 2\pi k; \frac{\pi}{3} + 2\pi k\right]$

**83.** Bərabərsizliyi həll edin: $\sqrt{3}tgx - 1 < 0.$

$tgx < \frac{1}{\sqrt{3}}$

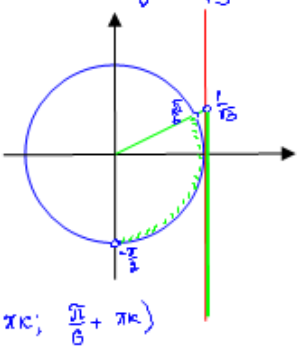
A) $\left(-\frac{\pi}{2} + \pi k; \frac{\pi}{6} + \pi k\right), k \in Z$

B) $\left(\frac{\pi}{6} + \pi k; \frac{\pi}{2} + \pi k\right), k \in Z$

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

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

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



$\left(-\frac{\pi}{2} + \pi k; \frac{\pi}{6} + \pi k\right)$

# Triqonometrik tənliklər və bərabərsizliklər

**84.** Tənliyi həll edin: $\sin x + \cos x = \sqrt{2}$.

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

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

$\frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{2}}\cos x = \sqrt{2}\cdot\frac{1}{\sqrt{2}}$

$\sin x \cdot \cos\frac{\pi}{4} + \cos x \sin\frac{\pi}{4} = 1$

$\sin\left(x + \frac{\pi}{4}\right) = 1$

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

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

$x = \frac{\pi}{4} + 2\pi k, k \in Z.$

$\sqrt{1^2+1^2} = \sqrt{2}$. hər tərəfi $\sqrt{2}$ yə bölüb köməkçi bucağ daxil edək

**85.** $\sin 3x \cos 3x \cos 6x = \frac{\sqrt{3}}{8}$ tənliyinin $\left[0; \frac{\pi}{18}\right]$ parçasında neçə həlli var? $[0; 10]$

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

$2\sin 3x \cdot \cos 3x \cos 6x = \frac{\sqrt{3}}{8}\cdot 2$

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

$\sin 12x = \frac{\sqrt{3}}{2}$

$12x = (-1)^k \frac{\pi}{3} + \pi k$

$x = (-1)^k \frac{\pi}{36} + \frac{\pi k}{12}$

$x = (-1)^k 5° + 15° k, k \in Z$

$k=0,\ x = 5°$ 1.

$k=1,\ x = 10°$ 2

**86.** Bərabərsizliyi həll edin: $1 - 2\cos^2\left(\frac{\pi}{2} - t\right) > 0.$

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

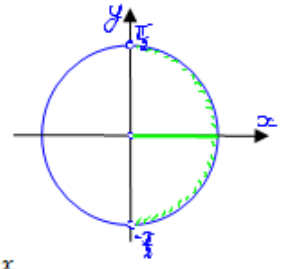
C) $\left(-\frac{\pi}{2} + 2\pi k; \frac{\pi}{2} + 2\pi k\right), k \in Z$ D) $\left(-\frac{\pi}{4}; \frac{\pi}{2}\right)$ E) $\left(-\frac{\pi}{2}; 0\right)$

$1 - 2\cdot\frac{1+\cos(\pi - 2t)}{2} > 0$

$1 - 1 - \cos(\pi - 2t) > 0$

$\cos 2t > 0$

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




**87.** Tənliyi həll edin: $3\sin x = 2\cos^2 x.$

A) $(-1)^k \frac{\pi}{6} + \pi k;\ (-1)^k \arcsin(-2) + \pi k; k \in Z$

B) $\frac{\pi}{6} + \pi k; k \in Z$ C) $(-1)^{k+1}\frac{\pi}{6} + \pi k;\ k \in Z$

D) $(-1)^k \frac{\pi}{6} + \pi k; k \in Z$ E) $(-1)^{k+1}\arcsin(-2) + \pi k; k \in Z$

$3\sin x = 2(1 - \sin^2 x)$

$3t = 2 - 2t^2$

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

$D = 9 + 16 = 25$

$t = \frac{-3 \pm 5}{4}$

$t_1 = \frac{1}{2}$ $t_2 = -2$ k.k.

$\sin x = t$

$\sin x = \frac{1}{2}$

$x = (-1)^k \frac{\pi}{6} + \pi k, k \in Z.$

**88.** $\sin x + \cos^2 x = 1\frac{1}{4}$ tənliyini həll edin.

A) $(-1)^k \frac{\pi}{6} + \pi k; k \in Z$ B) $(-1)^{k+1}\frac{\pi}{6} + \pi k; k \in Z$

C) $\frac{\pi}{6} + \pi k; k \in Z$ D) $-\frac{\pi}{6} + \pi k; k \in Z$ E) $\frac{\pi}{3} + \pi k; k \in Z$

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

$t + 1 - t^2 = 1\frac{1}{4}$

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

$4t^2 - 4t + 1 = 0$

$(2t-1)^2 = 0$

$2t - 1 = 0$

$t = \frac{1}{2}$

CFR

$\sin x = t$

$\sin x = \frac{1}{2}$

$x = (-1)^k \frac{\pi}{6} + \pi k, k \in Z.$

**89.** Bərabərsizliyi həll edin: $2\cos 2x < \sqrt{2}.$

A) $\frac{\pi}{8} + \pi k < x < \frac{7\pi}{8} + \pi k, k \in Z$ B) $\frac{\pi}{8} < x < \frac{7\pi}{8}$

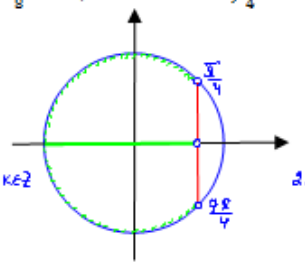
C) $-\frac{\pi}{8} + \pi k < x < \frac{\pi}{8} + \pi k, k \in Z$ D) $\frac{\pi}{4} < x < \frac{3\pi}{4}$

E) $x < 2\pi k, k \in Z$

$\cos 2x < \frac{\sqrt{2}}{2}$

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

$\frac{\pi}{8} + \pi k < x < \frac{7\pi}{8} + \pi k, k \in Z$




$2\pi - \frac{\pi}{4} = \frac{7\pi}{4}$

**90.** $\sin x = \cos x$ tənliyinin $[-2\pi; 2\pi]$ parçasına daxil olan köklərinin sayını tapın. $[-360°; 360°]$

A) 4 B) 1 C) 2 D) 3 E) sonsuz sayda

$\frac{\sin x}{\cos x} = \frac{\cos x}{\cos x}$

$tgx = 1$

$x = 45° + 180° k, k \in Z.$

$k=-2,\ x = -315°$ 1

$k=-1,\ x = -135°$ 2

$k=0,\ x = 45°$ 3

$k=1,\ x = 225°$ 4

**91.** Bərabərsizliyi həll edin: $3 - 4\sin^2\left(t - \frac{\pi}{2}\right) < 0.$

A) $\left(-\frac{\pi}{6} + \pi n; \frac{\pi}{6} + \pi n\right), n \in Z$ B) $\left(-\frac{\pi}{3} + \pi n; \frac{\pi}{3} + \pi n\right), n \in Z$

C) $\left(-\frac{5}{6}\pi + \pi n; \frac{5}{6}\pi + \pi n\right), n \in Z$ D) $\left(-\frac{5}{12}\pi n; \frac{5}{12}\pi n\right), n \in Z$

E) $\left(-\frac{5}{12}\pi + \pi n; \frac{5}{12}\pi + \pi n\right), n \in Z$

$3 - 4\cdot\frac{1-\cos(2t-\pi)}{2} < 0$

$3 - 2\cdot(1 + \cos 2t) < 0$

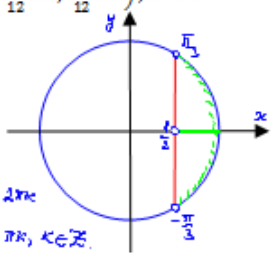
$3 - 2 - 2\cos 2t < 0$

$2\cos 2t > 1$

$\cos 2t > \frac{1}{2}$

$-\frac{\pi}{3} + 2\pi k < 2t < \frac{\pi}{3} + 2\pi k$

$-\frac{\pi}{6} + \pi k < t < \frac{\pi}{6} + \pi k, k \in Z.$




**92.** $ctg\alpha = 2$ olduqda, $\frac{3 - 4\sin\alpha\cos\alpha}{5}$ ifadəsinin qiymətini hesablayın.

A) 0,28 B) 0,075 C) 2,8 D) $-2,7$ E) 1,4

$$\frac{3\sin^2\alpha + 3\cos^2\alpha - 4\sin\alpha\cos\alpha}{5\sin^2\alpha + 5\cos^2\alpha} = \frac{\frac{3\sin^2\alpha}{\sin^2\alpha} + \frac{3\cos^2\alpha}{\sin^2\alpha} - \frac{4\sin\alpha\cos\alpha}{\sin^2\alpha}}{\frac{5\sin^2\alpha}{\sin^2\alpha} + \frac{5\cos^2\alpha}{\sin^2\alpha}} = \frac{3 + 3ctg^2\alpha - 4ctg\alpha}{5 + 5ctg^2\alpha} =$$

$$= \frac{3 + 3\cdot 2^2 - 4\cdot 2}{5 + 5\cdot 2^2} = \frac{7}{25} = 0,28$$

**93.** Bərabərsizliyi həll edin: $\left(\frac{16}{81}\right)^{\sin x \cos x} < 1,5.$

A) $\left(-\frac{5\pi}{12} + \pi k; -\frac{\pi}{12} + \pi k\right), k \in Z$ B) $\left(-\frac{\pi}{12} + \pi k; \frac{7\pi}{12} + \pi k\right), k \in Z$

C) $\left(\frac{\pi}{6} + 2\pi k; \frac{7\pi}{6} + 2\pi k\right), k \in Z$ D) $(2\pi k;\ \pi + 2\pi k), k \in Z$

E) $\left(\frac{\pi}{12} + \pi k; \frac{7\pi}{12} + \pi k\right), k \in Z$

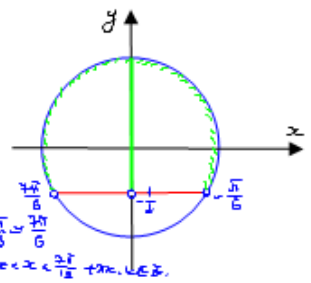
$\left(\frac{4}{9}\right)^{2\sin x \cos x} < \frac{3}{2}$

$\left(\frac{2}{3}\right)^{2\sin 2x} < \left(\frac{2}{3}\right)^{-1}$

$2\sin 2x > -1$

$\sin 2x > -\frac{1}{2}$

$-\frac{\pi}{6} + 2\pi k < 2x < \frac{7\pi}{6} + 2\pi k.$




$-\frac{\pi}{12} + \pi k < x < \frac{7\pi}{12} + \pi k, k \in Z.$

# Triqonometrik tənliklər və bərabərsizliklər

**94.** Bərabərsizliyi həll edin: $\left(\frac{25}{16}\right)^{1+\sin x\cos x} \geq \frac{4}{5}$.

A) $(-\infty;+\infty)$ B) $\left(-\frac{\pi}{6}+\pi k;\frac{\pi}{6}+\pi k\right), k\in Z$

C) $\left(-\frac{\pi}{12}+\pi k;\frac{\pi}{12}+\pi k\right), k\in Z$ D) $\emptyset$

E) $\left(-\frac{2}{3}\pi+\pi k;\frac{5}{6}\pi+\pi k\right), k\in Z$

$\left(\frac{5}{4}\right)^{2+2\sin x\cos x} \geq \frac{4}{5}$

$\left(\frac{5}{4}\right)^{1+\sin 2x} \geq \left(\frac{5}{4}\right)^{-1}$

$2+\sin 2x \geq -1$

$\sin 2x \geq -1-2$

$\sin 2x \geq -3$

$-1 \leq \sin 2x \leq 1$ olduğundan $x$-in istənilən qiymətində $\sin 2x \geq -3$ doğrudur.

**95.** $4\sin^2 x < 1$ bərabərsizliyini həll edin.

A) $\left(-\frac{\pi}{6}+\pi k;\frac{\pi}{6}+\pi k\right), k\in Z$ B) $\left(\frac{\pi}{6}+\pi k;\frac{5\pi}{6}+\pi k\right), k\in Z$

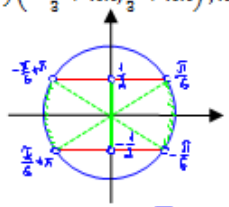
C) $\left(\frac{\pi}{4}+2\pi k;\frac{7\pi}{4}+2\pi k\right), k\in Z$ D) $\left(-\frac{\pi}{3}+\pi k;\frac{\pi}{3}+\pi k\right), k\in Z$

E) $\left(-\frac{\pi}{12}+\pi k;\frac{\pi}{12}+\pi k\right), k\in Z$

$\sin^2 x < \frac{1}{4}$

$|\sin x| < \frac{1}{2}$

$-\frac{1}{2} < \sin x < \frac{1}{2}$



$\left(-\frac{\pi}{6}+\pi k;\frac{\pi}{6}+\pi k\right), k\in Z$.

**96.** Bərabərsizliyi həll edin: $4\cos^2 x < 3$.

A) $\left(\frac{\pi}{6}+\pi k;\frac{5\pi}{6}+\pi k\right), k\in Z$ B) $\left(\frac{\pi}{3}+2\pi k;\frac{5\pi}{3}+2\pi k\right), k\in Z$

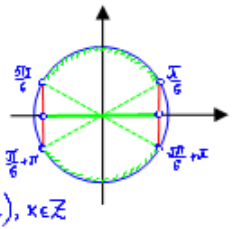
C) $\left(\frac{\pi}{6}+2\pi k;\frac{5\pi}{6}+2\pi k\right), k\in Z$ D) $\left(\frac{\pi}{3}+\pi k;\frac{5\pi}{3}+\pi k\right), k\in Z$

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

$\cos^2 x < \frac{3}{4}$

$|\cos x| < \frac{\sqrt{3}}{2}$

$-\frac{\sqrt{3}}{2} < \cos x < \frac{\sqrt{3}}{2}$



$\left(\frac{\pi}{6}+\pi k;\frac{5\pi}{6}+\pi k\right), k\in Z$

**97.** $100^{\cos x} > 0{,}1$ bərabərsizliyini həll edin və $[\pi;2\pi]$ parçasına daxil olan həllərini tapın.

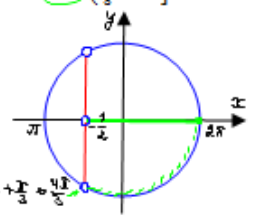
A) $\left[\pi;\frac{4\pi}{3}\right]$ B) $\left[\pi;\frac{5\pi}{3}\right]$ C) $\left(\frac{4\pi}{3};2\pi\right]$

D) $\left(\frac{5\pi}{3};2\pi\right]$ E) $\left[\pi;\frac{5\pi}{3}\right)$

$10^{2\cos x} > 10^{-1}$

$2\cos x > -1$

$\cos x > -\frac{1}{2}$



**98.** $1+\cos x+\cos\frac{x}{2}=0$ tənliyinin $(180^\circ;360^\circ)$ aralığına daxil olan kökünü tapın.

A) $210^\circ$ B) $240^\circ$ C) $270^\circ$ D) $290^\circ$ E) $335^\circ$

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

$\cos\frac{x}{2}\left(2\cos\frac{x}{2}+1\right)=0$

1) $\cos\frac{x}{2}=0$

$\frac{x}{2}=90^\circ+180^\circ\cdot k$

CFR $x=180^\circ+360^\circ k, k\in Z$.

2) $2\cos\frac{x}{2}+1=0$

$\cos\frac{x}{2}=-\frac{1}{2}$

$\frac{x}{2}=\pm 120^\circ+360^\circ\cdot k$

$x=\pm 240^\circ+720^\circ\cdot k, k\in Z$.

$x=240^\circ\in(180^\circ;360^\circ)$

**99.** $4^{\sin x} > \frac{1}{2}$ bərabərsizliyinin $\left[-\frac{\pi}{2};\frac{\pi}{2}\right]$ parçasına daxil olan həllərini tapın.

A) $\left(-\frac{\pi}{6};\frac{\pi}{2}\right]$ B) $\left(-\frac{\pi}{6};\frac{7}{6}\pi\right)$

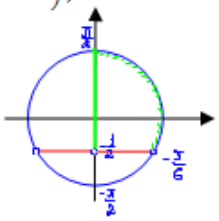
C) $\left(-\frac{\pi}{6}+2\pi k;\frac{7}{6}\pi+2\pi k\right), k\in Z$

D) $\left[-\frac{\pi}{6};\frac{\pi}{2}\right]$ E) $\left(-\frac{\pi}{2};\frac{7}{6}\pi\right]$

$2^{2\sin x} > 2^{-1}$

$2\sin x > -1$

$\sin x > -\frac{1}{2}$



**100.** $\frac{2tgx}{1-tg^2x} > \sqrt{3}$ bərabərsizliyini həll edin.

A) $\left(\frac{\pi}{12}+\frac{\pi k}{2};\frac{\pi}{4}+\frac{\pi k}{2}\right), k\in Z$ B) $\left(-\frac{\pi}{4}+\frac{\pi k}{2};\frac{\pi}{6}+\frac{\pi k}{2}\right), k\in Z$

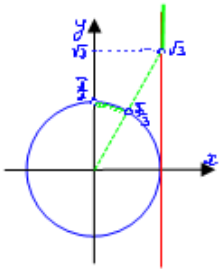
C) $\left(\frac{\pi}{3}+\pi k;\frac{\pi}{2}+\pi k\right), k\in Z$ D) $\left(\frac{\pi}{6}+\frac{\pi k}{2};\frac{\pi}{4}+\frac{\pi k}{2}\right), k\in Z$

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

$tg2x > \sqrt{3}$

$\frac{\pi}{3}+\pi k < 2x < \frac{\pi}{2}+\pi k$

$\frac{\pi}{6}+\frac{\pi k}{2} < x < \frac{\pi}{4}+\frac{\pi k}{2}, k\in Z$



**101.** Bərabərsizliyi həll edin: $\frac{1-tg^2\frac{x}{2}}{1+tg^2\frac{x}{2}} > \frac{1}{2}$.

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

B) $\left(-\frac{\pi}{6}+2\pi k;\frac{\pi}{6}+2\pi k\right), k\in Z$

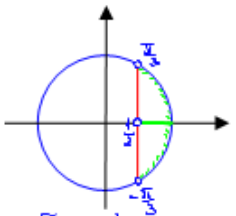
C) $\left(-\frac{\pi}{3}+\pi k;\frac{7}{3}\pi+\pi k\right), k\in Z$

D) $\left(-\frac{\pi}{6}+\pi k;\frac{7}{6}\pi+\pi k\right), k\in Z$

E) $\left(-\frac{4}{3}\pi+2\pi k;\frac{5}{3}\pi+2\pi k\right), k\in Z$

$\frac{1-tg^2\frac{x}{2}}{1+tg^2\frac{x}{2}} = \cos 2\cdot\frac{x}{2} = \cos x$

$\cos x > \frac{1}{2}$



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

**102.** $\frac{15}{\sin x+1} = 11-2\sin x$ tənliyini həll edin.

A) $(-1)^n\frac{\pi}{3}+\pi n, n\in Z$ B) $(-1)^n\frac{\pi}{2}+\pi n, n\in Z$

C) $(-1)^n\frac{\pi}{6}+\pi n, n\in Z$ D) $(-1)^n\frac{\pi}{4}+\pi n, n\in Z$

E) $\pi n, n\in Z$

$\sin x = t$

$\frac{15}{t+1} = 11-2t$

$(t+1)\cdot(11-2t)=15$

$11t-2t^2+11-2t=15$

$2t^2-9t+4=0$

$D=81-32=49=7^2$

$t=\frac{9\pm 7}{4}$

$t_1=4$ k.k. $t_2=\frac{1}{2}$

$\sin x=\frac{1}{2}$

$x=(-1)^n\frac{\pi}{6}+\pi n, n\in Z$.

# Triqonometrik tənliklər və bərabərsizliklər

**103.** $8\sin^4 x + 13\cos 2x = 7$ tənliyini həll edin.

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

C) $\pm\frac{\pi}{4}+\pi k, k\in Z$ D) $\pm\frac{\pi}{2}+\pi k, k\in Z$

E) $\pm\arccos\frac{1}{3}+\pi k, k\in Z$

$8(\sin^2 x)^2 + 13\cdot(1-2\sin^2 x) = 7,\quad \sin^2 x = t$

$8t^2+13-26t-7=0$

$8t^2-26t+6=0$

$D_1 = 13^2-8\cdot 6 = 169-48 = 121 = 11^2$

$t = \frac{13+11}{8}$

$t_1 = 3$ k.k.

$t_2 = \frac{1}{4}$

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

$\sin x = \pm\frac{1}{2}$

$x = \pm\frac{\pi}{6}+\pi k, k\in Z$

**104.** Tənliyi həll edin: $4\cos^4 x - 5\cos 2x = -1$.

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

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

$4\cos^4 x - 5(2\cos^2 x - 1) = -1$

$4\cos^4 x - 10\cos^2 x + 5 + 1 = 0$

$4t^2-10t+6=0$

$2t^2-5t+3=0$

$D = 25-24 = 1$

$t = \frac{5\pm 1}{4}$

$t_1 = 1{,}5\quad t_2 = 1$

$\cos^2 x = t$

1) $\cos^2 x = 1{,}5$ $\emptyset$

2) $\cos^2 x = 1$

$\cos x = \pm 1$

$x = \pi k, k\in Z$.

**105.** $\sin^2 x - \sin 2x + \cos^2 x = 0$

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

C) $-\frac{\pi}{4}+\pi k, k\in Z$ E) $(-1)^k\frac{\pi}{4}+\pi k, k\in Z$

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

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

$\frac{\sin x}{\cos x} - \frac{\cos x}{\cos x} = \frac{0}{\cos x}$

$tgx - 1 = 0$

$tgx = 1$

$x = \frac{\pi}{4}+\pi k, k\in Z$.

**106.** Tənliyi həll edin: $\cos 2x = 3 - 5\sin x$.

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

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

$1-2\sin^2 x = 3-5\sin x$

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

$D = 25-16 = 9 = 3^2$

$t = \frac{5\pm 3}{4}$

$t_1 = 2$ k.k.

$t_2 = \frac{1}{2}$

$\sin x = t$

$\sin x = \frac{1}{2}$

$x = (-1)^m\frac{\pi}{6}+\pi m, m\in Z$.

**107.** $\cos(2x+1) - \cos(2x-1) = 0$ tənliyini həll edin.

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

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

$-2\sin\frac{2x+1+2x-1}{2}\cdot\sin\frac{2x+1-2x+1}{2} = 0$

$\sin 2x\cdot\sin 1 = 0$

1) $\sin 2x = 0$ 2) $\sin 1 \neq 0$

$2x = \pi k$

$x = \frac{\pi k}{2}, k\in Z$.

**108.** Tənliyi həll edin: $\sin(2x+1) - \sin(2x-1) = 0$

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

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

$2\cos\frac{2x+1+2x-1}{2}\cdot\sin\frac{2x+1-2x+1}{2} = 0$

$\cos 2x\cdot\sin 1 = 0$

1) $\cos 2x = 0$ 2) $\sin 1 \neq 0$

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

$x = \frac{\pi}{4}+\frac{\pi k}{2}, k\in Z$

**109.** $\sin^2 x - \cos^2 x = 1$ tənliyini həll edin.

A) $\frac{\pi k}{3}, k\in Z$ B) $\frac{\pi}{2}+\pi k. k\in Z$ C) $\frac{\pi k}{12}. k\in Z$

D) $\frac{\pi}{6}+\frac{\pi k}{4}, k\in Z$ E) $\frac{3\pi k}{2}, k\in Z$

$-\cos 2x = 1$

$\cos 2x = -1$

$2x = \pi + 2\pi k$

$x = \frac{\pi}{2}+\pi k, k\in Z$.

**110.** Tənliyi həll edin: $\sin^2 x - \cos^2 x = \frac{\sqrt{3}}{2}$.

A) $\pm\frac{5\pi}{12}+\pi k, k\in Z$ B) $\pm\frac{\pi}{6}+2\pi k, k\in Z$

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

$-\cos 2x = \frac{\sqrt{3}}{2}$

$\cos 2x = -\frac{\sqrt{3}}{2}$

$2x = \pm(\pi - \frac{\pi}{6})+2\pi k$

$x = \pm\frac{5\pi}{12}+\pi k, k\in Z$.

**111.** $(\sqrt{3})^{tgx} = \frac{3\sqrt{3}}{3ctgx}$ tənliyini həll edin.

A) $\frac{\pi}{2}+\pi k, k\in Z$ B) $-\frac{\pi}{4}+\pi k, k\in Z$

C) $arctg3+\pi k, k\in Z$ D) $\frac{\pi}{4}+\pi k, k\in Z$ E) $\pi k, k\in Z$

$3^{\frac{tgx}{2}} = 3^{1\frac{1}{2}-tgx}$

$\frac{tgx}{2} = 1\frac{1}{2}-tgx$

$\frac{tgx}{2}+tgx = 1\frac{1}{2}$

$\frac{3tgx}{2} = \frac{3}{2}$

$tgx = 1$

$tgx = 1$

$x = \frac{\pi}{4}+\pi k, k\in Z$.

**112.** $(\sqrt{2})^{2\cos x} = \frac{1}{2\cdot 2^{\cos x}}$ tənliyini həll edin.

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

C) $\pm\frac{2\pi}{3}+2\pi k, k\in Z$ B) $\frac{\pi}{2}+\pi k, k\in Z$

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

$2^{\frac{2\cos x}{2}} = 2^{1-\cos x}$

$\cos x = -1+\cos x$

$2\cos x = -1$

$\cos x = -\frac{1}{2}$

$x = \pm\frac{2\pi}{3}+2\pi k, k\in Z$.

# Triqonometrik tənliklər və bərabərsizliklər

**113.** $y = 2\sin\left(x + \frac{\pi}{3}\right)$ və $y = \sqrt{3}\cos x$ funksiyalarının kəsişmə nöqtələrinin absislərini tapın.

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

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

$2\sin\left(x + \frac{\pi}{3}\right) = \sqrt{3}\cos x$

$2\sin x\cos\frac{\pi}{3} + 2\cos x\sin\frac{\pi}{3} = \sqrt{3}\cos x$

$2\cdot\frac{1}{2}\sin x + 2\cdot\frac{\sqrt{3}}{2}\cos x = \sqrt{3}\cos x$

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

$\sin x = 0$

$x = \pi k,\ k \in Z.$

**114.** Tənliyi həll edin: $4\sin^2 x = 2 - \sqrt{3}$.

(A) $\pm\frac{\pi}{12} + \pi k, k \in Z$ B) $(-1)^k\frac{\pi}{12} + \pi k, k \in Z$ C) $\pi k, k \in Z$

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

$4\cdot\frac{1-\cos 2x}{2} = 2 - \sqrt{3}$

$2(1 - \cos 2x) = 2 - \sqrt{3}$

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

$\cos 2x = \frac{\sqrt{3}}{2}$

$2x = \pm\frac{\pi}{6} + 2\pi k$

$x = \pm\frac{\pi}{12} + \pi k,\ k \in Z.$

**115.** $4\cos^2 x = 2 + \sqrt{3}$ tənliyini həll edin.

A) $\pm\frac{\pi}{12} + 2\pi k, k \in Z$ B) $\frac{\pi}{6} + 2\pi k, k \in Z$ C) $\frac{\pi}{3} + \pi k, k \in Z$

(D) $\pm\frac{\pi}{12} + \pi k, k \in Z$ E) $2\pi k, k \in Z$

$4\cdot\frac{1+\cos 2x}{2} = 2 + \sqrt{3}$

$2 + 2\cos 2x = 2 + \sqrt{3}$

$\cos 2x = \frac{\sqrt{3}}{2}$

$2x = \pm\frac{\pi}{6} + 2\pi k$

$x = \pm\frac{\pi}{12} + \pi k,\ k \in Z.$

**116.** Tənliyi həll edin: $\sin^2 x + \sin 2x + \cos^2 x = 0$

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

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

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

$(\sin x + \cos x)^2 = 0$

$\frac{\sin x}{\cos x} + \frac{\cos x}{\cos x} = \frac{0}{\cos x}$

$tgx + 1 = 0$

$tgx = -1 \qquad x = -\frac{\pi}{4} + \pi k,\ k \in Z.$

**117.** $2\cos\left(2x - \frac{\pi}{12}\right) - 1 < 0$ bərabərsizliyini həll edin.

(A) $\left(\frac{5\pi}{24} + \pi k; \frac{7\pi}{8} + \pi k\right), k \in Z$ B) $\left(-\frac{\pi}{8} + \pi k; \frac{5\pi}{24} + \pi k\right), k \in Z$

C) $\left(-\frac{13}{24} + \pi k; \frac{\pi}{8} + \pi k\right), k \in Z$ D) $\left(-\frac{5\pi}{12} + \pi k; \frac{\pi}{12} + \pi k\right), k \in Z$

E) $\left(\frac{\pi}{3} + 2\pi k; \frac{5\pi}{8} + 2\pi k\right), k \in Z$

$\cos\left(2x - \frac{\pi}{12}\right) < \frac{1}{2}$

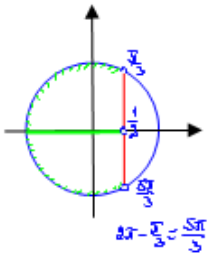
$\frac{\pi}{3} + 2\pi k < 2x - \frac{\pi}{12} < \frac{5\pi}{3} + 2\pi k$

$\frac{\pi}{3} + \frac{\pi}{12} + 2\pi k < 2x < \frac{5\pi}{3} + \frac{\pi}{12} + 2\pi k$

$\frac{5\pi}{12} + 2\pi k < 2x < \frac{21\pi}{12} + 2\pi k$

$\frac{5\pi}{24} + \pi k < x < \frac{21\pi}{24} + \pi k,\ k \in Z.$

$\frac{5\pi}{24} + \pi k < x < \frac{7\pi}{8} + \pi k,\ k \in Z.$




$2\pi - \frac{\pi}{3} = \frac{5\pi}{3}$

**118.** $3tg2x - \sqrt{3} < 0$ bərabərsizliyini həll edin.

A) $\left(-\frac{\pi}{2}; \frac{\pi}{6}\right)$ (B) $\left(-\frac{\pi}{4} + \frac{\pi k}{2}; \frac{\pi}{12} + \frac{\pi k}{2}\right), k \in Z$

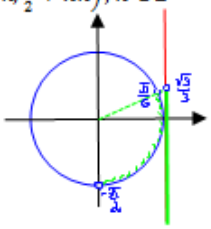
C) $\left(-\frac{\pi}{2} + \pi k; \frac{\pi}{3} + \pi k\right), k \in Z$ D) $\left(\frac{\pi}{6} + \pi k; \frac{\pi}{2} + \pi k\right), k \in Z$

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

$tg2x < \frac{\sqrt{3}}{3}$

$-\frac{\pi}{2} + \pi k < 2x < \frac{\pi}{6} + \pi k$

$-\frac{\pi}{4} + \frac{\pi k}{2} < x < \frac{\pi}{12} + \frac{\pi k}{2},\ k \in Z.$




**119.** $tg\left(x + \frac{\pi}{4}\right) + 1 < 0$ bərabərsizliyini həll edin.

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

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

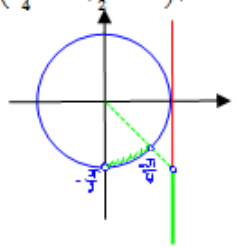
E) $\left(-\frac{\pi}{4} + \pi k; \frac{\pi}{4} + \pi k\right), k \in Z$

$tg\left(x + \frac{\pi}{4}\right) < -1$

$-\frac{\pi}{2} + \pi k < x + \frac{\pi}{4} < -\frac{\pi}{4} + \pi k$

$-\frac{\pi}{2} - \frac{\pi}{4} + \pi k < x < -\frac{\pi}{4} - \frac{\pi}{4} + \pi k$

$-\frac{3\pi}{4} + \pi k < x < -\frac{\pi}{2} + \pi k,\ k \in Z$




**120.** $3\cos x = 1 - \cos 2x$ tənliyini həll edin.

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

D) $-\frac{\pi}{6} + \pi k, k \in Z$) (E) $\pm\frac{\pi}{3} + 2\pi k, k \in Z$

$3\cos x = 1 - (2\cos^2 x - 1)$ $\quad \cos x = t$

$3\cos x = 1 - 2\cos^2 x + 1$ $\quad \cos x = \frac{1}{2}$

$2t^2 + 3t - 2 = 0$ $\quad x = \pm\frac{\pi}{3} + 2\pi k,\ k \in Z.$

$D = 9 + 16 = 25 = 5^2$

$t = \frac{-3 \pm 5}{4}$

$t_1 = -2$ kök. $\quad t_2 = \frac{1}{2}$

**121.** $\sin^2 x + \cos^2 3x = 1$ tənliyini həll edin.

A) $\frac{3\pi k}{4}, k \in Z$ B) $\frac{5\pi k}{4}, k \in Z$ (C) $\frac{\pi k}{4}, k \in Z$ D) $\frac{2\pi}{5}$ E) $\frac{3\pi}{7}$

$\frac{1-\cos 2x}{2} + \frac{1+\cos 6x}{2} = 1$

$\frac{1 - \cos 2x + 1 + \cos 6x}{2} = 1$

$2 + \cos 6x - \cos 2x = 2$

$\cos 6x - \cos 2x = 0$

$-2\sin\frac{6x + 2x}{2}\cdot\sin\frac{6x - 2x}{2} = 0$

$\sin 4x \cdot \sin 2x = 0$

1) $\sin 4x = 0$ $\quad 4x = \pi k$ $\quad x_1 = \frac{\pi k}{4}$

2) $\sin 2x = 0$ $\quad 2x = \pi n$ $\quad x_2 = \frac{\pi n}{2}$

$k, n \in Z.$

k-nın cüt qiymətlərində $x_1 = x_2$ olduğundan cavab $\frac{\pi k}{4}$ olar.

**122.** $y = 2\cos\left(x - \frac{\pi}{6}\right)$ və $y = \sqrt{3}\cos x$ funksiyalarının kəsişmə nöqtələrinin absislərini tapın.

(A) $\pi n, n \in Z$ B) $2\pi n, n \in Z$ C) $\frac{\pi}{2}n, n \in Z$

D) $4\pi n, n \in Z$ E) $3\pi n, n \in Z$

$y = 2\cos\left(x - \frac{\pi}{6}\right)$ $\quad y = \sqrt{3}\cos x$

$2\cos\left(x - \frac{\pi}{6}\right) = \sqrt{3}\cos x$

$2\cos x\cos\frac{\pi}{6} + 2\sin x\sin\frac{\pi}{6} = \sqrt{3}\cos x$

$2\cdot\frac{\sqrt{3}}{2}\cos x + 2\cdot\sin x\cdot\frac{1}{2} = \sqrt{3}\cos x$

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

$\sin x = 0$

$x = \pi n,\ n \in Z.$

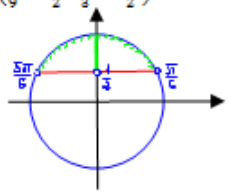
# Triqonometrik tənliklər və bərabərsizliklər

**123.** Bərabərsizliyi həll edin: $2\sin\left(3x-\frac{\pi}{6}\right)-1>0$.

(A) $\left(\frac{\pi}{9}+\frac{2\pi k}{3};\frac{\pi}{3}+\frac{2\pi k}{3}\right), k\in Z$ B) $\left(\frac{\pi}{9}+2\pi k;\frac{\pi}{3}+2\pi k\right), k\in Z$

C) $\left(\frac{\pi}{9}+\pi k;\frac{\pi}{3}+\pi k\right), k\in Z$ D) $\left(\frac{\pi}{9}+\frac{\pi k}{2};\frac{\pi}{3}+\frac{\pi k}{2}\right), k\in Z$

E) $\left(\frac{\pi}{6}+\pi k;\frac{\pi}{3}+\pi k\right), k\in Z$




$\sin\left(3x-\frac{\pi}{6}\right)>\frac{1}{2}$

$\frac{5\pi}{6}+2\pi k<3x-\frac{\pi}{6}<\frac{5\pi}{6}+2\pi k$

$\frac{2\pi}{6}+\frac{\pi}{6}+2\pi k<3x<\frac{5\pi}{6}+\frac{\pi}{6}+2\pi k$

$\frac{\pi}{2}+2\pi k<3x<\pi+2\pi k$

$\frac{\pi}{6}+\frac{2\pi k}{3}<x<\frac{\pi}{2}+\frac{2\pi k}{3}, k\in Z.$

**124.** Tənliyi həll edin: $\sin^2 4x+\cos^2 2x=1$.

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

D) $\frac{\pi}{6}(3k+1), k\in Z$ E) $\frac{\pi k}{4}, k\in Z$

$\frac{1-\cos 8x}{2}+\frac{1+\cos 4x}{2}=1$

$1-\cos 8x+1+\cos 4x=2$

$\cos 4x-\cos 8x=0$

$-2\sin\frac{4x+8x}{2}\cdot\sin\frac{4x-8x}{2}=0$

$-\sin 6x\cdot\sin 2x=0$

1) $\sin 6x=0$ $6x=\pi k$ $x_1=\frac{\pi k}{6}$

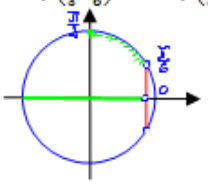
2) $\sin 2x=0$ $2x=\pi n$ $x_2=\frac{\pi n}{2}$

$k=3n$ olduqda $x_1=x_2$

ümumi həll $\frac{\pi k}{6}, k\in Z$

**125.** $\cos x<\frac{\sqrt{3}}{2}$ bərabərsizliyinin $\left[0;\frac{\pi}{2}\right]$ parçasına daxil olan həllərini tapın.

A) $\left[0;\frac{\pi}{6}\right)$ (B) $\left(\frac{\pi}{6};\frac{\pi}{2}\right]$ C) $\left[\frac{\pi}{6};\frac{\pi}{2}\right]$ D) $\left(\frac{\pi}{3};\frac{\pi}{6}\right)$ E) $\left(\frac{\pi}{3};\frac{\pi}{2}\right]$




**126.** $tg\frac{\pi x}{3}=1$ tənliyinin $0<x<13$ şərtini ödəyən həllərinin sayını tapın.

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

$\frac{\pi x}{3}=\frac{\pi}{4}+\pi k$

$x=\frac{3}{4}+3k, k\in Z$

$k=0, x=\frac{3}{4}$ $k=2, x=6\frac{3}{4}$ $k=4, x=12\frac{3}{4}$

$k=1, x=3\frac{3}{4}$ $k=3, x=9\frac{3}{4}$

**127.** Tənliyi həll edin: $\cos^2 x=1+\cos^2(90^\circ-x)$.

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

D) $\pm\frac{\pi}{3}+2\pi k, k\in Z$ D) $\emptyset$

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

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

$\cos 2x=1$

$2x=2\pi k$

$x=\pi k, k\in Z.$

**128.** Tənliyi həll edin: $\sin^2 x=1+\sin^2\left(\frac{\pi}{2}-x\right)$.

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

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

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

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

$-\cos 2x=1$

$\cos 2x=-1$

$2x=\pi+2\pi k$

$x=\frac{\pi}{2}+\pi k, k\in Z.$

**129.** $\cos\pi x=\frac{\sqrt{2}}{2}$ tənliyinin $0<x<4$ şərtini ödəyən həllərinin sayını tapın.

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

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

$x=\pm\frac{1}{4}+2k, k\in Z.$

$x_1=\frac{1}{4}+2k$, $k=0, x_1=\frac{1}{4}$; $k=1, x_1=2\frac{1}{4}$

$x_2=-\frac{1}{4}+2k$. $k=1, x_2=1\frac{3}{4}$; $k=2, x_2=3\frac{3}{4}$

(4)

**130.** Tənliyi həll edin: $tg\,\pi(x+1)=1$.

A) $\frac{\pi}{4}+\pi n, n\in Z$ B) $\frac{1}{4}+n, n\in Z$ C) $\frac{1}{4}-n, n\in Z$

(D) $-\frac{3}{4}+n, n\in Z$ E) $\frac{3}{4}-n, n\in Z$

$\pi(x+1)=\frac{\pi}{4}+\pi k$

$x=\frac{1}{4}-1+k$

$x=-\frac{3}{4}+k, n\in Z$

**131.** $\sin\frac{\pi x}{2}=\frac{1}{2}$ tənliyinin $0<x<9$ şərtini ödəyən həllərinin sayını tapın.

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

$\frac{\pi x}{2}=(-1)^k\frac{\pi}{6}+\pi k$

$x=(-1)^k\frac{1}{3}+2k, k\in Z$

$k=0, x=\frac{1}{3}$ $k=3, x=-\frac{1}{3}+6=5\frac{2}{3}$

$k=1, x=\frac{1}{3}+2=1\frac{2}{3}$ $k=4, x=8\frac{1}{3}$

$k=2, x=4\frac{1}{3}$

**132.** Tənliyi həll edin: $ctg\,\pi(x-1)=1$.

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

(D) $\frac{5}{4}+n, n\in Z$ E) $\frac{1}{4}+n, n\in Z$

$\pi(x-1)=\frac{\pi}{4}+\pi k, k\in Z.$

$x=1+\frac{1}{4}+k$

$x=\frac{5}{4}+k, k\in Z$

# Triqonometrik tənliklər və bərabərsizliklər

**133.** $ctg2\pi x = \sqrt{3}$ tənliyinin $0 < x < 3$ şərtini ödəyən köklərinin sayını tapın.

A)6 B)3 C)4 D)2 E)8

$2\pi x = \frac{\pi}{6} + \pi k$

$x = \frac{1}{12} + \frac{k}{2}$, $k \in \mathbb{Z}$

$x_k = \frac{1+6k}{12}$, $k \in \mathbb{Z}$.

$x_0 = \frac{1}{12}$ $x_3 = \frac{19}{12}$

$x_1 = \frac{7}{12}$ $x_4 = \frac{25}{12}$

$x_2 = \frac{13}{12}$ $x_5 = \frac{31}{12}$

$x_6 = \frac{37}{12} = 3\frac{1}{12} > 3$

6

**134.** $\cos(x + 15^\circ) = -\frac{\sqrt{2}}{2}$ tənliyinin $-190^\circ < x < 190^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A) $-30^\circ$ B)$30^\circ$ C)$120^\circ$ D) $-150^\circ$ E)$270^\circ$

$x + 15^\circ = \pm 135^\circ + 360^\circ k$

$x = \pm 135^\circ - 15^\circ + 360^\circ k$

$x_1 = 120^\circ + 360^\circ k$ $k=0$, $x_1 = 120^\circ$

$x_2 = -150^\circ + 360^\circ k$ $k=0$, $x_2 = -150^\circ$

$120^\circ + (-150^\circ) = -30^\circ$

**135.** $\cos(13^\circ + x) = \frac{\sqrt{2}}{2}$ tənliyinin $-90^\circ < x < 90^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A) $-26^\circ$ B)$32^\circ$ C)$58^\circ$ D) $-58^\circ$ E)$26^\circ$

$13^\circ + x = \pm 45^\circ + 360^\circ k$

$x = \pm 45^\circ - 13^\circ + 360^\circ k$

$x_1 = 32^\circ + 360^\circ k$. $k=0$ $x_1 = 32^\circ$

$x_2 = -58^\circ + 360^\circ k$ $x_2 = -58^\circ$

$32^\circ + (-58^\circ) = -26^\circ$

**136.** $\cos(x + 40^\circ) = \frac{1}{2}$ tənliyinin $-130^\circ < x < 170^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A) $-90^\circ$ B)$90^\circ$ C)$20^\circ$ D)$110^\circ$ E)$-110^\circ$

$x + 40^\circ = \pm 60^\circ + 360^\circ k$

$x = \pm 60^\circ - 40^\circ + 360^\circ k$

$x_1 = 20^\circ + 360^\circ k$ $k=0$ $x_1 = 20^\circ$

$x_2 = -100^\circ + 360^\circ k$ $x_2 = -100^\circ$

$x_1 + x_2 = 20^\circ + (-100^\circ) = -80^\circ$

**137.** $\cos(x - 20^\circ) = -\frac{1}{2}$ tənliyinin $-150^\circ < x < 250^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A)$270^\circ$ B)$40^\circ$ C)$400^\circ$ D)$170^\circ$ E)$230^\circ$

$x - 20^\circ = \pm 120^\circ + 360^\circ k$

$x = 20^\circ \pm 120^\circ + 360^\circ k$

$x_1 = 140^\circ + 360^\circ k$, $k=0$ $x_1 = 140^\circ$

$x_2 = -100^\circ + 360^\circ k$, $x_2 = -100^\circ$

$x_1 + x_2 = 140^\circ + (-100^\circ) = 40^\circ$

**138.** $\cos 3x = \sqrt{3}\sin 3x$ tənliyinin $5^\circ < x < 175^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A)$210^\circ$ B)$200^\circ$ C)$80^\circ$ D)$10^\circ$ E)$130^\circ$

$\frac{\cos 3x}{\sin 3x} = \sqrt{3}$

$ctg3x = \sqrt{3}$

$3x = 30^\circ + 180^\circ k$

$x = 10^\circ + 60^\circ k$, $k \in \mathbb{Z}$

$k=0$, $x = 10^\circ$ $10^\circ + 70^\circ + 130^\circ = 210^\circ$

$k=1$, $x = 10^\circ + 60^\circ = 70^\circ$

$k=2$, $x = 10^\circ + 120^\circ = 130^\circ$

**139.** $\sin 2x = \sqrt{3}\cos 2x$ tənliyinin $5^\circ < x < 195^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A)$150^\circ$ B)$30^\circ$ C)$120^\circ$ D)$60^\circ$ E)$180^\circ$

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

$tg2x = \sqrt{3}$

$2x = 60^\circ + 180^\circ k$

$x = 30^\circ + 90^\circ k$, $k \in \mathbb{Z}$

$k=0$, $x = 30^\circ$ $30^\circ + 120^\circ = 150^\circ$

$k=1$, $x = 120^\circ$

**140.** $\sin 5x + \cos 5x = 0$ tənliyinin $15^\circ < x < 135^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A)$189^\circ$ B)$324^\circ$ C)$135^\circ$ D)$27^\circ$ E)$99^\circ$

$\frac{\sin 5x}{\cos 5x} + \frac{\cos 5x}{\cos 5x} = \frac{0}{\cos 5x}$

$tg5x + 1 = 0$

$tg5x = -1$

$5x = 135^\circ + 180^\circ k$

$x = 27^\circ + 36^\circ k$, $k \in \mathbb{Z}$.

$k=0$, $x = 27^\circ$

$k=1$, $x = 27^\circ + 36^\circ = 63^\circ$

$k=2$, $x = 27 + 72^\circ = 99^\circ$

$27^\circ + 63^\circ + 99^\circ = 189^\circ$

**141.** $\sin 9x = \cos 9x$ tənliyinin $5^\circ < x < 85^\circ$ şərtini ödəyən köklərinin cəmini tapın.

A)$135^\circ$ B)$225^\circ$ C)$220^\circ$ D)$140^\circ$ E)$45^\circ$

$\frac{\sin 9x}{\cos 9x} = \frac{\cos 9x}{\cos 9x}$

$tg9x = 1$

$9x = 45^\circ + 180^\circ k$

$x = 5^\circ + 20^\circ k$

$k=1$, $x = 5 + 20^\circ = 25^\circ$

$k=2$, $x = 5 + 40^\circ = 45^\circ$

$k=3$, $x = 5 + 60^\circ = 65^\circ$

$25^\circ + 45^\circ + 65^\circ = 135^\circ$

**142.** Tənliyi həll edin: $\sin 7x + \cos 2x = -2$.

A) $\frac{\pi}{19} + k\pi, k \in Z$ B) $\frac{\pi}{14} + k\pi, k \in Z$ C) $\frac{\pi}{11} + k\pi, k \in Z$

D) $\frac{\pi}{2} + 2\pi k, k \in Z$ E) $\frac{\pi}{13} + k\pi, k \in Z$

Belə tənliklər standart olmayan tənliklər deyilir.

Və həlli $\begin{cases} \sin 7x = -1 \\ \cos 2x = -1 \end{cases}$ sisteminin həlli ilə eynidir.

$\begin{cases} 7x = -\frac{\pi}{2} + 2\pi k, k \in Z \\ 2x = \pi + 2\pi n, n \in Z. \end{cases} \Rightarrow \begin{cases} x = -\frac{\pi}{14} + \frac{2\pi}{7}k \\ x = \frac{\pi}{2} + \pi n \end{cases} \Rightarrow -\frac{\pi}{14} + \frac{2\pi k}{7} = \frac{\pi}{2} + \pi n$

$14\left(-\frac{1}{14} + \frac{2k}{7}\right) = \left(\frac{1}{2} + n\right) \cdot 14$

$-1 + 4k = 7 + 14n$

$4k = 8 + 14n$

$k = 2 + \frac{7}{2}n$

k və n tam olduğu üçün n cüt olmalıdır. $n = 2m, m \in Z$

$x = \frac{\pi}{2} + 2\pi m, m \in Z$

# Triqonometrik tənliklər və bərabərsizliklər

**143.** Tənliyi həll edin: $2(\cos^4 x - \sin^4 x) = 1$.

A) $-\frac{\pi}{6} + \pi n, n \in Z$ B) $\frac{\pi}{6} + \pi n, n \in Z$

C) $\pm\frac{\pi}{6} + 2\pi n, n \in Z$ (D) $\pm\frac{\pi}{6} + \pi n, n \in Z$

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

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

$\cos 2x = \frac{1}{2}$

$2x = \pm\frac{\pi}{3} + 2\pi k$

$x = \pm\frac{\pi}{6} + \pi k, k \in Z.$

**144.** Tənliyi həll edin: $2\sin(\pi - x) + 1 = 0$.

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

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

E) $(-1)^{k+1}\frac{\pi}{3} + \pi k, k \in Z$

$2\sin x = -1$

$\sin x = -\frac{1}{2}$

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

$2\sin(\pi - x) = -1$

$\sin(\pi - x) = -\frac{1}{2}$

$\sin(x - \pi) = \frac{1}{2}$

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

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

$x = (-1)^k\frac{\pi}{6} + \pi(k+1), k \in Z.$

**145.** Tənliyi həll edin: $\sin^2 x + \sin x = 0$.

A) $\frac{\pi k}{4}; \frac{\pi k}{3}, k \in Z$ B) $\frac{\pi k}{2}; \frac{\pi k}{4}, k \in Z$ C) $\frac{\pi k}{2}; \frac{\pi k}{3}, k \in Z$

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

$\sin x(\sin x + 1) = 0$

1) $\sin x = 0$ $x = \pi k, k \in Z.$

2) $\sin x + 1 = 0$ $\sin x = -1$ $x = -\frac{\pi}{2} + 2\pi k, k \in Z.$

**146.** Tənliyi həll edin: $\sqrt{3}\cos^2 x + \sin x \cos x = 0$.

(A) $\frac{\pi}{2} + \pi n; -\frac{\pi}{3} + \pi k, n, k \in Z$ B) $\frac{\pi}{2} + \pi n; -\frac{\pi}{4} + \pi k, n, k \in Z$

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

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

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

1) $\cos x = 0$ $x = \frac{\pi}{2} + \pi n$

2) $\sqrt{3}\frac{\cos x}{\cos x} + \frac{\sin x}{\cos x} = \frac{0}{\cos x}$ $\sqrt{3} + \operatorname{tg} x = 0$

$\operatorname{tg} x = -\sqrt{3} \Rightarrow x = -\frac{\pi}{3} + \pi k, k \in Z.$

**147.** Tənliyi həll edin: $\sin 9x + \sin 5x = 5\cos 2x$.

(A) $\frac{\pi}{4} + \frac{\pi n}{2}, n \in Z$ B) $(-1)^n\frac{\pi}{6} + \pi n, n \in Z$ C) $\pi n, n \in Z$

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

$2\sin\frac{9x+5x}{2} \cdot \cos\frac{9x-5x}{2} = 5\cos 2x$

$2\sin 7x \cdot \cos 2x - 5\cos 2x = 0$

$\cos 2x(2\sin 7x - 5) = 0$

1) $\cos 2x = 0$ $2x = \frac{\pi}{2} + \pi k$ $x = \frac{\pi}{4} + \frac{\pi k}{2}, k \in Z.$

2) $2\sin 7x - 5 = 0$ $\sin 7x = \frac{5}{2} > 1$ $\emptyset$

**148.** $\sin 3x - \sin 7x = \sqrt{3}\sin 2x$ tənliyinin $\left[0; \frac{\pi}{2}\right]$ parçasına daxil olan köklərinin cəmini tapın

A) $\frac{\pi}{6}$ B) $\frac{\pi}{3}$ (C) $\frac{2\pi}{5}$ D) 0 E) $\frac{9\pi}{10}$

$2\cos\frac{3x+7x}{2} \cdot \sin\frac{3x-7x}{2} = \sqrt{3}\sin 2x$

$-2\cos 5x \cdot \sin 2x - \sqrt{3}\sin 2x = 0$

$-\sin x(2\cos 5x + \sqrt{3}) = 0$

1) $\sin x = 0$ $x = \pi n, n \in Z.$

2) $2\cos 5x + \sqrt{3} = 0$ $\cos 5x = -\frac{\sqrt{3}}{2}$ $5x = \pm\frac{5\pi}{6} + 2\pi k$ $x = \pm\frac{\pi}{6} + \frac{2\pi k}{5}$

$x_1 = 30° + 72°k, k \in Z.$ $k=0, x_1 = 30°$

$x_2 = -30° + 72°k, k \in Z.$ $k=1, x_2 = 42°$ $72° = \frac{2\pi}{5}$

**149.** Tənliyi həll edin: $tg3x \cos x - tg3x = 0$.

A) $arctg3 + \pi k; \pm\frac{\pi}{3} + 2\pi k, k \in Z$ (B) $\frac{\pi k}{3}, k \in Z$

C) $\pm\frac{\pi}{3} + 2\pi k; \frac{\pi}{3} + \pi k, k \in Z$ D) $\pi + 2\pi k; \frac{\pi}{6} + \pi k, k \in Z$

E) $2\pi k, k \in Z$

$\operatorname{tg} 3x(\cos 3x - 1) = 0$

1) $\operatorname{tg} 3x = 0$ $3x = \pi k$ $x = \frac{\pi k}{3}, k \in Z.$

2) $\cos 3x - 1 = 0$ $\cos 3x = 1$ $x = \frac{2\pi n}{3}, n \in Z.$

$k = 6m, m \in Z$ olduqda 2)-nin kök alınır. Ümumi kök $\frac{\pi k}{3}, k \in Z.$

**150.** Tənliyi həll edin: $\frac{8}{\pi}\operatorname{arctg}\left(\operatorname{tg}\frac{7\pi}{8}\right) + \operatorname{tg} 2x = \cos\left(\arccos\left(-\frac{1}{2}\right) + \frac{\pi}{3}\right)$.

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

D) $\frac{\pi}{3} + k\pi, k \in Z$ E) $\frac{\pi}{6} + \frac{k\pi}{2}, k \in Z$

$\frac{8}{\pi}\operatorname{arctg}\left(\operatorname{tg}\left(\pi - \frac{\pi}{8}\right)\right) + \operatorname{tg} 2x = \cos\left(\frac{2\pi}{3} + \frac{\pi}{3}\right)$

$\frac{8}{\pi}\operatorname{arctg}\left(-\operatorname{tg}\frac{\pi}{8}\right) + \operatorname{tg} 2x = \cos\pi$

$\frac{8}{\pi} \cdot \frac{-\pi}{8} + \operatorname{tg} 2x = -1$

$-1 + \operatorname{tg} 2x = -1$

$\operatorname{tg} 2x = 0$

$2x = \pi k$

$x = \frac{\pi k}{2}, k \in Z.$

**151.** Tənliyi həll edin: $\sqrt{4\sin^2 210°} + ctg^4\frac{x}{2} = 10$.

A) $\frac{\pi}{4} + \pi n, n \in Z$ B) $\pm\frac{\pi}{4} + 2\pi n, n \in Z$ C) $\pm\frac{\pi}{6} + 2\pi n, n \in Z$

D) $\frac{\pi}{6} + \pi n, n \in Z$ (E) $\pm\frac{\pi}{3} + 2\pi n, n \in Z$

$|2\sin 210°| + ctg^4\frac{x}{2} = 10$

$|2\sin(180° + 30°)| + ctg^4\frac{x}{2} = 10$

$|2 \cdot (-\sin 30°)| + ctg^4\frac{x}{2} = 10$

$|2 \cdot \frac{-1}{2}| + ctg^4\frac{x}{2} = 10$

$1 + ctg^4\frac{x}{2} = 10$

$ctg^4\frac{x}{2} = 9$

$ctg\frac{x}{2} = \pm\sqrt[4]{3^2}$

$ctg\frac{x}{2} = \pm\sqrt{3}$

$\frac{x}{2} = \pm\frac{\pi}{6} + \pi k$

$x = \pm\frac{\pi}{3} + 2\pi k, k \in Z.$

# Triqonometrik tənliklər və bərabərsizliklər

**152.** Tənliyi həll edin: $\sin 2x - \cos 2x = \sqrt{2}\sin 3x$.

A) $\frac{\pi}{2}+\frac{2}{3}k\pi, k\in Z$ B) $\frac{\pi}{12}+\frac{\pi k}{3}, k\in Z$

C) $\frac{\pi}{4}+\frac{2}{5}k\pi;\ -\frac{\pi}{4}+2k\pi, k\in Z$ D) $\frac{\pi}{5}+\frac{3}{4}k\pi, k\in Z$

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

$\frac{1}{\sqrt2}\sin 2x - \frac{1}{\sqrt2}\cos 2x = \sin 3x$

$\sin 2x\cdot\cos\frac{\pi}{4} - \cos 2x\sin\frac{\pi}{4} = \sin 3x$

$\sin\left(2x-\frac{\pi}{4}\right) = \sin 3x$

$\sin 3x - \sin\left(2x-\frac{\pi}{4}\right) = 0$

$2\cos\frac{3x+2x-\frac{\pi}{4}}{2}\cdot\sin\frac{3x-2x+\frac{\pi}{4}}{2} = 0$

$\cos\left(\frac{5x}{2}-\frac{\pi}{8}\right)\cdot\sin\left(\frac{x}{2}+\frac{\pi}{8}\right) = 0$

1) $\cos\left(\frac{5x}{2}-\frac{\pi}{8}\right) = 0$

$\frac{5x}{2}-\frac{\pi}{8} = \frac{\pi}{2}+\pi k$

$\frac{5x}{2} = \frac{5\pi}{8}+\pi k$

$x = \frac{\pi}{4}+\frac{2\pi}{5}k$

2) $\sin\left(\frac{x}{2}+\frac{\pi}{8}\right) = 0$

$\frac{x}{2}+\frac{\pi}{8} = \pi k,\ \frac{x}{2} = -\frac{\pi}{8}+\pi k$

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

**153.** Tənliyi həll edin: $\sin 2x + \cos 2x = \sqrt{2}\sin 3x$.

A) $\frac{3\pi}{20}+\frac{2\pi k}{5}, k\in Z;\ \frac{\pi}{4}+2\pi k, k\in Z$ B) $\frac{\pi}{3}+\frac{\pi k}{4}, k\in Z$

C) $\frac{2\pi}{5}+\frac{3\pi k}{20}, k\in Z$ D) $\frac{2\pi k}{3}+\pi k, k\in Z$

E) $\frac{\pi}{4}+\frac{2\pi k}{5}, k\in Z$

$\frac{1}{\sqrt2}\sin 2x + \frac{1}{\sqrt2}\cos 2x = \sin 3x$

$\sin 2x\cdot\cos 45^\circ + \cos 2x\cdot\sin 45^\circ = \sin 3x$

$\sin(2x+45^\circ) = \sin 3x$

$\sin 3x - \sin(2x+45^\circ) = 0$

$2\cos\frac{3x+2x+45^\circ}{2}\sin\frac{3x-2x-45^\circ}{2} = 0$

$2\cos\left(\frac{5x}{2}+\frac{\pi}{8}\right)\cdot\sin\left(\frac{x}{2}-\frac{\pi}{8}\right) = 0$

1) $\cos\left(\frac{5x}{2}+\frac{\pi}{8}\right) = 0$

$\frac{5x}{2}+\frac{\pi}{8} = \frac{\pi}{2}+\pi k$

$\frac{5x}{2} = \frac{3\pi}{8}+\pi k$

$x = \frac{3\pi}{20}+\frac{2\pi}{5}k,\ k\in Z$

2) $\sin\left(\frac{x}{2}-\frac{\pi}{8}\right) = 0$

$\frac{x}{2}-\frac{\pi}{8} = \pi k$

$\frac{x}{2} = \frac{\pi}{8}+\pi k$

$x = \frac{\pi}{4}+2\pi k,\ k\in Z$

**154.** $\sin^2 x < \frac{1}{4}$ bərabərsizliyini həll edin.

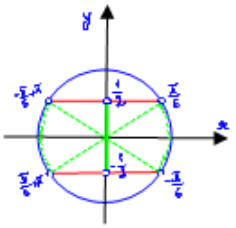
A) $\left(\frac{\pi}{6}+2\pi k;\ \frac{5\pi}{6}+\pi k\right), k\in Z$ B) $\left(-\frac{\pi}{6}+\pi k;\ \frac{\pi}{6}+\pi k\right), k\in Z$

C) $\left(-\frac{5\pi}{6}+2\pi k;\ -\frac{\pi}{6}+2\pi k\right), k\in Z$ D) $\left[-\frac{7\pi}{6}+2\pi k;\ \frac{\pi}{6}+2\pi k\right], k\in Z$

D) $\left[\frac{5\pi}{6}+2\pi k;\ \frac{7\pi}{6}+2\pi k\right], k\in Z$

$|\sin x| < \frac{1}{2}$

$-\frac{\pi}{6}+\pi k < x < \frac{\pi}{6}+\pi k,\ k\in Z$



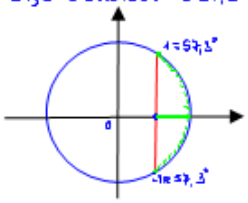
**155.** Bərabərsizliyi həll edin: $\cos(\sin 1996x) > 0$.

A) $[2\pi n;\ (2n+1)\pi], n\in Z$ B) $\emptyset$

C) $\left(\frac{\pi}{2}+\pi n;\ \frac{3\pi}{2}+\pi n\right), n\in Z$ D) $(-\infty;+\infty)$ E) $[-1996;\ 1996]$

$-1 \le \sin 1996x \le 1 \Rightarrow -57{,}3^\circ \le \sin 1996x \le 57{,}3^\circ$

$x\in(-\infty;\infty)$



**156.** Bərabərsizliyi həll edin: $\cos\left(\sin\left(3x-\frac{1996}{11}\right)\right) > 0$.

A) $(0;+\infty)$ B) $(2\pi n;\ (2n+1)\pi), n\in Z$

C) $(-\infty;+\infty)$ D) $\left(-\frac{\pi}{2}+\pi;\ \frac{\pi}{2}+\pi n\right), n\in Z$

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

$-57{,}3^\circ \le -1 \le \sin\left(3x-\frac{1996}{11}\right) \le 1 \le 57{,}3^\circ$

$t\in[-57{,}3^\circ;\ 57{,}3^\circ]$ $\cos t > 0$

$x\in(-\infty;\infty)$

**157.** $tg2x = 3tgx$ tənliyini həll edin.

A) $k\pi;\ \pm\frac{\pi}{6}+k\pi, k\in Z$ B) $(2k+1)\pi;\ \frac{\pi}{2}+k\pi, k\in Z$

C) $k\pi;\ \pm\frac{\pi}{3}+k\pi, k\in Z$ D) $(k-1)\pi;\ \frac{\pi}{4}+k\pi, k\in Z$

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

$\frac{2tgx}{1-tg^2x} = 3tgx$

$2tgx = 3tgx\cdot(1-tg^2x)$

$2tgx - 3tgx\cdot(1-tg^2x) = 0$

$tgx\left(2-3(1-tg^2x)\right) = 0$

1) $tgx = 0$

$x = \pi k,\ k\in Z$

2) $2-3(1-tg^2x) = 0$

$2-3+3tg^2x = 0$

$3tg^2x = 1$

$tg^2x = \frac{1}{3}$

$tgx = \pm\frac{1}{\sqrt3}$

$x = \pm\frac{\pi}{6}+\pi k,\ k\in Z.$

**158.** Bərabərsizliyi həll edin: $2\cos^2 x > 1$.

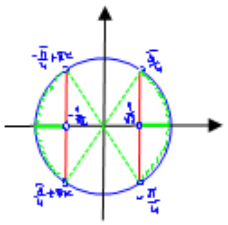
A) $\left(-\frac{\pi}{4}+\pi k;\ \frac{\pi}{4}+\pi k\right), k\in Z$ B) $\left(-\frac{\pi}{4};\ \frac{\pi}{4}\right)$ C) $\left(-\frac{\pi}{2};\ \frac{\pi}{2}\right)$

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

$\cos^2 x > \frac{1}{2}$

$|\cos x| > \frac{1}{\sqrt2}$

$\left(-\frac{\pi}{4}+\pi k < x < \frac{\pi}{4}+\pi k\right)$



$\frac{1+\cos 2x}{2} > \frac{1}{2}$

$1+\cos 2x > 1$

$\cos 2x > 0$

$-\frac{\pi}{2}+2\pi k < 2x < \frac{\pi}{2}+2\pi k$

$-\frac{\pi}{4}+\pi k < x < \frac{\pi}{4}+\pi k$

**159.** $\cos 3x = 1-\sqrt3\sin 3x$ tənliyinin ən kiçik müsbət kökünü tapın.

A) $\frac{\pi}{4}$ B) $\frac{\pi}{3}$ C) $\frac{2\pi}{9}$ D) $\frac{\pi}{5}$ E) $\pi$

$\cos 3x + \sqrt3\sin 3x = 1$

$\frac{1}{2}\cos 3x + \frac{\sqrt3}{2}\sin 3x = \frac{1}{2}$

$\cos 3x\cdot\cos 60^\circ + \sin 3x\cdot\sin 60^\circ = \frac{1}{2}$

$\cos(3x-60^\circ) = \frac{1}{2}$

$3x-60^\circ = \pm 60^\circ + 360^\circ k$

$3x = 60^\circ \pm 60^\circ + 360^\circ k$

$x = 20^\circ \pm 20^\circ + 120^\circ k,\ k\in Z$

$k=0,\ x = 20^\circ+20^\circ = 40^\circ = \frac{2\pi}{9}$

**160.** Bərabərsizliyi həll edin: $\sin 2x\cos 3x < \cos 2x\sin 3x$.

A) $\left(\frac{\pi}{2}+2\pi n;\ \pi+2\pi n\right), n\in Z$ B) $\left(-\frac{\pi}{2}+2\pi n;\ \frac{\pi}{2}+2\pi n\right), n\in Z$

C) $(2\pi n;\ \pi+2\pi n), n\in Z$ D) $\emptyset$ E) $(-\infty;\infty)$

$\sin 2x\cos 3x - \cos 2x\sin 3x < 0$

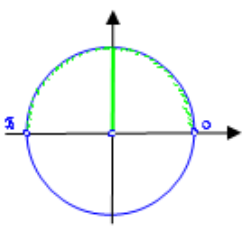
$\sin(2x-3x) < 0$

$\sin(-x) < 0$

$-\sin x < 0$

$\sin x > 0$

$0+2\pi n < x < \pi+2\pi n,\ n\in Z.$



# Triqonometrik tənliklər və bərabərsizliklər

**161.** $\cos 2x = 5\sin x + 3$ tənliyini həll edin.

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

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

$1 - 2\sin^2 x = 5\sin x + 3, \quad \sin x = t$

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

$D = 25 - 16 = 9 = 3^2$

$t = \frac{-5 \pm 3}{4}$

$t_1 = -\frac{1}{2}$

$t_2 = -2$

1) $\sin x = -\frac{1}{2}$

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

2) $\sin x = -2$

$\emptyset$

**162.** $a$ parametrinin hansı qiymətlərində $1 + \cos^4 x - \sin^4 x = a$ tənliyinin həlli var?

A) $[-2; 2]$ B) $[-2; 0]$ C) $[-1; 3]$ D) $[2; 4]$ E) $[0; 2]$

$1 + (\cos^2 x - \sin^2 x)(\cos^2 x + \sin^2 x) = a$

$1 + \cos 2x \cdot 1 = a$

$\cos 2x = a - 1$

$-1 \le a - 1 \le 1$

$-1 + 1 \le a \le 1 + 1$

$0 \le a \le 2.$

**163.** $3\sin^2 x - \cos^2 x = 4\cos x$ tənliyini həll edin.

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

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

$3(1 - \cos^2 x) - \cos^2 x = 4\cos x, \quad \cos x = t$

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

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

$D_1 = 4 + 12 = 16 = 4^2$

$t = \frac{-2 \pm 4}{4}$

$t_1 = \frac{1}{2} \quad t_2 = -1,5$

1) $\cos x = \frac{1}{2}$

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

2) $\cos x = -1,5$

$\emptyset$

**164.** Tənliyi həll edin: $\sin(2\operatorname{arctg} x) = 0.$

A) $0$ B) $\emptyset$ C) $\frac{\pi}{2}$ D) $\pi$ E) $tg\frac{k\pi}{2}, k \in Z$

$2\operatorname{arctg} x = \pi k, \quad k \in Z.$

$\operatorname{arctg} x = \frac{\pi k}{2}, \quad k \in Z.$

$k = 0, \quad \operatorname{arctg} x = 0$

$x = 0$

**165.** $\frac{\cos x}{1 + \sin x} = 0$ tənliyinin $[-2\pi; 2\pi]$ parçasında yerləşən neçə həlli var? $[-360°; 360°]$

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

$\begin{cases} \cos x = 0 \\ 1 + \sin x \neq 0 \end{cases} \quad \begin{cases} \cos x = 0 \\ \sin x \neq -1 \end{cases} \quad x = \frac{\pi}{2} + 2\pi k = 90° + 360°\cdot k, k \in Z$

1. $k = -1, \ x = 90° - 360° = -270°$
2. $k = 0, \ x = 90°$

**166.** $\frac{\sin^2 x - 2\sin x}{x} = 0$ tənliyinin $[-2\pi; 2\pi]$ parçasında yerləşən neçə həlli var? $[-360°; 360°]$

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

$\begin{cases} \sin^2 x - 2\sin x = 0 \\ x \neq 0 \end{cases}$

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

1) $\sin x = 0$ $x = \pi k, k \in Z.$

2) $\sin x - 2 = 0$ $\sin x = 2$ $\emptyset$

$x = \pi k, \ k \in Z.$

$k = -2, \ x = -2\pi$ 1

$k = -1, \ x = -\pi$ 2

$k = 1, \ x = \pi$ 3

$k = 2 \quad x = 2\pi$ 4

**167.** Tənliyi həll edin: $\cos(2\arcsin x) = 0.$

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

$2\arcsin x = \frac{\pi}{2} + \pi k$

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

$k = 0, \quad \arcsin x = \frac{\pi}{4}$

$\sin(\arcsin x) = \sin\frac{\pi}{4}$

$x = \frac{\sqrt{2}}{2}$

$k = -1, \quad \arcsin x = \frac{\pi}{4} - \frac{\pi}{2} = -\frac{\pi}{4}$

$\sin(\arcsin x) = \sin(-\frac{\pi}{4})$

$x = -\frac{\sqrt{2}}{2}.$

$x = \pm\frac{\sqrt{2}}{2}$

**168.** Tənliyi həll edin: $\frac{4}{\sin^2 x} = 4 + ctg^2 x.$

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

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

$\frac{4}{\sin^2 x} = 4 + ctg^2 x$

$4(1 + ctg^2 x) = 4 + ctg^2 x$

$4 + 4ctg^2 x = 4 + ctg^2 x$

$3ctg^2 x = 0$

$ctg x = 0$

$x = \frac{\pi}{2} + \pi k, \ k \in Z.$

**169.** $3\sin x + 4\cos x = a$ tənliyinin həlli olması üçün $a$ hansı qiymətlər almalıdır?

A) $[-3; 3]$ B) $[-4; 4]$ C) $[-3; 4]$ D) $[-5; 5]$ E) $[-5; 4]$

$\sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$

$\frac{3}{5}\sin x + \frac{4}{5}\cos x = \frac{a}{5}$

elə $\alpha$ bucağı var ki, $\cos\alpha = \frac{3}{5}, \ \sin\alpha = \frac{4}{5}$

$\sin x \cdot \cos\alpha + \cos x \cdot \sin\alpha = \frac{a}{5}$

$\sin(x + \alpha) = \frac{a}{5}$

$-1 \le \frac{a}{5} \le 1$

$-5 \le a \le 5$

**170.** $\sin x + 2\cos x = b$ tənliyinin həlli olması üçün $b$ hansı qiymətlər almalıdır?

A) $[-\sqrt{5}; \sqrt{5}]$ B) $[-2; 2]$ C) $[-\sqrt{5}; 2]$ D) $[-2; \sqrt{5}]$ E) $[-5; 5]$

$\sqrt{1^2 + 2^2} = \sqrt{1 + 4} = \sqrt{5}$

$\frac{1}{\sqrt{5}}\sin x + \frac{2}{\sqrt{5}}\cos x = \frac{b}{\sqrt{5}}$

$\sin(x + \alpha) = \frac{b}{\sqrt{5}}$

$-1 \le \frac{b}{\sqrt{5}} \le 1$

$-\sqrt{5} \le b \le \sqrt{5}$

**171.** $\cos x$ ; $\sin x$ ; 1,5 ardıcıllığı x-in hansı qiymətlərində həndəsi silsilə əmələ gətirir?

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

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

$\sin^2 x = \cos x \cdot 1,5$

$1 - \cos^2 x = 1,5\cos x, \quad \cos x = t$

$t^2 + 1,5t - 1 = 0$

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

$D = 3^2 + 16 = 25$

$t = \frac{-3 \pm 5}{4}$

$t_1 = \frac{1}{2}$

$t_2 = -2$

1) $\cos x = \frac{1}{2}$

$x = \pm\frac{\pi}{3} + 2\pi k, \ k \in Z.$

2) $\cos x = -2 < -1.$

$\emptyset$

# Triqonometrik tənliklər və bərabərsizliklər

**172.** $x$-in $[0;\pi]$ parçasına daxil olan hansı qiymətlərində $3\sin x;\ \sin^2 x;\ -1$ ədədləri ədədi silsilə təşkil edir? $x$-in həmin qiymətlərinin cəmini tapın.

A) $\frac{2\pi}{3}$ B) $\frac{\pi}{2}$ C) $\frac{\pi}{6}$ D) $\frac{3\pi}{2}$ E) $0$

$2\sin^2 x = 3\sin x + (-1)$, $\sin x = t$

$2t^2 - 3t + 1 = 0$

$D = 9 - 8 = 1$

$t = \frac{3 \pm 1}{4}$

$t_1 = 1$

$t_2 = \frac{1}{2}$

1) $\sin x = 1$

$x = \frac{\pi}{2} + 2\pi k,\ x \in Z$.

$k = 0,\ x = \frac{\pi}{2}$

2) $\sin x = \frac{1}{2}$

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

$k = 0,\ x = \frac{\pi}{6}$; $k = 1,\ x = \frac{5\pi}{6}$

$\frac{\pi}{2} + \frac{\pi}{6} + \frac{5\pi}{6} = \frac{3\pi}{2}$

**173.** $\cos x = \sin^2 x + \log_{\sqrt{3}}\left(\frac{1}{ctg\frac{\pi}{6}}\right)$ tənliyini həll edin.

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

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

$\log_{\sqrt{3}}\left(\frac{1}{ctg\frac{\pi}{6}}\right) = \log_{\sqrt{3}} \frac{1}{\sqrt{3}} = -1$.

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

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

$\cos^2 x + \cos x = 0$

$\cos x(\cos x + 1) = 0$

1) $\cos x = 0$

$x = \frac{\pi}{2} + \pi k,\ k \in Z$.

2) $\cos x + 1 = 0$

$\cos x = -1$

$x = \pi + 2\pi k,\ k \in Z$.

**174.** $4\sin^2 x < 1$ bərabərsizliyini həll edin.

A) $\left(-\frac{\pi}{6} + \pi k; \frac{\pi}{6} + \pi k\right), k \in Z$ B) $\left(-\frac{\pi}{3} + 2\pi k; \frac{\pi}{3} + 2\pi k\right), k \in Z$

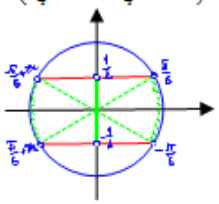
C) $\left(\frac{\pi}{6} + 2\pi k; \frac{5\pi}{6} + 2\pi k\right), k \in Z$ D) $\left(-\frac{\pi}{4} + 2\pi k; \frac{\pi}{4} + 2\pi k\right), k \in Z$

E) $\left(\frac{\pi}{4} + \pi k; \frac{3\pi}{4} + \pi k\right), k \in Z$

$\sin^2 x < \frac{1}{4}$

$|\sin x| < \frac{1}{2}$

$-\frac{\pi}{6} + \pi k < x < \frac{\pi}{6} + \pi k,\ k \in Z$.



**175.** Bərabərsizliyi həll edin: $4\cos^2 x < 1$.

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

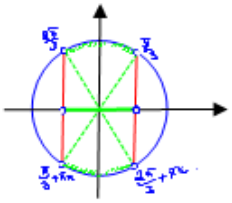
C) $\left(-\frac{2\pi}{3} + 2\pi k; \frac{2\pi}{3} + 2\pi k\right), k \in Z$ D) $\left(-\frac{\pi}{3} + \pi k; \frac{\pi}{3} + \pi k\right), k \in Z$

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

$\cos^2 x < \frac{1}{4}$

$|\cos x| < \frac{1}{2}$

$\frac{\pi}{3} + \pi k < x < \frac{2\pi}{3} + \pi k,\ \pi R$.



**176.** Bərabərsizliyi həll edin: $tg\left(3x - \frac{\pi}{4}\right) < \frac{1}{\sqrt{3}}$

A) $\left(-\frac{\pi}{6} + \pi k; \frac{5\pi}{3} + \pi k\right), k \in Z$ B) $\left(-\frac{\pi}{12} + \frac{\pi k}{3}; \frac{5\pi}{36} + \frac{\pi k}{3}\right), k \in Z$

C) $\left(-\frac{\pi}{12} + \pi k; \frac{\pi}{2} + \pi k\right), k \in Z$ D) $\left(\pi k; \frac{5\pi}{3} + \pi k\right), k \in Z$

E) $\left(-\frac{\pi}{6} + 2\pi k; \frac{\pi}{6} + \pi k\right), k \in Z$

$-\frac{\pi}{2} + \pi k < 3x - \frac{\pi}{4} < \frac{\pi}{6} + \pi k$

$-\frac{\pi}{2} + \frac{\pi}{4} + \pi k < 3x < \frac{\pi}{6} + \frac{\pi}{4} + \pi k$

$-\frac{\pi}{4} + \pi k < 3x < \frac{5\pi}{12} + \pi k$

$-\frac{\pi}{12} + \frac{\pi k}{3} < x < \frac{5\pi}{36} + \frac{\pi}{3} k,\ k \in Z$.

**177.** Bərabərsizliyin ən böyük mənfi həllini tapın: $\sin 2x \geq \frac{1}{2}$.

A) $-\frac{7\pi}{6}$ B) $-\frac{11\pi}{12}$ C) $-\frac{11\pi}{6}$ D) $-\frac{7\pi}{12}$ E) $-\frac{5\pi}{12}$

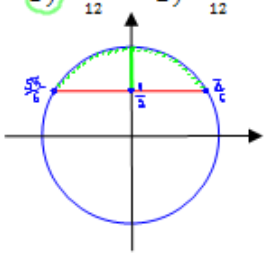
$\frac{\pi}{6} + 2\pi k \leq 2x \leq \frac{5\pi}{6} + 2\pi k$

$\frac{\pi}{12} + \pi k \leq x \leq \frac{5\pi}{12} + \pi k,\ k \in Z$

$k = -1$.

$\frac{\pi}{12} - \pi \leq x \leq \frac{5\pi}{12} - \pi$

$-\frac{11\pi}{12} \leq x \leq -\frac{7\pi}{12}$



**178.** Bərabərsizliyin ən kiçik müsbət həllini tapın: $\sin x \cdot \cos x \geq \frac{1}{4}$.

A) $\frac{\pi}{6}$ B) $\frac{\pi}{3}$ C) $\frac{\pi}{12}$ D) $\frac{\pi}{4}$ E) $\pi$

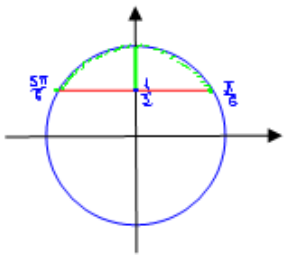
$2\sin x \cdot \cos x \geq \frac{1}{4} \cdot 2$

$\sin 2x \geq \frac{1}{2}$

$\frac{\pi}{6} + 2\pi k \leq 2x \leq \frac{5\pi}{6} + 2\pi k$,

$\frac{\pi}{12} + \pi k \leq x \leq \frac{5\pi}{12} + \pi k,\ k \in Z$.

$k = 0,\ \frac{\pi}{12} \leq x \leq \frac{5\pi}{12}$



**179.** Tənliyi həll edin: $3\cos^2\left(3x - \frac{3}{2}\pi\right) = \sqrt[3]{54\cos 300^\circ}$.

A) $\pm\frac{\pi}{3} + 2\pi n,\ n \in Z$ B) $\pm\frac{\pi}{4} + 2\pi n,\ n \in Z$ C) $\pm\frac{\pi}{6} + 2\pi n,\ n \in Z$

D) $\frac{\pi}{6} + \frac{\pi n}{3},\ n \in Z$ E) $\frac{\pi}{12} + \frac{\pi n}{4},\ n \in Z$

$3 \cdot \frac{1 + \cos(6x - 3\pi)}{2} = \sqrt[3]{54 \cdot \cos(360^\circ - 60^\circ)}$

$3 \cdot \frac{1 + \cos(\pi - 6x)}{2} = \sqrt[3]{54 \cdot \frac{1}{2}}$

$3 \cdot \frac{1 - \cos 6x}{2} = 3^1$

$1 - \cos 6x = 2$

$\cos 6x = -1$

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

**180.** Tənliyi həll edin: $(1 - \cos 4x)\cos 2x = \sin^2 2x$.

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

D) $\pi n;\ \pm\frac{\pi}{3} + \pi n, n \in Z$ E) $\pm\frac{\pi}{12} + \pi n, n \in Z$

$(1 - \cos^2 2x + \sin^2 2x) \cdot \cos 2x = \sin^2 2x$

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

$\sin^2 2x(2\cos 2x - 1) = 0$

1) $\sin 2x = 0$

$2x = \pi k$

$x = \frac{\pi k}{2},\ k \in Z$.

2) $2\cos 2x - 1 = 0$

$\cos 2x = \frac{1}{2}$

$2x = \pm\frac{\pi}{3} + 2\pi k$

$x = \pm\frac{\pi}{6} + \pi k,\ k \in Z$.

**181.** Tənliyi həll edin: $4\sin^2(x - 1) - 1 = 0$.

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

C) $1 \pm \frac{\pi}{6} + \pi n, n \in Z$ D) $\pi n, n \in Z$ E) $\frac{\pi}{2} + \pi n, n \in Z$

$4 \cdot \frac{1 - \cos(2x - 2)}{2} - 1 = 0$

$2(1 - \cos(2x - 2)) - 1 = 0$

$2 - 2\cos(2x - 2) - 1 = 0$

$2\cos(2x - 2) = 1$

$\cos(2x - 2) = \frac{1}{2}$

$2x - 2 = \pm\frac{\pi}{3} + 2\pi k$

$x - 1 = \pm\frac{\pi}{6} + \pi k$

$x = \pm\frac{\pi}{6} + 1 + \pi k,\ k \in Z$.

# Triqonometrik tənliklər və bərabərsizliklər

**182.** $a$-nın hansı ən kiçik qiymətində $\cos x = a^2 + \frac{1}{2}$ bərabərliyi mümkündür?

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

$-1 \le \cos x \le 1$ olduğundan

$-1 \le a^2 + \frac{1}{2} \le 1$

$-1 - \frac{1}{2} \le a^2 \le 1 - \frac{1}{2}$

$-1\frac{1}{2} \le a^2 \le \frac{1}{2} \Rightarrow |a| \le \frac{1}{\sqrt{2}} \Rightarrow -\frac{1}{\sqrt{2}} \le a \le \frac{1}{\sqrt{2}}$

$\frac{-\sqrt{2}}{2} \le a \le \frac{\sqrt{2}}{2}$

**183.** $\begin{cases} \cos x \cdot \sin y = -\frac{3}{4}, \\ \sin x \cdot \cos y = \frac{1}{4} \end{cases}$ sistemindən $x + y$ cəmini tapın.

A) $(-1)^{n+1}\frac{\pi}{3} + \pi n, n \in Z$ B) $\frac{\pi}{3} + \pi n, n \in Z$

C) $(-1)^{n+1}\frac{\pi}{6} + \pi n, n \in Z$ D) $\frac{\pi}{6} + \pi n, n \in Z$ E) $\frac{\pi}{6}$

$\sin x \cos y + \cos x \sin y = -\frac{1}{2}$

$\sin(x+y) = -\frac{1}{2}$

$x + y = (-1)^{k+1}\frac{\pi}{6} + \pi k, k \in Z.$

**184.** $\begin{cases} \cos x \cdot \cos y = \frac{1}{4}, \\ \sin x \cdot \sin y = -\frac{3}{4} \end{cases}$ sistemindən $x - y$ fərqini tapın.

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

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

$\cos x \cdot \cos y + \sin x \cdot \sin y = -\frac{1}{2}$

$\cos(x-y) = -\frac{1}{2}$

$x - y = \pm\left(\pi - \frac{\pi}{3}\right) + 2\pi k, k \in Z.$

$x - y = \pm\frac{2\pi}{3} + 2\pi k, k \in Z.$

**185.** $2\sin^2 x + 5\sin x - 3 > 0$ bərabərsizliyi həll edin.

A) $\left(-\frac{\pi}{6} + 2\pi k; \frac{7\pi}{6} + 2\pi k\right), k \in Z$

B) $\left(\frac{\pi}{6} + 2\pi k; \frac{5\pi}{6} + 2\pi k\right), k \in Z$

C) $\left(\frac{\pi}{6} + 2\pi k; \frac{11\pi}{6} + 2\pi k\right), k \in Z$

D) $\left(-\frac{5\pi}{6} + 2\pi k; \frac{5\pi}{6} + 2\pi k\right), k \in Z$

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

$\sin x = t$

$2t^2 + 5t - 3 > 0$

$D = 5^2 - 4 \cdot 2 \cdot (-3) = 25 + 24 = 49 = 7^2$

$t = \frac{-5 \pm 7}{4}$

$t_1 = \frac{-12}{4} = -3$

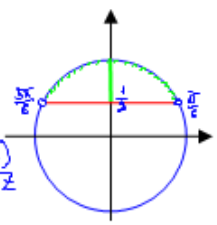
$t_2 = \frac{2}{4} = \frac{1}{2}$

CFR: 1) $t < -3$ 2) $t > \frac{1}{2}$

1) $\sin x < -3$ $\varnothing$

2) $\sin x > \frac{1}{2}$

$\left(\frac{\pi}{6} + 2\pi k, \frac{5\pi}{6} + 2\pi k\right), k \in Z$




**186.** Tənliyi həll edin: $\cos(\pi \lg x) + \sin(\pi \lg x) = 1.$

A) $\frac{\pi}{2} + 2\pi k, k \in Z$ B) 1 və 10 C) $10^{\pi}$ və $\pi$

D) $10^{\pi+k}$ və $10^{\pi k}, k \in Z$ E) $10^{2k+\frac{1}{2}}$ və $10^{2k}, k \in Z$

$(\cos(\pi \lg x) + \sin(\pi \lg x))^2 = 1^2$

$\cos^2(\pi \lg x) + 2\cos(\pi \lg x) \cdot \sin(\pi \lg x) + \sin^2(\pi \lg x) = 1$

$1 + \sin 2\pi \lg x = 1$

$\sin 2\pi \lg x = 0$

$2\pi \lg x = \pi k$

$\lg x = \frac{k}{2}$

$x = 10^{\frac{k}{2}}, k \in Z.$

$k$ tək olduqda, $k = 2n+1$

$x = 10^{\frac{2n+1}{2}} = 10^{n+\frac{1}{2}}$ ..... ? $n \in Z$

$k$ cüt olarsa, $k = 2n$

$x = 10^{\frac{2n}{2}} = 10^{n}$ ..... ? $n \in Z$

**187.** Tənliyi həll edin: $\sin x + \sin 2x = \sin^3 x.$

A) $\frac{\pi}{4}k, k \in Z$ B) $\frac{\pi}{2}(2k+1), k \in Z$ C) $\frac{\pi k}{2}, k \in Z$

D) $\pi k, k \in Z$ E) $2\pi k, k \in Z$

$\sin x + 2\sin x \cos x - \sin^3 x = 0$

$\sin x (1 + 2\cos x - \sin^2 x) = 0$

1) $\sin x = 0$

$x = \pi k, k \in Z.$

2) $1 + 2\cos x - \sin^2 x = 0$

$1 + 2\cos x - (1 - \cos^2 x) = 0$

$1 + 2\cos x - 1 + \cos^2 x = 0$

$\cos^2 x + 2\cos x = 0$

$\cos x (\cos x + 2) = 0$

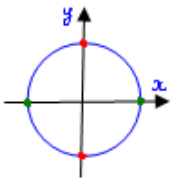
1) $\cos x = 0$

$x = \frac{\pi}{2} + \pi k,$

2) $\cos x + 2 = 0$

$\cos x = -2 < -1.$

$\varnothing$




$\left[\begin{array}{l} x = \pi k, k \in Z \\ x = \frac{\pi}{2} + \pi k, k \in Z \end{array}\right. \Rightarrow x = \frac{\pi k}{2}, k \in Z$

**188.** Tənliyi həll edin: $\cos x - \sin 2x = \cos^3 x.$

A) $\pi n, n \in Z$ B) $\frac{\pi n}{2}, n \in Z$ C) $2\pi n, n \in Z$

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

$\cos x - 2\sin x \cos x - \cos^3 x = 0$

$\cos x (1 - 2\sin x - \cos^2 x) = 0$

1) $\cos x = 0$

$x = \frac{\pi}{2} + \pi k, k \in Z.$

2) $1 - 2\sin x - (1 - \sin^2 x) = 0$

$1 - 2\sin x - 1 + \sin^2 x = 0$

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

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

1) $\sin x = 0$

$x = \pi k, k \in Z.$

2) $\sin x - 2 = 0$

$\sin x = 2 > 1$

$\varnothing$

Cavab: $x = \frac{\pi k}{2}, k \in Z.$

**189.** Tənliyini həll edin: $\sin x = \cos^2 x + \frac{1}{2}\log_{\sqrt{2}}\left(\frac{1}{\sin\frac{\pi}{6}}\right).$

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

C) $(-1)^k\frac{\pi}{6} + \pi k, k \in Z$ D) $\pi k, k \in Z$ E) $(-1)^k\frac{\pi}{4} + \pi k, k \in Z$

əvvəlcə: $\frac{1}{2}\log_{\sqrt{2}}\left(\frac{1}{\sin\frac{\pi}{6}}\right) = \frac{1}{2}\log_{\sqrt{2}}\frac{1}{\frac{1}{2}} = \log_{\sqrt{2}^2} 2 = \log_2 2 = 1$

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

$\sin x = 1 - \sin^2 x + 1, \quad \sin x = t$

$t^2 + t - 2 = 0$

$t_1 = -2$

$t_2 = 1$

1) $\sin x = -2$ $\varnothing$

2) $\sin x = 1$

$x = \frac{\pi}{2} + 2\pi k, k \in Z.$

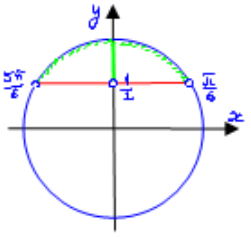
# Triqonometrik tənliklər və bərabərsizliklər

**190.** Bərabərsizliyi həll edin: $\sin t + \sqrt{3}\cos t > 1$.

A) $\left(-\frac{\pi}{2}+2\pi k;\ \frac{\pi}{6}+\pi k\right)$, $k\in Z$ B) $\left(-\frac{\pi}{6}+2\pi k;\ \frac{\pi}{2}+2\pi k\right)$, $k\in Z$

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

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




$\frac{1}{2}\sin t + \frac{\sqrt{3}}{2}\cos t > \frac{1}{2}$

$\sin t\cdot\cos\frac{\pi}{3} + \cos t\cdot\sin\frac{\pi}{3} > \frac{1}{2}$

$\sin\left(t+\frac{\pi}{3}\right) > \frac{1}{2}$

$\frac{\pi}{6}+2\pi k < t+\frac{\pi}{3} < \frac{5\pi}{6}+2\pi k$

$\frac{\pi}{6}-\frac{\pi}{3}+2\pi k < t < \frac{5\pi}{6}-\frac{\pi}{3}+2\pi k$

$-\frac{\pi}{6}+2\pi k < t < \frac{\pi}{2}+2\pi k,\ k\in Z.$

**191.** Triqonometrik bərabərsizliklər sistemi verilmişdir:

$2\sin\left(3x-\frac{\pi}{2}\right) - 7\cos\left(2y+\frac{\pi}{6}\right) \ge 9,\ 0\le x\le\frac{2\pi}{3},\ 0\le y<\frac{\pi}{2}.$

Aşağıdakı bərabərsizliklərdən hansını bu sistemin bütün bütün halları ödəyir?

A) $-\frac{\pi}{3}\le x+y<0$ B) $\frac{\pi}{6}\le x+y<\frac{\pi}{5}$

C) $\frac{\pi}{5}\le x+y<\frac{\pi}{2}$ D) $\frac{\pi}{2}\le x+y<\frac{2\pi}{3}$ E) $\frac{2\pi}{3}\le x+y<\pi$

bu bərabərsizliyin ödənməsi üçün

$\begin{cases}\sin\left(3x-\frac{\pi}{2}\right)=1\\ \cos\left(2y+\frac{\pi}{6}\right)=-1\end{cases}$ ödənməlidir ki, $2\cdot1-7\cdot(-1)=2+7\ge9$ ödəsin.

$3x-\frac{\pi}{2}=\frac{\pi}{2}+2\pi k$

$3x=\pi+2\pi k$

$x=\frac{\pi}{3}+\frac{2\pi k}{3},\ x=\frac{\pi}{3}\in\left(0;\frac{\pi}{2}\right)$

$2y+\frac{\pi}{6}=\pi+2\pi k$

$2y=\frac{5\pi}{6}-\frac{\pi}{6}+2\pi k$

$2y=\frac{5\pi}{6}+2\pi k$

$y=\frac{5\pi}{12}+\pi k.$

$y=\frac{5\pi}{12}\in\left(0;\frac{\pi}{2}\right)$

$x+y=\frac{\pi}{3}+\frac{5\pi}{12}=\frac{9\pi}{12}=\frac{3\pi}{4}$

$x+y=\frac{3\pi}{4}=135^\circ\in(120,150)$

**192.** Tənliyi həll edin: $ctgx(1-\cos 2x)=0$.

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

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

1) $ctgx=0$

$\frac{\cos x}{\sin x}=0$

$\begin{cases}\cos x=0\\ \sin x\ne0\end{cases}$ $x=\frac{\pi}{2}+\pi k$ ✔ $x\ne\pi k$ ✘

2) $1-\cos 2x=0$

$\cos 2x=1$

$2x=2\pi k$

$x=\pi k$ ✘

**193.** Tənliyi həll edin: $\sin 7x-\sin x=3\sin 3x$.

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

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

$2\cos\frac{7x+x}{2}\cdot\sin\frac{7x-x}{2}=3\sin 3x$

$2\cos 4x\cdot\sin 3x-3\sin 3x=0$

$\sin 3x\left(2\cos 4x-3\right)=0$

1) $\sin 3x=0$

$3x=\pi k$

$x=\frac{\pi k}{3}$

2) $2\cos 4x-3=0$

$\cos 4x=\frac{3}{2}>1$

$\emptyset$

**194.** Triqonometrik bərabərsizliklər sistemi verilmişdir:

$3\sin 2x-4\cos\left(5y-\frac{2\pi}{3}\right)\ge7,\ 0\le x\le\pi,\ 0\le y\le\frac{\pi}{2}.$

Aşağıdakı bərabərsizliklərdən hansını bu sistemin bütün halları ödəyir?

A) $-\frac{\pi}{2}<x+y<0$ B) $\frac{\pi}{8}<x+y<\frac{\pi}{7}$

C) $\frac{\pi}{4}<x+y<\frac{\pi}{3}$ D) $\frac{\pi}{2}<x+y<\frac{2\pi}{3}$ E) $\frac{2\pi}{3}<x+y<\pi$

$\begin{cases}\sin 2x=1\\ \cos\left(5y-\frac{2\pi}{3}\right)=-1\end{cases}$ olmalıdır ki, $3\cdot1-4\cdot(-1)=3+4=7\ge7$ doğru olsun.

$\sin 2x=1$

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

$x=\frac{\pi}{4}+\pi k.\ k=0,\ x=\frac{\pi}{4}\in[0,\pi]$

$\cos\left(5y-\frac{2\pi}{3}\right)=-1$

$5y-\frac{2\pi}{3}=\pi+2\pi k.$

$5y=\pi+\frac{2\pi}{3}+2\pi k.$

$5y=\frac{5\pi}{3}+2\pi k.$

$y=\frac{\pi}{3}+\frac{2\pi k}{5};\ k=0,\ y=\frac{\pi}{3}\in\left[0;\frac{\pi}{2}\right].$

$x+y=\frac{\pi}{4}+\frac{\pi}{3}=\frac{7\pi}{12}=105^\circ\in\left(\frac{\pi}{2},\frac{2\pi}{3}\right)$

**195.** Tənliyi həll edin: $tgx(1+\cos 2x)=0$.

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

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

1) $tgx=0\Rightarrow\begin{cases}\sin x=0\\ \cos x\ne0\end{cases}$ $\begin{cases}x=\pi k,\ ✔\\ x\ne\frac{\pi}{2}+\pi k\ ✘\end{cases}\ k\in Z.$

2) $1+\cos 2x=0$

$\cos 2x=-1$

$2x=\pi+2\pi k$

$x=\frac{\pi}{2}+\pi k$ ✘

**196.** Tənliyi həll edin: $(1+\cos 4x)\sin 2x=\cos^2 2x$.

A) $\frac{\pi}{4}+\pi k;\ (-1)^k\frac{\pi}{6}+\pi k,k\in Z$

B) $\frac{\pi}{4}+2\pi k;\ (-1)^k\frac{\pi}{4}+2\pi k,k\in Z$

C) $\frac{\pi}{4}+\frac{\pi k}{2};\ (-1)^k\frac{\pi}{12}+\frac{\pi k}{2},k\in Z$

D) $\frac{\pi}{4}+\pi k;\ (-1)^k\frac{\pi}{12}+\pi k,k\in Z$ E) $\frac{\pi}{8}+\pi k,k\in Z$

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

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

$\cos^2 2x\left(2\sin 2x-1\right)=0$

1) $\cos^2 2x=0$

$\cos 2x=0$

$2x=\frac{\pi}{2}+\pi k.$

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

2) $2\sin 2x-1=0$

$\sin 2x=\frac{1}{2}$

$2x=(-1)^k\frac{\pi}{6}+\pi k.$

$x=(-1)^k\frac{\pi}{12}+\frac{\pi k}{2}$

**197.** Bərabərsizliyi həll edin: $\cos 2x\cdot\cos 3x>\sin 2x\cdot\sin 3x$.

A) $\left(-\frac{\pi}{10};\frac{\pi}{10}\right)$ B) $\left(-\frac{\pi}{10}+\frac{\pi k}{3};\frac{\pi}{10}+\frac{\pi k}{3}\right),k\in Z$

C) $\left(-\frac{\pi}{10}+\frac{2\pi k}{5};\frac{\pi}{10}+\frac{2\pi k}{5}\right),k\in Z$

D) $\left(-\frac{\pi}{10};\frac{\pi}{2}\right)$ E) $\left(-\frac{\pi}{10}+\pi k;\frac{\pi}{10}+\frac{2\pi k}{5}\right),k\in Z$

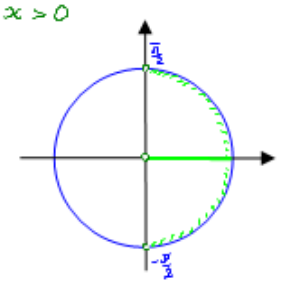
$\cos 2x\cdot\cos 3x-\sin 2x\cdot\sin 3x>0$

$\cos\left(2x+3x\right)>0$

$\cos 5x>0$

$-\frac{\pi}{2}+2\pi k<5x<\frac{\pi}{2}+2\pi k$

$-\frac{\pi}{10}+\frac{2\pi k}{5}<x<\frac{\pi}{10}+\frac{2\pi k}{5},\ k\in Z$



# Triqonometrik tənliklər və bərabərsizliklər

**198.** $\cos^2 2x = 1$ tənliyini həll edin və onun $\left[-\frac{\pi}{2}; \frac{\pi}{2}\right]$ parçasına daxil olan köklərinin cəmini tapın.

A) $\pi$ B) $0$ C) $\frac{\pi}{2}$ D) $-\frac{\pi}{2}$ E) $-\frac{3\pi}{2}$

$\frac{1+\cos 4x}{2} = 1$

$1+\cos 4x = 2$

$\cos 4x = 1$

$4x = 2\pi k$

$x = \frac{\pi k}{2}$

$k=-1,\ x=-\frac{\pi}{2}$

$k=0,\ x=0$

$k=1,\ x=\frac{\pi}{2}$

$-\frac{\pi}{2}+0+\frac{\pi}{2}=0$

**199.** Tənliyi həll edin: $|\sin x| + |\cos x| = \sqrt{2}$.

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

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

1) $x\in$ I rüb. $\sin x+\cos x=\sqrt{2}$

$\frac{1}{\sqrt2}\sin x+\frac{1}{\sqrt2}\cos x=1$

$\sin x\cdot\cos\frac{\pi}{4}+\cos x\cdot\sin\frac{\pi}{4}=1$

$\sin\left(x+\frac{\pi}{4}\right)=1$

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

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

2) $x\in$ II rüb. $\sin x-\cos x=\sqrt{2}$

oxşar yolla

$\sin\left(x-\frac{\pi}{4}\right)=1$

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

$x=\frac{3\pi}{4}+2\pi k,$

3) $x\in$ III rüb. $-\sin x-\cos x=\sqrt{2}$

$\sin x+\cos x=-\sqrt{2}$

$\sin\left(x+\frac{\pi}{4}\right)=-1$

$x+\frac{\pi}{4}=\frac{3\pi}{2}+2\pi k$

$x=\frac{5\pi}{4}+2\pi k.$

4) $x\in$ IV-rüb

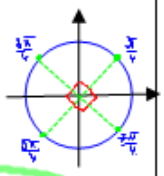
$-\sin x+\cos x=\sqrt{2}$

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

$\sin\left(x-\frac{\pi}{4}\right)=-1$

$x-\frac{\pi}{4}=\frac{3\pi}{2}+2\pi k$

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




C: $\frac{\pi}{4}+\frac{\pi}{2}k$

**200.** Tənliyi həll edin: $|\sin x + \cos x| = \sqrt{2}$.

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

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

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

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

$1+\sin 2x=2$

$\sin 2x=1$

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

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

**201.** Tənliklər sistemini həll edin: $\begin{cases}\sin x+\cos y=1,\\ \sin x-\cos y=1.\end{cases}$ +

A) $\left(\frac{3\pi}{4}+\pi k; \frac{2\pi}{3}+\pi n\right), (k,n)\in Z$

B) $(2\pi k; \pi n), (k,n)\in Z$

C) $\left(\frac{\pi}{4}+\pi k; \frac{\pi}{3}+\pi n\right), (k,n)\in Z$

D) $\left(\frac{\pi}{8}+\pi k; \frac{\pi}{12}+\pi n\right), (k,n)\in Z$

E) $\left(\frac{\pi}{2}+2\pi k; \frac{\pi}{2}+\pi n\right), (k,n)\in Z$

$2\sin x=2$

$\sin x=1$

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

$1+\cos y=1$

$\cos y=0$

$y=\frac{\pi}{2}+\pi n, n\in Z$

**202.** $\cos 2x = 2\sin x + 1$ tənliyini həll edin və $[0; 2\pi]$ aralığına düşən köklərin cəmini tapın.

A) $\frac{5\pi}{6}$ B) $\frac{\pi}{2}$ C) $4{,}5\pi$ D) $2\pi$ E) $3{,}5\pi$

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

$2\sin^2 x+2\sin x=0$

$2\sin x(\sin x+1)=0$

1) $\sin x=0$

$x=\pi k, k\in Z$

$k=0,\ x=0$

$k=1,\ x=\pi$

$k=2,\ x=2\pi$

2) $\sin x+1=0$

$\sin x=-1$

$x=\frac{3\pi}{2}+2\pi k$

$k=0,\ x=\frac{3\pi}{2}.$

$0+\pi+2\pi+\frac{3\pi}{2}=4{,}5\pi$

**203.** Tənliyi həll edin: $\sin 5x - 2\cos 2x = 3$.

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

C) $\frac{\pi}{2}+2\pi n, n\in Z$ D) $-\frac{\pi}{2}+\frac{\pi n}{5}, n\in Z$ E) $-\frac{\pi}{10}+\frac{\pi n}{5}, n\in Z$

$\begin{cases}\sin 5x=1\\ \cos 2x=-1\end{cases}$ olmalıdır ki, $1-2\cdot(-1)=1+2=3$ olsun.

$\sin 5x=1$

$5x=\frac{\pi}{2}+2\pi k$

$x=\frac{\pi}{10}+\frac{2\pi k}{5}, k\in Z$

$\cos 2x=-1$

$2x=\pi+2\pi n$

$x=\frac{\pi}{2}+\pi n, n\in Z$

$\frac{\pi}{10}+\frac{2\pi k}{5}=\frac{\pi}{2}+\pi n$

$\frac{1}{10}+\frac{2k}{5}=\frac{1}{2}+n$

$1+4k=5+10n$

$4k=4+10n$

$k=1+\frac{5}{2}n$

$k=1+\frac{5}{2}n$ ifadəsində $k$-nın tam olması üçün $n$ cüt olmalıdır. yəni $n=2m$-i yazıb yazsaq. $x=\frac{\pi}{2}+2\pi m, m\in Z$

**204.** Bərabərsizliyi həll edin: $|\cos x| > \frac{1}{2}$.

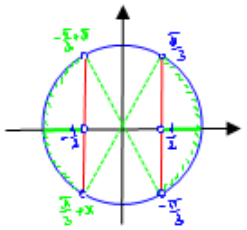
A) $\left(-\frac{\pi}{3}+2\pi k; \frac{\pi}{3}+2\pi k\right), k\in Z$

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

D) $\left(-\frac{\pi}{4}+2\pi k; \frac{\pi}{4}+2\pi k\right), k\in Z$ E) $\left(-\frac{\pi}{6}+2\pi k; \frac{\pi}{6}+2\pi k\right), k\in Z$

$|\cos x|>\frac{1}{2} \Rightarrow \begin{bmatrix}\cos x<-\frac{1}{2}\\ \cos x>\frac{1}{2}\end{bmatrix}$

$-\frac{\pi}{3}+\pi k<x<\frac{\pi}{3}+\pi k, k\in Z$




**205.** $\arccos\frac{1+2x}{3}=\frac{2\pi}{3}$ tənliyini həll edin.

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

$\cos\left(\arccos\frac{1+2x}{3}\right)=\cos\frac{2\pi}{3}$

$\frac{1+2x}{3}=-\frac{1}{2}$

$1+2x=-\frac{3}{2}$

$2x=-\frac{3}{2}-1=-\frac{5}{2}$

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

# Triqonometrik tənliklər və bərabərsizliklər

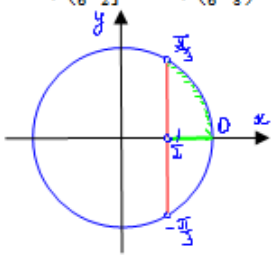
**206.** $2\sin^2\left(\frac{3\pi}{2}-t\right)-1>\frac{1}{2}$ bərabərsizliyinin $\left[0;\frac{\pi}{2}\right]$ parçasına daxil olan həllərini tapın.

A) $\left[0;\frac{\pi}{3}\right)$ B) $\left[\frac{\pi}{3};\frac{\pi}{2}\right]$ C) $\left[0;\frac{\pi}{6}\right)$ D) $\left(\frac{\pi}{6};\frac{\pi}{2}\right]$ E) $\left(\frac{\pi}{6};\frac{\pi}{3}\right)$

$2\cdot\frac{1-\cos(3\pi-2t)}{2}-1>\frac{1}{2}$

$1-\cos(\pi-2t)-1>\frac{1}{2}$

$\cos 2t>\frac{1}{2}$




**207.** $2\sin(180^\circ-t)\cos(360^\circ-t)>\frac{1}{2}$ bərabərsizliyinin $[0;\pi]$ parçasına daxil olan hədlərini tapın.

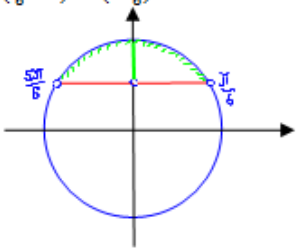
A) $\left(\frac{\pi}{6};\frac{5\pi}{6}\right)$ B) $\left(\frac{5\pi}{6};\pi\right)$ C) $\left(\frac{\pi}{4};\frac{3\pi}{4}\right)$

D) $\left(\frac{\pi}{12};\frac{5\pi}{12}\right)$ E) $\left(\frac{5\pi}{6};\pi\right)\cup\left(0;\frac{\pi}{6}\right)$

$2\sin t\cdot\cos t>\frac{1}{2}$

$\sin t>\frac{1}{2}$

$\left(\frac{\pi}{6};\frac{5\pi}{6}\right)$



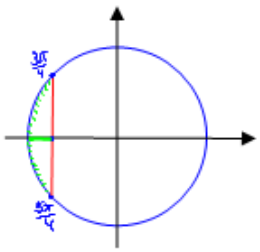

**208.** $\cos 5x\cos 4x+\sin 5x\sin 4x\le-\frac{\sqrt{2}}{2}$ bərabərsizliyinin $\left[0;\frac{3\pi}{2}\right]$ parçasına daxil olan həllərini tapın.

A) $\left[\frac{3\pi}{4};\frac{5\pi}{4}\right]$ B) $\left(\frac{5\pi}{4};\frac{3\pi}{2}\right]$ C) $\left[\pi;\frac{5\pi}{4}\right]$

D) $\left[\frac{5\pi}{4};\frac{3\pi}{2}\right)$ E) $\left[\frac{\pi}{12};\frac{5\pi}{36}\right]$

$\cos(5x-4x)\le-\frac{\sqrt{2}}{2}$

$\cos x\le-\frac{\sqrt{2}}{2}$

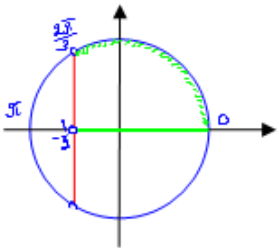



**209.** $\cos^2\frac{x}{2}-\sin^2\frac{x}{2}>-\frac{1}{2}$ bərabərsizliyinin $[0;\pi]$ parçasına daxil olan həllərini tapın.

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

$\cos 2\cdot\frac{x}{2}>-\frac{1}{2}$

$\cos x>-\frac{1}{2}$




**210.** $a$ parametrinin neçə tam qiymətində $(1+a)^2=1+a\sin x$ tənliyinin həlli var?

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

$1+2a+a^2=1+a\sin x$

$a\sin x=a(a+2)$

$\sin x=\frac{a(a+2)}{a}$

$\sin x=a+2$

$-1\le a+2\le 1$

$-1-2\le a\le 1-2$

$-3\le a\le -1$

$a=\{-3;-2;-1\}$ və 0

**211.** $5\sin\left(x+\frac{\pi}{3}\right)=7\sin\left(x-\frac{\pi}{3}\right)$ tənliyindən $\operatorname{tg}x$-i tapın.

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

$5\sin x\cos\frac{\pi}{3}+5\cos x\cdot\sin\frac{\pi}{3}=7\sin x\cos\frac{\pi}{3}-7\cos x\cdot\sin\frac{\pi}{3}$

$5\cdot\frac{1}{2}\sin x+5\cdot\frac{\sqrt{3}}{2}\cos x=7\cdot\frac{1}{2}\sin x-7\cdot\frac{\sqrt{3}}{2}\cos x$

$\frac{5\sqrt{3}}{2}\cos x+\frac{7\sqrt{3}}{2}\cos x=\frac{7}{2}\sin x-\frac{5}{2}\sin x$

$\frac{12\sqrt{3}}{2}\cos x=\frac{2}{2}\sin x$

$\frac{\sin x}{\cos x}=6\sqrt{3}$

$\operatorname{tg}x=6\sqrt{3}$

**212.** $3\cos x=8\sin\left(\frac{\pi}{6}-x\right)$ tənliyindən $\operatorname{tg}x$-i tapın.

A)$4\sqrt{3}$ B)$2\sqrt{3}$ C)$\frac{\sqrt{3}}{4}$ D)1 E)$\frac{\sqrt{3}}{12}$

$3\cos x=8\sin\frac{\pi}{6}\cos x-8\cos\frac{\pi}{6}\sin x$

$3\cos x=8\cdot\frac{1}{2}\cdot\cos x-8\cdot\frac{\sqrt{3}}{2}\sin x$

$4\sqrt{3}\sin x=4\cos x-3\cos x$

$4\sqrt{3}\sin x=\cos x$

$4\sqrt{3}\frac{\sin x}{\cos x}=1$

$\operatorname{tg}x=\frac{1}{4\sqrt{3}}=\frac{\sqrt{3}}{12}$

$\operatorname{tg}x=\frac{\sqrt{3}}{12}.$