

E.g. Suppose that  $\sin(u) = \frac{-3}{5}$  and that  $\cos(u)$  is negative.

Find the following

$\sin(u) = \frac{-3}{5}$
$\cos(u) = -\frac{4}{5}$
$\tan(u) = \frac{-\frac{3}{5}}{-\frac{4}{5}}$
$= \frac{3}{4}$

$$(\sin(u))^2 + (\cos(u))^2 = 1$$

$$\left(\frac{-3}{5}\right)^2 + (\cos(u))^2 = 1$$

$$\frac{9}{25} + \cos^2(u) = \frac{25}{25}$$

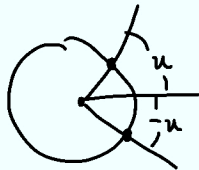
$$\cos^2(u) = \frac{25}{25} - \frac{9}{25} = \frac{16}{25}$$

$$\cos(u) = \pm \sqrt{\frac{16}{25}}$$

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

$$\sin(u) = \frac{-3}{5}$$

$$\cos(u) = \frac{-4}{5}$$



$$\sin(-u) = -\sin(u)$$

$$\cos(-u) = \cos(u)$$

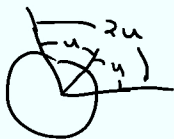
$$\sin(-u) = -\sin(u) = -\frac{-3}{5} = \frac{3}{5}$$

$$\cos(-u) = \cos(u) = \frac{-4}{5}$$

$$\tan(-u) = \frac{\sin(-u)}{\cos(-u)} = \frac{3/5}{-4/5} = \frac{-3}{4}$$

$$\sin(u) = \frac{-3}{5}$$

$$\cos(u) = \frac{-4}{5}$$



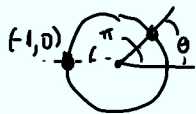
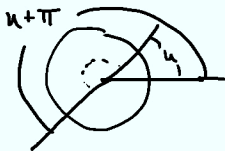
$$\sin(2u) = 2 \cdot \sin(u) \cdot \cos(u) = 2 \cdot \left(\frac{-3}{5}\right) \cdot \left(\frac{-4}{5}\right) = \frac{2 \cdot 3 \cdot 4}{5 \cdot 5} = \frac{24}{25}$$

$$\begin{aligned} \cos(2u) &= (\cos(u))^2 - (\sin(u))^2 = \left(\frac{-4}{5}\right)^2 - \left(\frac{-3}{5}\right)^2 = \frac{16}{25} - \frac{9}{25} \\ &= \frac{7}{25} \end{aligned}$$

$$\tan(2u) = \frac{\sin(2u)}{\cos(2u)} = \frac{24/25}{7/25} = \frac{24}{7}$$

$$\sin(u) = \frac{-3}{5}$$

$$\cos(u) = \frac{-4}{5}$$



$$\begin{aligned}x\text{-coord} &= \cos(\theta) \\ y\text{-coord} &= \sin(\theta).\end{aligned}$$

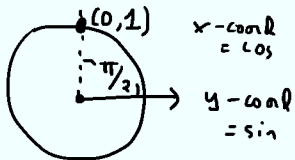
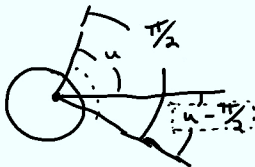
$$\begin{aligned}\sin(u + \pi) &= \sin(u) \cdot \cos(\pi) + \cos(u) \cdot \sin(\pi) \\ &= \frac{-3}{5} \cdot (-1) + \frac{-4}{5} \cdot (0) = \frac{3}{5}\end{aligned}$$

$$\begin{aligned}\cos(u + \pi) &= \cos(u) \cdot \cos(\pi) - \sin(u) \cdot \sin(\pi) \\ &= \frac{-4}{5} \cdot (-1) - \frac{-3}{5} \cdot (0) = \frac{4}{5}\end{aligned}$$

$$\tan(u + \pi) = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4}$$

$$\sin(u) = \frac{-3}{5}$$

$$\cos(u) = \frac{-4}{5}$$



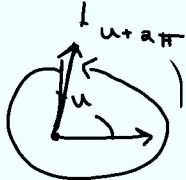
$$\begin{aligned} \sin\left(u - \frac{\pi}{2}\right) &= \sin(u) \cdot \cos\left(\frac{\pi}{2}\right) - \cos(u) \cdot \sin\left(\frac{\pi}{2}\right) \\ &= \frac{-3}{5} \cdot (0) - \frac{-4}{5} \cdot (1) = \frac{4}{5} \end{aligned}$$

$$\begin{aligned} \cos\left(u - \frac{\pi}{2}\right) &= \cos(u) \cdot \cos\left(\frac{\pi}{2}\right) + \sin(u) \cdot \sin\left(\frac{\pi}{2}\right) \\ &= \frac{-4}{5} \cdot 0 + \frac{-3}{5} \cdot 1 = \frac{-3}{5} \end{aligned}$$

$$\tan\left(u - \frac{\pi}{2}\right) = \frac{4/5}{-3/5} = \frac{-4}{3}$$

$$\sin(u) = \frac{-3}{5}$$

$$\cos(u) = \frac{-4}{5}$$



$$\sin(u + 2\pi) = \sin(u) = \frac{-3}{5}$$

$$\cos(u + 2\pi) = \cos(u) = \frac{-4}{5}$$

$$\tan(u + 2\pi) = \frac{-3/5}{-4/5} = \frac{3}{4}$$