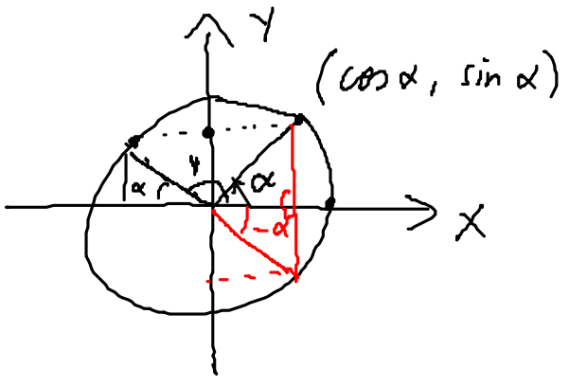


Sinin kaavoja:

täydet ympyrät
$n \in \mathbb{Z}$

$$\sin x = \sin(x + n2\pi)$$ (täydet ympyrät mukaan ratkaisuihin)

$$\sin(-x) = -\sin x$$ (voit siirtää edessä oleva miinuksen sinin sisään)

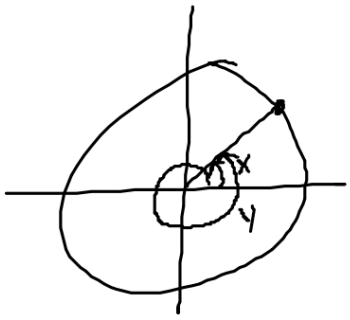
$$\sin x = \sin(\pi - x)$$ (suplem.-kulma mukaan vaihtoehtoihin)

$$\sin x = \cos\left(\frac{\pi}{2} - x\right)$$ ← (voit muuttaa sin ↔ cos)

$$\sin\left(\frac{\pi}{2} - x\right) = \cos x$$

$\sin x = \sin y$

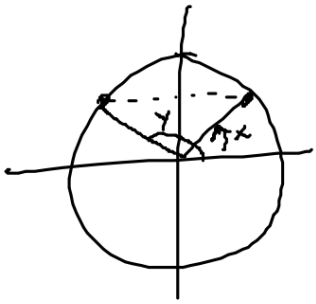
1. Samat kulmat (+ täydet ymp.)



$$x = y + n2\pi$$

$$x = y + n \cdot 360^\circ$$

2. Kulmat suplementtikulmia



$$x = \pi - y + n2\pi$$

$$x = 180^\circ - y + n360^\circ$$

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

↖ MAOL:sta $\sin \frac{\pi}{6} = \frac{1}{2}$

$\sin x = \sin \frac{\pi}{6}$

$x = \frac{\pi}{6} + n2\pi$ tai $x = \pi - \frac{\pi}{6} + n2\pi$

$x = \frac{5\pi}{6} + n2\pi$

n kokon. luku

Esim. $\sin x = 0,37$

$\updownarrow$

$\sin y = 0,37$

$y = \sin^{-1}(0,37) \approx 0,37901$

$\sin x = \sin(0,37901)$

$x = 0,37901 + n2\pi$ tai

$x = \pi - 0,37901 + n2\pi = 2,763 + n2\pi$

Esim. $4 \cdot \sin 3x = 1 \quad /:4$

$\sin 3x = \frac{1}{4} = \sin(0{,}25268)$

$y = \sin^{-1}(0{,}25)$

$3x = 0{,}25268 + n2\pi$ tai $\quad /:3$

$3x = \pi - 0{,}25268 + n2\pi$

V: $\begin{cases} x = 0{,}084 + \frac{n2\pi}{3} \\ x = 0{,}963 + \frac{n2\pi}{3} \end{cases}$

302. a) $\sin\frac{X}{5} = \sin 250^\circ$

↓ MAOL

$\frac{X}{5} = 250^\circ + n360^\circ \;//\cdot 5$ tai $\frac{X}{5} = 180^\circ - 250^\circ + n360^\circ$

$\frac{X}{5} = -70^\circ + n360^\circ \;//\cdot 5$

$X = 1250^\circ + n\cdot 1800^\circ$

$X = -350^\circ + n\cdot 1800^\circ$

304. a) $\sin\alpha = \frac{\sqrt{3}}{2}$

MAOL: $\sin\frac{\pi}{3} = \frac{\sqrt{3}}{2}$

$\sin\alpha = \sin\frac{\pi}{3}$

$\alpha = \frac{\pi}{3} + n2\pi$ tai $\alpha = \pi - \frac{\pi}{3} + n2\pi$

$\alpha = \frac{2}{3}\pi + n2\pi$

308. a) $2 \cdot \sin\left(x - \frac{\pi}{3}\right) = -\sqrt{3}$ $\quad | : 2$

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

MAOL: $\sin\frac{4}{3}\pi = -\frac{\sqrt{3}}{2}$

$\sin\underbrace{\left(x - \frac{\pi}{3}\right)}_{=x} = \sin\underbrace{\frac{4}{3}\pi}_{=y}$

x ja y MAOL:in kaavaan nro 48

$x - \frac{\pi}{3} = \frac{4}{3}\pi + n2\pi$ tai $x - \frac{\pi}{3} = \pi - \frac{4}{3}\pi + n2\pi$

$x = \frac{5}{3}\pi + n2\pi$

$x = 0 + n2\pi$

$x = n2\pi$

310. a) $\sin\left(x+\frac{\pi}{4}\right) = \cos\left(\underbrace{\frac{\pi}{6}-x}_{"x"}\right) = \sin\left(\frac{\pi}{2}-\left(\frac{\pi}{6}-x\right)\right)$

MAOL: $\cos x = \sin\left(\frac{\pi}{2}-x\right)$

$$\sin\left(x+\frac{\pi}{4}\right) = \sin\left(x+\frac{\pi}{2}-\frac{\pi}{6}\right)$$

$$\sin\underbrace{\left(x+\frac{\pi}{4}\right)}_{x} = \sin\underbrace{\left(x+\frac{\pi}{3}\right)}_{y}$$

$x+\frac{\pi}{4} = x+\frac{\pi}{3}+n2\pi$

x:t supistuu

→ ei ratk.

tai $x+\frac{\pi}{4} = \pi-\left(x+\frac{\pi}{3}\right)+n2\pi$

$x+\frac{\pi}{4} = \pi-x-\frac{\pi}{3}+n2\pi$

$2x = \pi^{(12)} - \frac{\pi}{4}^{(3)} - \frac{\pi}{3}^{(4)} + n2\pi$

$\leftarrow 2x = \frac{5\pi}{12}+n2\pi \quad \| :2$

V: $x = \frac{5\pi}{24}+n\pi$

313. $\cos^2 x - \sin x = \frac{1}{4}$

MAOL: $\sin^2 x + \cos^2 x = 1$

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

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

$\sin^2 x + \sin x - \frac{3}{4} = 0$

Sij. $\boxed{t = \sin x}$

$\rightarrow t^2 + t - \frac{3}{4} = 0 \quad \| \cdot 4$

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

$t = \frac{-4 \pm \sqrt{16 - 4 \cdot 4 \cdot (-3)}}{8} = \frac{-4 \pm \sqrt{64}}{8} = \frac{-4 \pm 8}{8}$

$\begin{cases} = \frac{1}{2} \\ = -1{,}5 \end{cases}$

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

2) $\sin x = -1{,}5$ ei ratkea.

Yksikön ratkeaa:

$\sin x = \sin \frac{\pi}{6}$

$x = \frac{\pi}{6} + n2\pi$ tai

$x = \pi - \frac{\pi}{6} + n2\pi$

$x = \frac{5\pi}{6} + n2\pi$

s. 42: 302 b, 304 b, 308 b, 310 b, 312, 314