

Повторение

**cos x = a;**      0 ≤ arccos a ≤ π

если |a| > 1, то решений нет

если |a| ≤ 1, то **x = ± arccosa + 2πn; n ∈ Z**

*arccos(-a) = π - arccos a*

Частные случаи:

cos x = 1; x = 2πn; где n ∈ Z;

cos x = -1; x = π + 2πn; n ∈ Z;

cos x = 0; x = π/2 + πn; n ∈ Z

**tg x = a;**      -π/2 ≤ arctg a ≤ π/2

**x = arctg a + πn; n ∈ Z**

*arctg(-a) = -arctg a*

Частные случаи:

tg x = 0; x = πn; n ∈ Z;

tg x = 1; x = π/4 + πn; n ∈ Z;

tg x = -1; x = -π/4 + πn; n ∈ Z

**sin x = a;**      -π/2 ≤ arcsin a ≤ π/2

если |a| > 1, то решений нет

если |a| ≤ 1, то **x = (-1)<sup>n</sup> arcsin a + πn; n ∈ Z**

*arcsin(-a) = -arcsin a*

Частные случаи:

sin x = 1; x = π/2 + 2πn; n ∈ Z;

sin x = -1; x = -π/2 + 2πn; n ∈ Z;

sin x = 0; x = πn; n ∈ Z

**ctg x = a;**      0 ≤ arcctg a ≤ π

**x = arcctg a + πn; n ∈ Z**

*arc ctg(-a) = π - arc ctg a*

Частные случаи:

ctg x = 0; x = π/2 + πn; n ∈ Z;

ctg x = 1; x = π/4 + πn; n ∈ Z;

ctg x = -1; x = 3π/4 + πn; n ∈ Z

Таблица некоторых значений тригонометрических функций

α	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{3\pi}{2}$	2π
	0°	30°	45°	60°	90°	120°	135°	150°	180°	270°	360°
sin α	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1	0
cos α	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-1	0	1
tg α	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	-	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0	-	0
ctg α	-	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	$-\frac{1}{\sqrt{3}}$	-1	$-\sqrt{3}$	-	0	-

Повторение

$\cos x = a;$        $0 \leq \arccos a \leq \pi$

если  $|a| > 1$ , то решений нет

если  $|a| \leq 1$ , то  $x = \pm \arccos a + 2\pi n;$      $n \in \mathbb{Z}$

$\arccos(-a) = \pi - \arccos a$

Частные случаи:

$\cos x = 1;$      $x = 2\pi n;$     где  $n \in \mathbb{Z};$

$\cos x = -1;$      $x = \pi + 2\pi n;$      $n \in \mathbb{Z};$

$\cos x = 0;$      $x = \pi/2 + \pi n;$      $n \in \mathbb{Z}$

$\operatorname{tg} x = a;$        $-\pi/2 \leq \operatorname{arctg} a \leq \pi/2$

$x = \operatorname{arctg} a + \pi n;$      $n \in \mathbb{Z}$

$\operatorname{arctg}(-a) = -\operatorname{arctg} a$

Частные случаи:

$\operatorname{tg} x = 0;$      $x = \pi n;$      $n \in \mathbb{Z};$

$\operatorname{tg} x = 1;$      $x = \pi/4 + \pi n;$      $n \in \mathbb{Z};$

$\operatorname{tg} x = -1;$      $x = -\pi/4 + \pi n;$      $n \in \mathbb{Z}$

$\sin x = a;$        $-\pi/2 \leq \arcsin a \leq \pi/2$

если  $|a| > 1$ , то решений нет

если  $|a| \leq 1$ , то  $x = (-1)^n \arcsin a + \pi n;$      $n \in \mathbb{Z}$

$\arcsin(-a) = -\arcsin a$

Частные случаи:

$\sin x = 1;$      $x = \pi/2 + 2\pi n;$      $n \in \mathbb{Z};$

$\sin x = -1;$      $x = -\pi/2 + 2\pi n;$      $n \in \mathbb{Z};$

$\sin x = 0;$      $x = \pi n;$      $n \in \mathbb{Z}$

$\operatorname{ctg} x = a;$        $0 \leq \operatorname{arcctg} a \leq \pi$

$x = \operatorname{arcctg} a + \pi n;$      $n \in \mathbb{Z}$

$\operatorname{arc} \operatorname{ctg}(-a) = \pi - \operatorname{arc} \operatorname{ctg} a$

Частные случаи:

$\operatorname{ctg} x = 0;$      $x = \pi/2 + \pi n;$      $n \in \mathbb{Z};$

$\operatorname{ctg} x = 1;$      $x = \pi/4 + \pi n;$      $n \in \mathbb{Z};$

$\operatorname{ctg} x = -1;$      $x = 3\pi/4 + \pi n;$      $n \in \mathbb{Z}$

Таблица некоторых значений тригонометрических функций

$\alpha$	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	$\pi$	$\frac{3\pi}{2}$	$2\pi$
	0°	30°	45°	60°	90°	120°	135°	150°	180°	270°	360°
$\sin \alpha$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1	0
$\cos \alpha$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-1	0	1
$\operatorname{tg} \alpha$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	-	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0	-	0
$\operatorname{ctg} \alpha$	-	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	$-\frac{1}{\sqrt{3}}$	-1	$-\sqrt{3}$	-	0	-

Простейшие тригонометрические уравнения (В – 7) (для объяснения) Занятие 2

№ п/п	Задание	Решение и ответ
<b>Решите уравнения:</b>		
1.	$\sin\left(x + \frac{\pi}{3}\right) = \frac{1}{2}$	$x + \frac{\pi}{3} = (-1)^n \arcsin \frac{1}{2} + \pi n, n \in \mathbb{Z}$ $x + \frac{\pi}{3} = (-1)^n \frac{\pi}{6} + \pi n, n \in \mathbb{Z};$ $x = (-1)^n \frac{\pi}{6} - \frac{\pi}{3} + \pi n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ:</b> <math>(-1)^n \frac{\pi}{6} - \frac{\pi}{3} + \pi n, n \in \mathbb{Z}</math></p>
2.	$\cos \frac{\pi x}{3} = \frac{\sqrt{3}}{2}$	$\frac{\pi x}{3} = \pm \arccos \frac{\sqrt{3}}{2} + 2\pi n, n \in \mathbb{Z}$ $\frac{\pi x}{3} = \pm \frac{\pi}{6} + 2\pi n, n \in \mathbb{Z} \quad /(\cdot 3)$ $\pi x = \pm \frac{\pi}{2} + 6\pi n, n \in \mathbb{Z} \quad /(: \pi)$ $x = \pm \frac{1}{2} + 6n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ:</b> <math>\pm \frac{1}{2} + 6n, n \in \mathbb{Z}</math></p>
3.	$\operatorname{tg} \frac{x}{4} = -\sqrt{3}$	$\frac{x}{4} = \arctg(-\sqrt{3}) + \pi n, n \in \mathbb{Z}$ $\frac{x}{4} = -\arctg \sqrt{3} + \pi n, n \in \mathbb{Z}$ $\frac{x}{4} = -\frac{\pi}{3} + \pi n, n \in \mathbb{Z} \quad /(\cdot 4)$ $x = -\frac{4\pi}{3} + 4\pi n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ:</b> <math>-\frac{4\pi}{3} + 4\pi n, n \in \mathbb{Z}</math></p>
4.	$\sin\left(3x + \frac{\pi}{2}\right) = -\frac{\sqrt{3}}{2}$	$3x + \frac{\pi}{2} = (-1)^n \arcsin\left(-\frac{\sqrt{3}}{2}\right) + \pi n, n \in \mathbb{Z}$ $3x + \frac{\pi}{2} = (-1)^n (-1) \arcsin \frac{\sqrt{3}}{2} + \pi n, n \in \mathbb{Z}$ $3x + \frac{\pi}{2} = (-1)^{n+1} \cdot \frac{\pi}{3} + \pi n, n \in \mathbb{Z}$ $3x = (-1)^{n+1} \cdot \frac{\pi}{3} - \frac{\pi}{2} + \pi n, n \in \mathbb{Z} \quad /(: 3)$ $x = (-1)^{n+1} \cdot \frac{\pi}{9} - \frac{\pi}{6} + \frac{\pi n}{3}, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ:</b> <math>(-1)^{n+1} \cdot \frac{\pi}{9} - \frac{\pi}{6} + \frac{\pi n}{3}, n \in \mathbb{Z}</math></p>
5.	$\sin 2\pi x = -1$	$2\pi x = -\frac{\pi}{2} + 2\pi n, n \in \mathbb{Z} \quad /(: 2\pi)$ $x = -\frac{1}{4} + n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ:</b> <math>-\frac{1}{4} + n, n \in \mathbb{Z}</math></p>
6.	$\cos 6x = -\frac{1}{2}$	$6x = \pm \arccos\left(-\frac{1}{2}\right) + 2\pi n, n \in \mathbb{Z}$ $6x = \pm \left(\pi - \arccos \frac{1}{2}\right) + 2\pi n, n \in \mathbb{Z}$ $6x = \pm \left(\pi - \frac{\pi}{3}\right) + 2\pi n, n \in \mathbb{Z}$ $6x = \pm \frac{2\pi}{3} + 2\pi n, n \in \mathbb{Z}$ $x = \pm \frac{\pi}{9} + \frac{\pi n}{3}, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ:</b> <math>\pm \frac{\pi}{9} + \frac{\pi n}{3}, n \in \mathbb{Z}</math></p>

7.	$\cos \frac{\pi x}{7} = -1$	$\frac{\pi x}{7} = \pi + 2\pi n, n \in \mathbb{Z}$ $x = 7 + 14n, n \in \mathbb{Z}$	<b>Ответ: <math>7 + 14n, n \in \mathbb{Z}</math></b>
8.	$\operatorname{ctg} \left( x + \frac{\pi}{3} \right) = -\sqrt{3}$	$x + \frac{\pi}{3} = \operatorname{arc} \operatorname{ctg}(-\sqrt{3}) + \pi n, n \in \mathbb{Z}$ $x + \frac{\pi}{3} = (\pi - \operatorname{arc} \operatorname{ctg} \sqrt{3}) + \pi n, n \in \mathbb{Z}$ $x + \frac{\pi}{3} = \left( \pi - \frac{\pi}{6} \right) + \pi n, n \in \mathbb{Z}$ $x + \frac{\pi}{3} = \frac{5\pi}{6} + \pi n, n \in \mathbb{Z}$ $x = \frac{5\pi}{6} - \frac{\pi}{3} + \pi n, n \in \mathbb{Z}$ $x = \frac{\pi}{2} + \pi n, n \in \mathbb{Z}$	<b>Ответ: <math>\frac{\pi}{2} + \pi n, n \in \mathbb{Z}</math></b>
9.	$\sin \pi x = 1$	$\pi x = \frac{\pi}{2} + 2\pi n, n \in \mathbb{Z}$ $x = \frac{1}{2} + 2n, n \in \mathbb{Z}$	<b>Ответ: <math>\frac{1}{2} + 2n, n \in \mathbb{Z}</math></b>
10.	$\cos \frac{\pi x}{4} = 0$	$\frac{\pi x}{4} = \frac{\pi}{2} + \pi n, n \in \mathbb{Z}$ $x = 2 + 4n, n \in \mathbb{Z}$	<b>Ответ: <math>2 + 4n, n \in \mathbb{Z}</math></b>
11.	$\operatorname{tg} \frac{\pi x}{4} = 0$	$\frac{\pi x}{4} = \pi n, n \in \mathbb{Z}$ $x = 4n, n \in \mathbb{Z}$	<b>Ответ: <math>4n, n \in \mathbb{Z}</math></b>
12.	$\operatorname{ctg} \left( 2x - \frac{\pi}{6} \right) = -\frac{1}{\sqrt{3}}$	$2x - \frac{\pi}{6} = \operatorname{arc} \operatorname{ctg} \left( -\frac{1}{\sqrt{3}} \right) + \pi n, n \in \mathbb{Z}$ $2x - \frac{\pi}{6} = \left( \pi - \operatorname{arc} \operatorname{ctg} \frac{1}{\sqrt{3}} \right) + \pi n, n \in \mathbb{Z}$ $2x - \frac{\pi}{6} = \left( \pi - \frac{\pi}{3} \right) + \pi n, n \in \mathbb{Z}$ $2x - \frac{\pi}{6} = \frac{2\pi}{3} + \pi n, n \in \mathbb{Z}$ $2x = \frac{2\pi}{3} + \frac{\pi}{6} + \pi n, n \in \mathbb{Z}$ $2x = \frac{5\pi}{6} + \pi n, n \in \mathbb{Z}$ $x = \frac{5\pi}{12} + \frac{\pi n}{2}, n \in \mathbb{Z}$	<b>Ответ: <math>\frac{5\pi}{12} + \frac{\pi n}{2}, n \in \mathbb{Z}</math></b>

## Самостоятельно (В – 7) (решение)

№ п/п	Задание	Решение и ответ
<b>Решите уравнения:</b>		
1.	$\sin \pi x = 0$	$\pi x = \pi n, n \in \mathbb{Z}$ $x = n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>n, n \in \mathbb{Z}</math></b></p>
2.	$\sin \pi x = 1$	$\pi x = \frac{\pi}{2} + 2\pi n, n \in \mathbb{Z}$ $x = \frac{1}{2} + 2n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>\frac{1}{2} + 2n, n \in \mathbb{Z}</math></b></p>
3.	$\sin \left(x - \frac{\pi}{2}\right) = -1$	$x - \frac{\pi}{2} = -\frac{\pi}{2} + 2\pi n, n \in \mathbb{Z}$ $x = -\frac{\pi}{2} + \frac{\pi}{2} + 2\pi n, n \in \mathbb{Z};$ $x = 2\pi n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>2\pi n, n \in \mathbb{Z}</math></b></p>
4.	$\cos \frac{\pi x}{4} = 0$	$\frac{\pi x}{4} = \frac{\pi}{2} + \pi n, n \in \mathbb{Z} \quad (\cdot 4)$ $\pi x = 2\pi + 4\pi n, n \in \mathbb{Z} \quad (: \pi)$ $x = 2 + 4n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>2 + 4n, n \in \mathbb{Z}</math></b></p>
5.	$\cos \left(x + \frac{\pi}{3}\right) = 1$	$x + \frac{\pi}{3} = 2\pi n, n \in \mathbb{Z}$ $x = -\frac{\pi}{3} + 2\pi n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>-\frac{\pi}{3} + 2\pi n, n \in \mathbb{Z}</math></b></p>
6.	$\cos \frac{\pi x}{7} = -1$	$\frac{\pi x}{7} = \pi + 2\pi n, n \in \mathbb{Z} \quad (\cdot 7)$ $\pi x = 7\pi + 14\pi n, n \in \mathbb{Z} \quad (: \pi)$ $x = 7 + 14n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>7 + 14n, n \in \mathbb{Z}</math></b></p>
7.	$\operatorname{tg} 3x = 0$	$3x = \pi n, n \in \mathbb{Z}$ $x = \frac{\pi n}{3}, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>\frac{\pi n}{3}, n \in \mathbb{Z}</math></b></p>
8.	$\cos \frac{\pi x}{3} = \frac{\sqrt{3}}{2}$	$\frac{\pi x}{3} = \pm \arccos \frac{\sqrt{3}}{2} + 2\pi n, n \in \mathbb{Z}$ $\frac{\pi x}{3} = \pm \frac{\pi}{6} + 2\pi n, n \in \mathbb{Z} \quad /(\cdot 3)$ $\pi x = \pm \frac{\pi}{2} + 6\pi n, n \in \mathbb{Z} \quad /(: \pi)$ $x = \pm \frac{1}{2} + 6n, n \in \mathbb{Z}$ <p style="text-align: right;"><b>Ответ: <math>\pm \frac{1}{2} + 6n, n \in \mathbb{Z}</math></b></p>

9.	$\sin\left(2x - \frac{\pi}{3}\right) = \frac{\sqrt{2}}{2}$	$2x - \frac{\pi}{3} = (-1)^n \arcsin\left(\frac{\sqrt{2}}{2}\right) + \pi n, n \in \mathbb{Z}$ $2x - \frac{\pi}{3} = (-1)^n \cdot \frac{\pi}{4} + \pi n, n \in \mathbb{Z}$ $2x = (-1)^n \cdot \frac{\pi}{4} + \frac{\pi}{3} + \pi n, n \in \mathbb{Z}$ $x = (-1)^n \cdot \frac{\pi}{8} + \frac{\pi}{6} + \frac{\pi n}{2}, n \in \mathbb{Z}$	<b>Ответ:</b> $(-1)^n \cdot \frac{\pi}{8} + \frac{\pi}{6} + \frac{\pi n}{2}, n \in \mathbb{Z}$
10.	$\sin\left(x + \frac{\pi}{6}\right) = -\frac{1}{2}$	$x + \frac{\pi}{6} = (-1)^n \arcsin\left(-\frac{1}{2}\right) + \pi n, n \in \mathbb{Z}$ $x + \frac{\pi}{6} = (-1)^n (-1) \arcsin\frac{1}{2} + \pi n, n \in \mathbb{Z}$ $x + \frac{\pi}{6} = (-1)^{n+1} \cdot \frac{\pi}{6} + \pi n, n \in \mathbb{Z}$ $x = (-1)^{n+1} \cdot \frac{\pi}{6} - \frac{\pi}{6} + \pi n, n \in \mathbb{Z}$	<b>Ответ:</b> $(-1)^{n+1} \cdot \frac{\pi}{6} - \frac{\pi}{6} + \pi n, n \in \mathbb{Z}$
11.	$\cos\frac{x}{6} = \frac{1}{2}$	$\frac{x}{6} = \pm \arccos\frac{1}{2} + 2\pi n, n \in \mathbb{Z}$ $\frac{x}{6} = \pm \frac{\pi}{3} + 2\pi n, n \in \mathbb{Z} \quad /(\cdot 6)$ $x = \pm \frac{\pi}{2} + 12\pi n, n \in \mathbb{Z}$	<b>Ответ:</b> $\pm \frac{\pi}{2} + 12\pi n, n \in \mathbb{Z}$
12.	$\cos\left(4x - \frac{\pi}{4}\right) = -\frac{\sqrt{2}}{2}$	$4x - \frac{\pi}{4} = \pm \arccos\left(-\frac{\sqrt{2}}{2}\right) + 2\pi n, n \in \mathbb{Z}$ $4x - \frac{\pi}{4} = \pm \left(\pi - \arccos\frac{\sqrt{2}}{2}\right) + 2\pi n, n \in \mathbb{Z}$ $4x - \frac{\pi}{4} = \pm \left(\pi - \frac{\pi}{4}\right) + 2\pi n, n \in \mathbb{Z}$ $4x - \frac{\pi}{4} = \pm \frac{3\pi}{4} + 2\pi n, n \in \mathbb{Z}$ $4x = \pm \frac{3\pi}{4} + \frac{\pi}{4} + 2\pi n, n \in \mathbb{Z} \quad (:4)$ $x = \pm \frac{3\pi}{16} + \frac{\pi}{16} + \frac{\pi n}{2}, n \in \mathbb{Z}$	<b>Ответ:</b> $\pm \frac{3\pi}{16} + \frac{\pi}{16} + \frac{\pi n}{2}, n \in \mathbb{Z}$
13.	$\operatorname{tg}\frac{4x}{5} = \sqrt{3}$	$\frac{4x}{5} = \arctg(\sqrt{3}) + \pi n, n \in \mathbb{Z}$ $\frac{4x}{5} = \frac{\pi}{3} + \pi n, n \in \mathbb{Z} \quad /(\cdot 5)$ $4x = \frac{5\pi}{3} + 5\pi n, n \in \mathbb{Z} \quad /(:4)$ $x = \frac{5\pi}{12} + \frac{5\pi n}{4}, n \in \mathbb{Z}$	<b>Ответ:</b> $\frac{5\pi}{12} + \frac{5\pi n}{4}, n \in \mathbb{Z}$
14.	$\operatorname{ctg} 3x = -\sqrt{3}$	$3x = \operatorname{arccotg}(-\sqrt{3}) + \pi n, n \in \mathbb{Z}$ $3x = (\pi - \operatorname{arccotg}\sqrt{3}) + \pi n, n \in \mathbb{Z}$ $3x = \left(\pi - \frac{\pi}{6}\right) + \pi n, n \in \mathbb{Z}$ $3x = \frac{5\pi}{6} + \pi n, n \in \mathbb{Z}$ $x = \frac{5\pi}{18} + \frac{\pi n}{3}, n \in \mathbb{Z}$	<b>Ответ:</b> $\frac{5\pi}{18} + \frac{\pi n}{3}, n \in \mathbb{Z}$

Решите уравнения			
1.	$\sin \pi x = 0$	8.	$\cos \frac{\pi x}{3} = \frac{\sqrt{3}}{2}$
2.	$\sin \pi x = 1$	9.	$\sin \left(2x - \frac{\pi}{3}\right) = \frac{\sqrt{2}}{2}$
3.	$\sin \left(x - \frac{\pi}{2}\right) = -1$	10.	$\sin \left(x + \frac{\pi}{6}\right) = -\frac{1}{2}$
4.	$\cos \frac{\pi x}{4} = 0$	11.	$\cos \frac{x}{6} = \frac{1}{2}$
5.	$\cos \left(x + \frac{\pi}{3}\right) = 1$	12.	$\cos \left(4x - \frac{\pi}{4}\right) = -\frac{\sqrt{2}}{2}$
6.	$\cos \frac{\pi x}{7} = -1$	13.	$\operatorname{tg} \frac{4x}{5} = \sqrt{3}$
7.	$\operatorname{tg} 3x = 0$	14.	$\operatorname{ctg} 3x = -\sqrt{3}$

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2.	$\sin \pi x = 1$	9.	$\sin \left(2x - \frac{\pi}{3}\right) = \frac{\sqrt{2}}{2}$
3.	$\sin \left(x - \frac{\pi}{2}\right) = -1$	10.	$\sin \left(x + \frac{\pi}{6}\right) = -\frac{1}{2}$
4.	$\cos \frac{\pi x}{4} = 0$	11.	$\cos \frac{x}{6} = \frac{1}{2}$
5.	$\cos \left(x + \frac{\pi}{3}\right) = 1$	12.	$\cos \left(4x - \frac{\pi}{4}\right) = -\frac{\sqrt{2}}{2}$
6.	$\cos \frac{\pi x}{7} = -1$	13.	$\operatorname{tg} \frac{4x}{5} = \sqrt{3}$
7.	$\operatorname{tg} 3x = 0$	14.	$\operatorname{ctg} 3x = -\sqrt{3}$