



# Четность, нечетность синуса, косинуса, тангенса, котангенса

$$\sin(-\alpha) = -\sin \alpha$$

$$\operatorname{tg}(-\alpha) = -\operatorname{tg} \alpha$$

$$\operatorname{ctg}(-\alpha) = -\operatorname{ctg} \alpha$$



**Нечетные  
функции**

$$\cos(-\alpha) = \cos \alpha$$



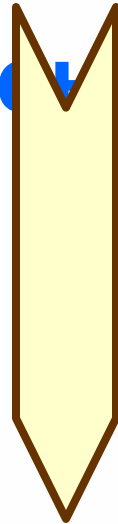
**Четная  
функция**

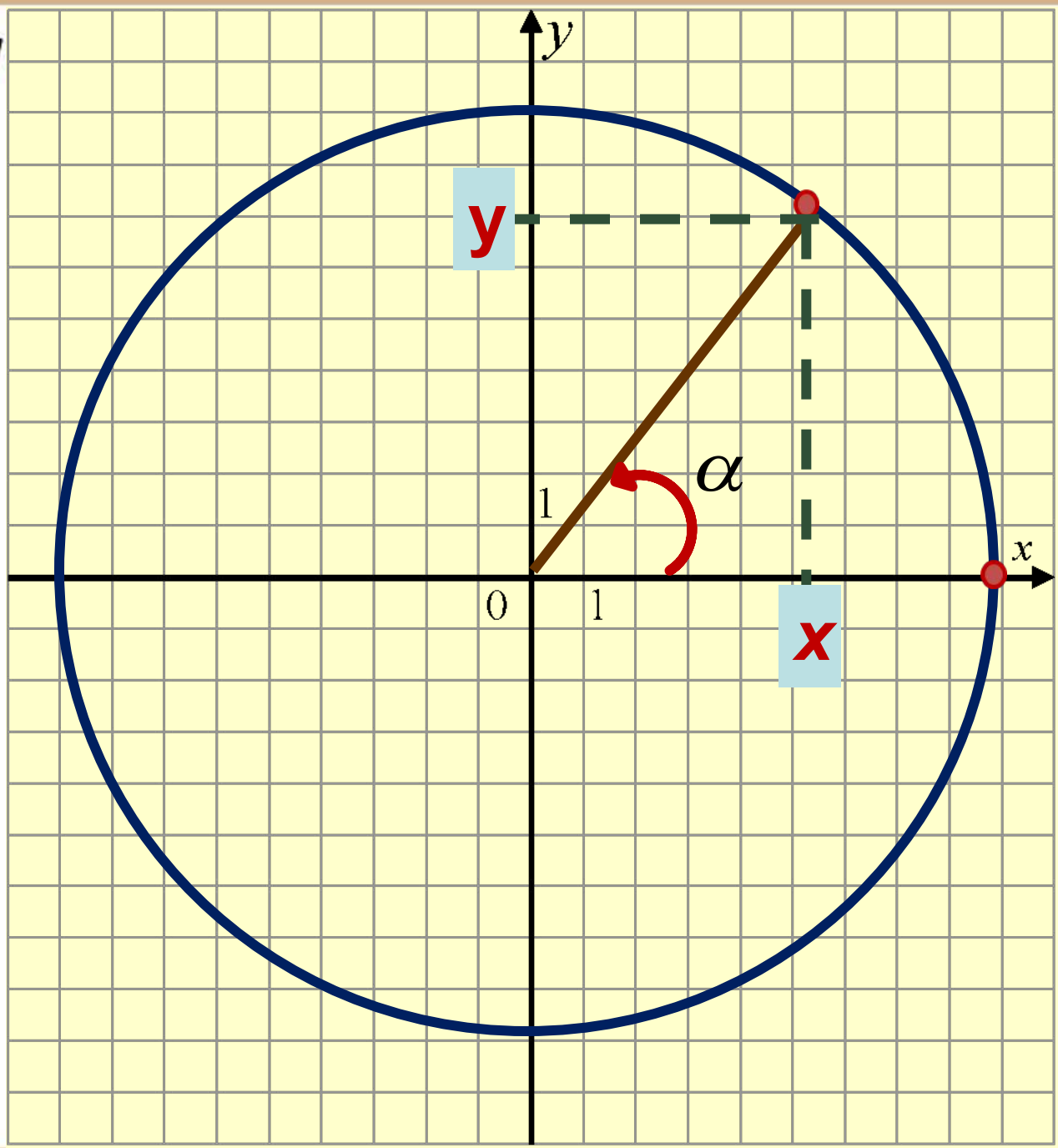


# Периодичность тригонометрических функций

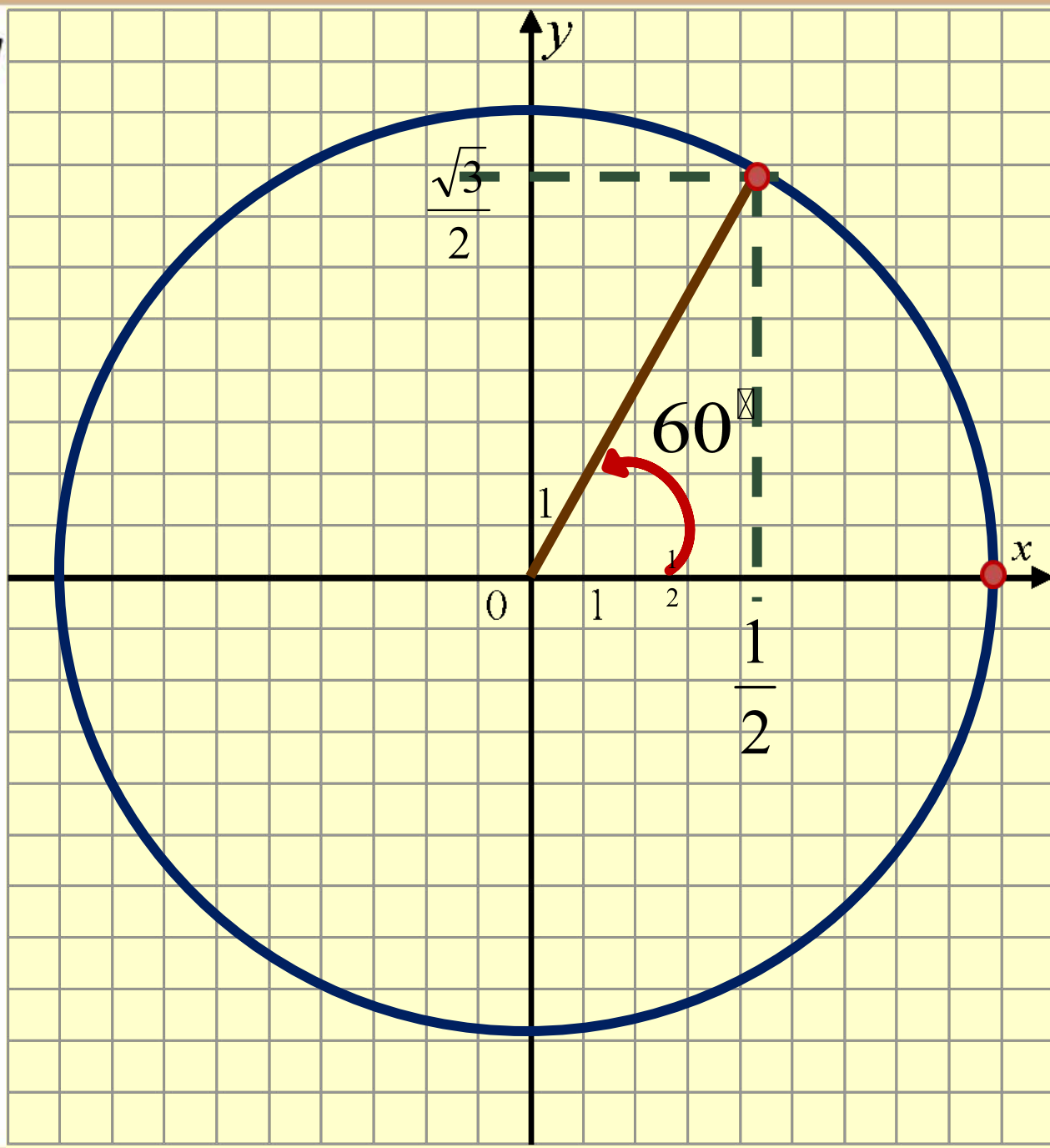
При изменении угла на целое число  
оборотов  
значения синуса, косинуса, тангенса,  
котангенса

не изменяются





$$\begin{aligned} \sin \alpha &= \\ &= \sin(\alpha + 360^\circ) = \\ &= \sin(\alpha + 2 \cdot 360^\circ) = \\ &= \sin(\alpha + n \cdot 360^\circ) \\ \cos \alpha &= \\ &= \cos(\alpha + 360^\circ) = \\ &= \cos(\alpha + 2 \cdot 360^\circ) = \\ &= \cos(\alpha + n \cdot 360^\circ) \\ \operatorname{tg} \alpha &= \\ &= \operatorname{tg}(\alpha + n \cdot 180^\circ) \\ \operatorname{ctg} \alpha &= \\ &= \operatorname{ctg}(\alpha + n \cdot 180^\circ) \end{aligned}$$



$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 60^\circ = \frac{1}{2}$$

$$\sin 480^\circ = ?$$

$$\cos 480^\circ = ?$$

$$\begin{aligned} \sin 480^\circ &= \\ &= \sin(60^\circ + 2 \cdot 360^\circ) = \\ &= \sin(60^\circ + 720^\circ) = \\ &= \sin 60^\circ = \frac{\sqrt{3}}{2} \end{aligned}$$

$$\begin{aligned} \cos 480^\circ &= \\ &= \cos(60^\circ + 2 \cdot 360^\circ) = \\ &= \cos 60^\circ = \frac{1}{2} \end{aligned}$$



$$\sin\left(-\frac{\pi}{3}\right) = -\sin\frac{\pi}{3} = -\frac{\sqrt{3}}{2}$$

$$\operatorname{ctg}\left(-\frac{\pi}{6}\right) = -\operatorname{ctg}\frac{\pi}{6} = -\sqrt{3}$$

$$\cos(-45^{\circ}) = \cos 45^{\circ} = \frac{\sqrt{2}}{2}$$

$$\operatorname{tg}(-60^{\circ}) = -\operatorname{tg} 60^{\circ} = -\sqrt{3}$$

$$\sin 405^{\circ} = \sin(360^{\circ} + 45^{\circ}) = \sin 45^{\circ} = \frac{\sqrt{2}}{2}$$

$$\sin(-765^{\circ}) = -\sin 765^{\circ} = -\sin(2 \cdot 360^{\circ} + 45^{\circ}) = -\sin 45^{\circ} = -\frac{\sqrt{2}}{2}$$



$$\sin 765^\circ =$$

$$= \sin(45^\circ + 2 \cdot 360^\circ) =$$

$$= \sin 45^\circ = \frac{\sqrt{2}}{2}$$

$$\cos 1110^\circ =$$

$$= \cos(30^\circ + 3 \cdot 360^\circ) =$$

$$= \cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\sin(-1470^\circ) = -\sin 1470^\circ = -\sin(30^\circ + 4 \cdot 360^\circ) = -\sin 30^\circ = -\frac{1}{2}$$

$$\cos(-1140^\circ) = \cos 1140^\circ = \cos(60^\circ + 3 \cdot 360^\circ) = \cos 60^\circ = \frac{1}{2}$$

$$\sin(-810^\circ) = -\sin 810^\circ = -\sin(90^\circ + 2 \cdot 360^\circ) = -\sin 90^\circ = -1$$

$$\cos(-1170^\circ) = \cos 1170^\circ = \cos(90^\circ + 3 \cdot 360^\circ) = \cos 90^\circ = 0$$



$$\sin\left(-\frac{\pi}{4}\right) = -\sin\frac{\pi}{4} = -\frac{\sqrt{2}}{2}$$

$$\sin 2,5\pi = \sin(0,5\pi + 2\pi) = \sin 0,5\pi = \sin\frac{\pi}{2} = 1$$

$$\cos\left(-\frac{9\pi}{4}\right) = \cos\left(2\frac{1}{4}\pi\right) = \cos\left(2\pi + \frac{\pi}{4}\right) = \cos\frac{\pi}{4} = \frac{\sqrt{2}}{2}$$

$$\operatorname{tg}\frac{13\pi}{6} = \operatorname{tg}\left(2\frac{1}{6}\pi\right) = \operatorname{tg}\left(\frac{\pi}{6} + 2\pi\right) = \operatorname{tg}\frac{\pi}{6} = \frac{\sqrt{3}}{3}$$

$$\operatorname{ctg}\left(-\frac{7\pi}{3}\right) = -\operatorname{ctg}\left(2\frac{1}{3}\pi\right) = -\operatorname{ctg}\left(\frac{\pi}{3} + 2\pi\right) = -\operatorname{ctg}\frac{\pi}{3} = -\sqrt{3}$$



$$\operatorname{tg} \frac{17\pi}{4} = \operatorname{tg} \left( \frac{16\pi}{4} + \frac{\pi}{4} \right) = \operatorname{tg} \left( 4\pi + \frac{\pi}{4} \right) = \operatorname{tg} \frac{\pi}{4} = 1$$

$$\operatorname{ctg} \left( -\frac{13\pi}{6} \right) = -\operatorname{ctg} \left( \frac{12\pi}{6} + \frac{\pi}{6} \right) = -\operatorname{ctg} \left( 2\pi + \frac{\pi}{6} \right) = -\operatorname{ctg} \frac{\pi}{6} = -\sqrt{3}$$

$$\cos \left( -\frac{25\pi}{6} \right) = \cos \frac{25\pi}{6} = \cos \left( \frac{24\pi}{6} + \frac{\pi}{6} \right) = \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$$





# Решите самостоятельно!

1. Найдите значение выражения  $3\sqrt{3} \cos \frac{\pi}{6} \cos 7\pi$ .
2. Найдите значение выражения  $-5\sqrt{3} \cos(-390^\circ)$ .
3. Найдите значение выражения  $4\sqrt{3} \operatorname{tg}(-750^\circ)$ .
4. Найдите значение выражения  $\frac{28 \sin 316^\circ}{\sin 44^\circ}$ .
5. Найдите значение выражения  $\frac{16}{\sin\left(-\frac{29\pi}{4}\right) \cos \frac{65\pi}{4}}$ .