LA FUNZIONE TANGENTE:

$$\boxed{\tan(x) = \frac{\sin(x)}{\cos(x)}}$$

$\forall x \neq \frac{\pi}{2} + k\pi$ FUNZIONE π - PERIODICA

FORMULE DELLA SOMMA / DELLA SOTTRAZIONE:

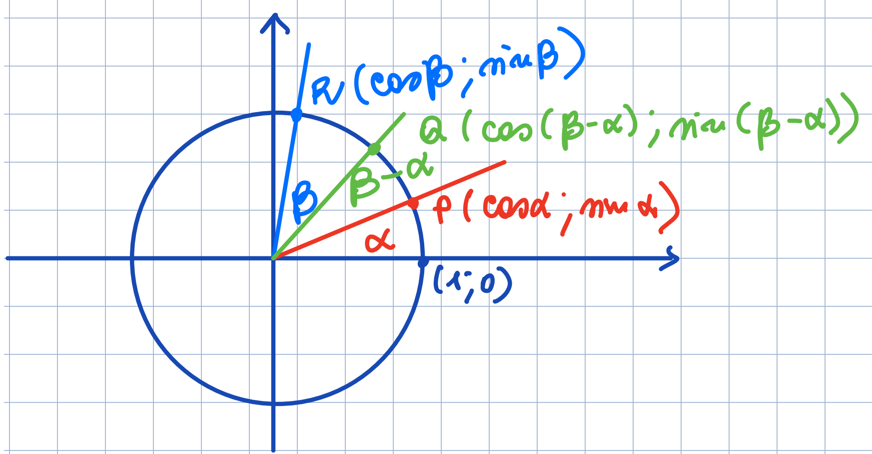
$$\sin(\alpha \pm \beta) = \sin\alpha \cos\beta \pm \sin\beta \cos\alpha$$

$$\cos(\alpha \pm \beta) = \cos\alpha \cos\beta \mp \sin\alpha \sin\beta$$

DIM.

PROVIANO CHE $\cos(\alpha - \beta) = \cos\alpha \cos\beta + \sin\alpha \sin\beta$

$\forall \alpha, \beta \in \mathbb{R}$



$$d(Q;(1;0)) = \sqrt{(\cos(\beta-\alpha)-1)^2 + (\sin(\beta-\alpha))^2}$$

$$d(Q;(1;0)) = d(R;P)$$

$$d(R;P) = \sqrt{(\cos\beta - \cos\alpha)^2 + (\sin\beta - \sin\alpha)^2}$$

$$(\cos(\beta-\alpha)-1)^2 + \sin^2(\beta-\alpha) = (\cos\beta - \cos\alpha)^2 + (\sin\beta - \sin\alpha)^2$$

$$\cos^2(\beta-\alpha) - 2\cos(\beta-\alpha) + 1 + \sin^2(\beta-\alpha) = \cos^2\beta - 2\cos\beta\cos\alpha + \cos^2\alpha + \sin^2\beta - 2\sin\beta\sin\alpha + \sin^2\alpha$$

$$\cancel{1} - 2\cos(\beta-\alpha) + \cancel{1} = \cancel{1} - 2\cos\beta\cos\alpha + \cancel{1} - 2\sin\beta\sin\alpha$$

$$-2\cos(\beta-\alpha) = -2\cos\beta\cos\alpha - 2\sin\beta\sin\alpha$$

$$\cos(\beta-\alpha) = \cos\beta\cos\alpha + \sin\beta\sin\alpha$$

c.v.d.

DA QUESTA DIMOSTRAZIONE POSTO $\beta = y$ E $\alpha = -x$ RICAVO:

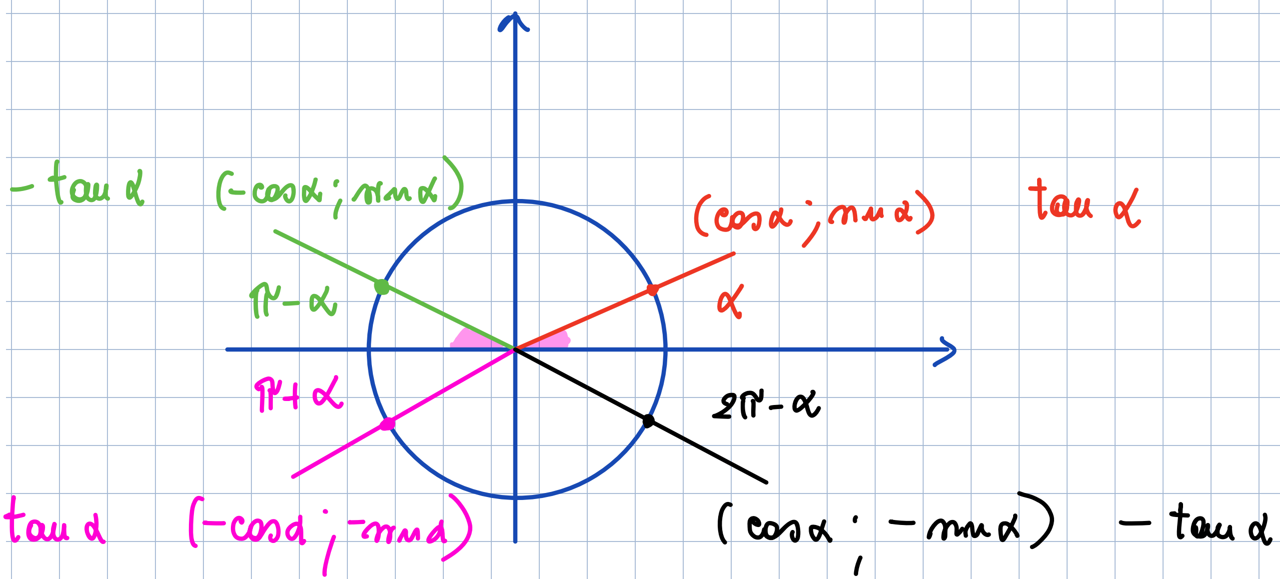
$\cos(y+x) = \cos y\cos x - \sin y\sin x = \cos\beta\cos(-\alpha) - \sin\beta\cdot\sin(-\alpha)$
$= \cos\beta\cos\alpha + \sin\beta\sin\alpha.$

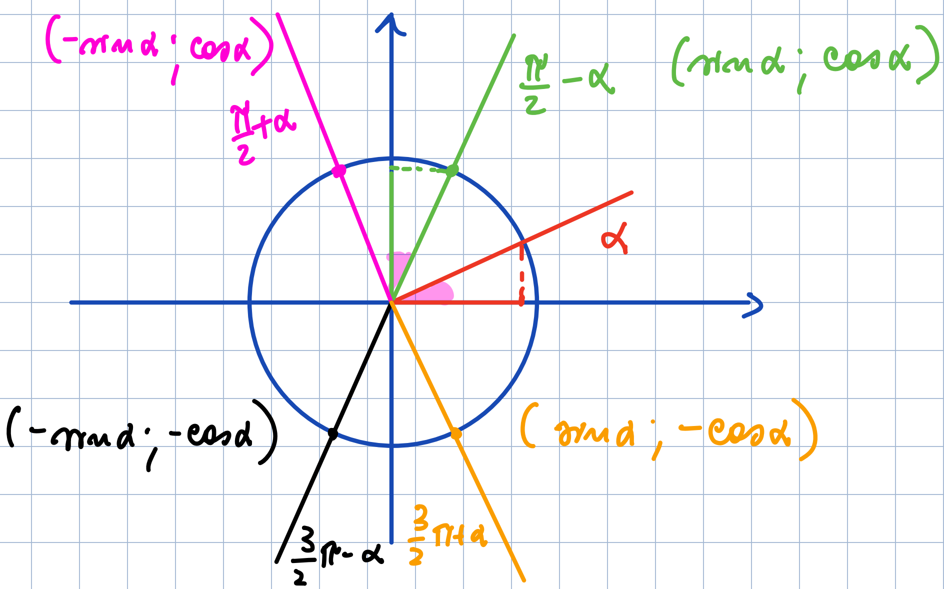
$\sin(y+x) = \cos\left(y+x-\frac{\pi}{2}\right) = \cos y\cos\left(x-\frac{\pi}{2}\right) - \sin y\cdot\sin\left(x-\frac{\pi}{2}\right) =$
$= \cos y\cos\left(-\left(\frac{\pi}{2}-x\right)\right) - \sin y\cdot\sin\left(-\left(\frac{\pi}{2}-x\right)\right) = \cos y\cos\left(\frac{\pi}{2}-x\right) + \sin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

$y = \beta$ e $x = -\alpha$

$\sin(\beta-\alpha) = \sin(y+x) = \sin x\cos y + \sin y\cos x = \sin(-\alpha)\cos\beta +$
$+ \sin\beta\cdot\cos(-\alpha) = -\sin\alpha\cos\beta + \sin\beta\cos\alpha = \sin\beta\cos\alpha - \sin\alpha\cos\beta$

ANGOLI AGGIUNTI:





1ª REL. FOND.
$\sin^2 x + \cos^2 x = 1$

$\downarrow$

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

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

FORMULE DI DUPLICAZIONE:

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

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

DIM.

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

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

c.v.d.

FORMULE DI BISEZIONE

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

DIM.

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

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

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

$$\sin\frac{x}{2} = \begin{cases} \sqrt{\dfrac{1-\cos x}{2}} & 2k\pi \le \dfrac{x}{2} \le \pi + 2k\pi \\ -\sqrt{\dfrac{1-\cos x}{2}} & \pi + 2k\pi < x \le 2\pi + 2k\pi \end{cases}$$

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

$$\cos\frac{x}{2} = \begin{cases} \sqrt{\dfrac{1+\cos x}{2}} & -\dfrac{\pi}{2} + 2k\pi \le \dfrac{x}{2} \le \dfrac{\pi}{2} + 2k\pi \\ -\sqrt{\dfrac{1+\cos x}{2}} & \dfrac{\pi}{2} + 2k\pi < x \le \dfrac{3}{2}\pi + 2k\pi \end{cases}$$

ES. CALCOLARE $\sin \frac{\pi}{12}$ E $\cos \frac{\pi}{12}$

$$\sin\left(\frac{\pi}{12}\right) = \sin\left(\frac{\pi/6}{2}\right) = \sqrt{\frac{1-\cos(\pi/6)}{2}} = \sqrt{\frac{1-\sqrt{3}/2}{2}} =$$

$$= \sqrt{\frac{2-\sqrt{3}}{4}}$$

$$\cos\left(\frac{\pi}{12}\right) = \cos\left(\frac{\pi/6}{2}\right) = \sqrt{\frac{1+\cos(\pi/6)}{2}} = \sqrt{\frac{1+\sqrt{3}/2}{2}} = \sqrt{\frac{2+\sqrt{3}}{4}}$$

ESPRIMERE LE FUNZIONI TRIGONOMETRICHE IN FUNZIONE DI SIN X

$$\cos x = \begin{cases} \sqrt{1-\sin^2 x} & \cos x \geq 0 \\ -\sqrt{1-\sin^2 x} & \cos x < 0 \end{cases}$$

$$\tan x = \frac{\sin x}{\cos x} = \begin{cases} \sqrt{\frac{\sin^2 x}{1-\sin^2 x}} & \tan x > 0 \\ -\sqrt{\frac{\sin^2 x}{1-\sin^2 x}} & \tan x < 0 \end{cases}$$

ESPRIMERE LE FUNZIONI TRIGONOMETRICHE IN FUNZIONE DI COS X

$$\sin x = \begin{cases} \sqrt{1-\cos^2 x} & \sin x \geq 0 \\ -\sqrt{1-\cos^2 x} & \sin x < 0 \end{cases}$$

$$\tan x = \begin{cases} \sqrt{\dfrac{1-\cos^2 x}{\cos^2 x}} & \tan x > 0 \\ -\sqrt{\dfrac{1-\cos^2 x}{\cos^2 x}} & \tan x < 0 \end{cases}$$

ESPRIMERE LE FUNZIONI TRIGONOMETRICHE IN FUNZIONE DI TAN X

$$\sin x = \begin{cases} \sqrt{\dfrac{\tan^2 x}{\tan^2 x + 1}} & \sin x \geq 0 \\ -\sqrt{\dfrac{\tan^2 x}{\tan^2 x + 1}} & \sin x < 0 \end{cases}$$

$$\cos x = \begin{cases} \dfrac{1}{\sqrt{1+\tan^2 x}} & \cos x \geq 0 \\ \dfrac{-1}{\sqrt{1+\tan^2 x}} & \cos x < 0 \end{cases}$$

TANGENTE DI UNA SOMMA:

$$\tan(\alpha+\beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\cdot\tan\beta} \qquad \forall \alpha;\beta \text{ t.c. } \tan\alpha\cdot\tan\beta \neq 1$$

DIM.

$$\tan(\alpha+\beta) = \frac{\sin(\alpha+\beta)}{\cos(\alpha+\beta)} = \frac{\sin\alpha\cos\beta + \sin\beta\cos\alpha}{\cos\alpha\cos\beta - \sin\alpha\sin\beta} \quad \frac{\frac{1}{\cos\alpha\cos\beta}}{\frac{1}{\cos\alpha\cos\beta}}$$

$$= \frac{\frac{\sin\alpha\cancel{\cos\beta}}{\cos\alpha\cancel{\cos\beta}} + \frac{\sin\beta\cancel{\cos\alpha}}{\cancel{\cos\alpha}\cos\beta}}{\frac{\cancel{\cos\alpha\cos\beta}}{\cancel{\cos\alpha\cos\beta}} - \frac{\sin\alpha\sin\beta}{\cos\alpha\cos\beta}} = \frac{\frac{\sin\alpha}{\cos\alpha} + \frac{\sin\beta}{\cos\beta}}{1 - \frac{\sin\alpha\sin\beta}{\cos\alpha\cos\beta}} =$$

$$= \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\cdot\tan\beta}$$

FORMULA DI DUPLICAZIONE DELLA TANGENTE:

$$\tan(2\alpha) = \frac{2\tan\alpha}{1 - \tan^2\alpha}$$

FORMULE PARAMETRICHE:

$$\sin x = \frac{2t}{1+t^2} \qquad \cos x = \frac{1-t^2}{1+t^2} \qquad \tan x = \frac{2t}{1-t^2}$$

DIM.

$$\sin x = \sin\left(2\cdot\frac{x}{2}\right) = 2\sin\frac{x}{2}\cdot\cos\frac{x}{2} = \frac{2\sin\frac{x}{2}\cos\frac{x}{2}}{\sin^2\frac{x}{2}+\cos^2\frac{x}{2}} \qquad \frac{\frac{1}{\cos^2 x/2}}{\frac{1}{\cos^2 x/2}}$$

$\cos^2 x/2 \neq 0$

$$= \frac{\frac{2\sin\frac{x}{2}\cancel{\cos\frac{x}{2}}}{\cos^{\cancel{2}}\frac{x}{2}}}{\frac{\sin^2\frac{x}{2}}{\cos^2\frac{x}{2}} + \frac{\cancel{\cos^2 x/2}}{\cancel{\cos^2 x/2}}} = \frac{\frac{2\sin\frac{x}{2}}{\cos\frac{x}{2}}}{\frac{\sin^2 x/2}{\cos^2 x/2}+1} = \frac{2\tan\frac{x}{2}}{\tan^2 x/2 + 1}$$

$$\tan\frac{x}{2} = t \qquad\qquad \sin x = \frac{2t}{1+t^2}$$

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

$$= \frac{\frac{\cos^2 x/2}{\cos^2 x/2} - \frac{\sin^2 x/2}{\cos^2 x/2}}{\frac{\cos^2 x/2}{\cos^2 x/2} + \frac{\sin^2 x/2}{\cos^2 x/2}} = \frac{1-\tan^2\frac{x}{2}}{1+\tan^2\frac{x}{2}} \overset{\tan\frac{x}{2}=t}{=} \frac{1-t^2}{1+t^2}$$

$$\tan x = \frac{\sin x}{\cos x} = \frac{\frac{2t}{1+t^2}}{\frac{1-t^2}{1+t^2}} = \frac{2t}{\cancel{1+t^2}}\cdot\frac{\cancel{1+t^2}}{1-t^2} = \frac{2t}{1-t^2}$$

FORMULE DI PROSTAFERESI:

$$\sin\alpha + \sin\beta = 2\cdot\sin\left(\frac{\alpha+\beta}{2}\right)\cdot\cos\left(\frac{\alpha-\beta}{2}\right)$$

$$\sin\alpha - \sin\beta = 2\cdot\sin\left(\frac{\alpha-\beta}{2}\right)\cdot\cos\left(\frac{\alpha+\beta}{2}\right)$$

$$\cos\alpha + \cos\beta = 2\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)$$

$$\cos\alpha - \cos\beta = -2\sin\left(\frac{\alpha+\beta}{2}\right)\cdot\sin\left(\frac{\alpha-\beta}{2}\right)$$

DIM.

$$\sin\alpha = \sin\left(\frac{\alpha+\beta}{2}+\frac{\alpha-\beta}{2}\right) = \sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) + \sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right)$$

$$\sin\beta = \sin\left(\frac{\alpha+\beta}{2}-\frac{\alpha-\beta}{2}\right) = \sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) - \sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right)$$

$$\sin\alpha + \sin\beta = \sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) + \cancel{\sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right)} + \sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) + \cancel{-\sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right)} =$$

$$= 2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)$$

$$\sin\alpha - \sin\beta = \cancel{\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)} + \sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right) - \cancel{\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)}$$
$$+ \sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right) = 2\sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right)$$

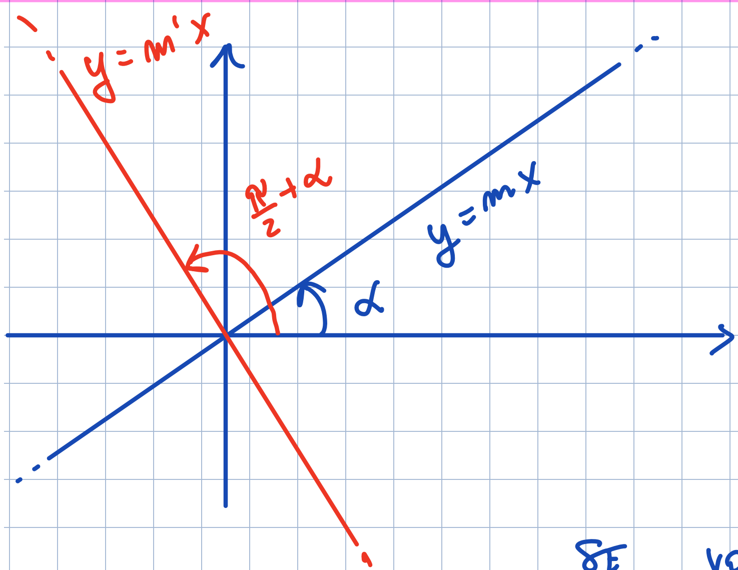
$$\cos\alpha = \cos\left(\frac{\alpha+\beta}{2}+\frac{\alpha-\beta}{2}\right) = \cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) - \sin\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)$$

$$\cos\beta = \cos\left(\frac{\alpha+\beta}{2}-\frac{\alpha-\beta}{2}\right) = \cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) + \sin\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)$$

$$\cos\alpha + \cos\beta = \cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) \cancel{- \sin\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)} + \cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) \cancel{+ \sin\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)} = 2\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)$$

$$\cos\alpha - \cos\beta = -2\sin\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)$$

c.v.d.



• DATE DUE RETTE DI COEFFICIENTE ANGOLARE m E m' QUESTE SONO PERPENDICOLARI SE $m \cdot m' = -1$

SE VOGLIO CHE LE DUE RETTE SIANO PERPENDICOLARI $\longrightarrow$ $\beta = \frac{\pi}{2}+\alpha$

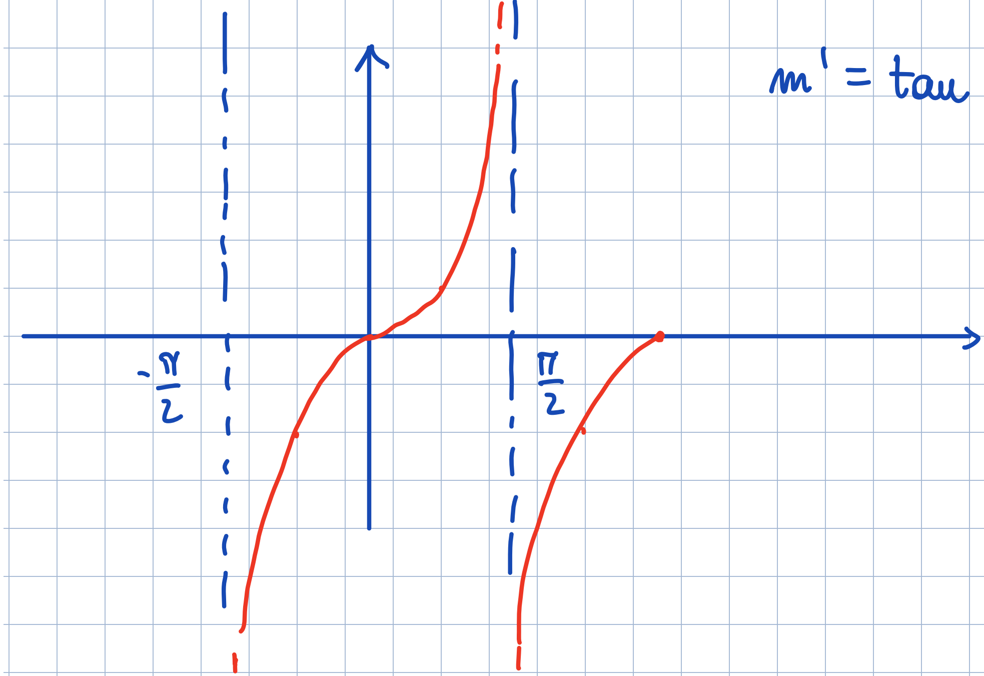
$m = \tan\alpha$

$m' = \tan\beta$

$$\lim_{x\to\frac{\pi}{2}} \tan(x+\alpha) = \lim_{x\to\frac{\pi}{2}} \frac{\tan x + \tan\alpha}{1 - \tan x \cdot \tan\alpha} =$$

$$= \lim_{x\to\frac{\pi}{2}} \frac{\cancel{\tan x}\left(1 + \frac{\tan\alpha}{\tan x}\right)}{\cancel{\tan x}\left(\frac{1}{\tan x} - \tan\alpha\right)} = -\frac{1}{\tan\alpha}$$

$\frac{\tan\alpha}{\tan x} \to 0$, $\frac{1}{\tan x} \to 0$



$$m' = \tan\left(\frac{\pi}{2}+\alpha\right) = -\frac{1}{\tan\alpha} = -\frac{1}{m}$$

$$\Longrightarrow m \cdot m' = -1$$

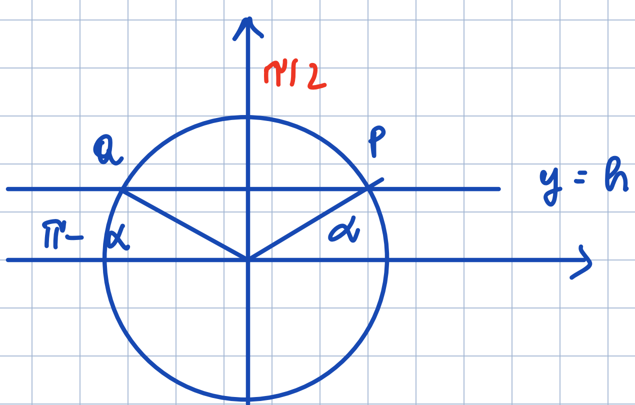
c.v.d.

L'EQUAZIONE $\sin\varphi = h$

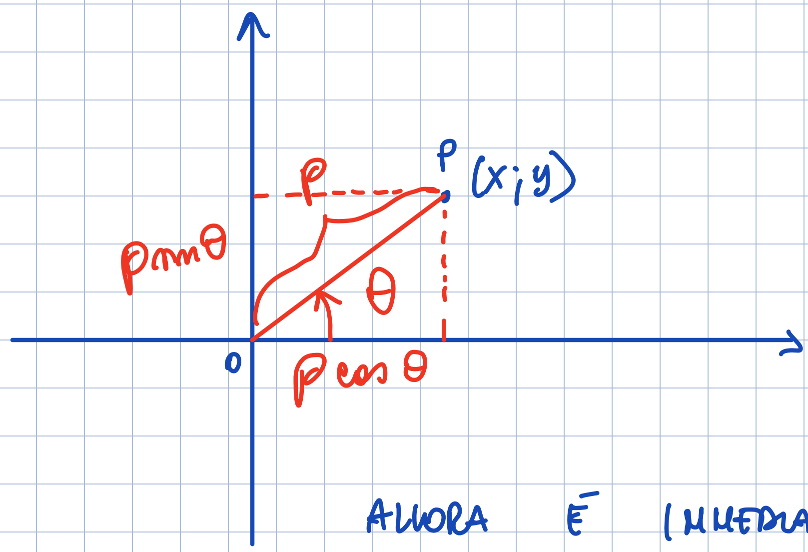
L'EQUAZIONE $\sin\varphi = h$ NON HA UNA SOLUZIONE UNICA.

INFATTI SE $\exists\, \bar\theta \in [0; 2\pi[\ : \ \sin\bar\theta = h$ ALLORA:

1. $-1 \le h \le 1$
2. $\sin(\pi - \bar\theta) = h$
3. $\sin(\bar\theta + 2k\pi) = \sin\bar\theta \cos(2k\pi) + \cancel{\sin(2k\pi)}^{\,0} \cdot \cos\bar\theta =$
   $= \sin\bar\theta \qquad \forall k \in \mathbb{Z}$



COORDINATE POLARI



PRESO UN PUNTO $P \in \mathbb{R}^2 \setminus \{(0;0)\}$

SI CONSIDERIAMO

$\rho = d(P;(0;0))$

θ: ANGOLO MISURATO IN SENSO ANTIORARIO FORMATO DA PO CON IL SEMIASSE POSITIVO

ALLORA È IMMEDIATO CALCOLARE

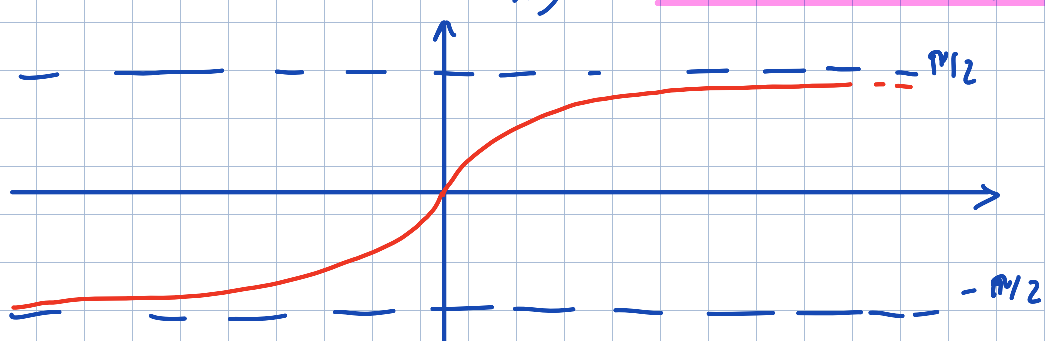
$$\begin{cases} x = \rho\cos\theta \\ y = \rho\sin\theta \end{cases}$$

$(x;y)$ COORDINATE DI P

VICEVERSA : DATO UN PUNTO $P(x;y)$

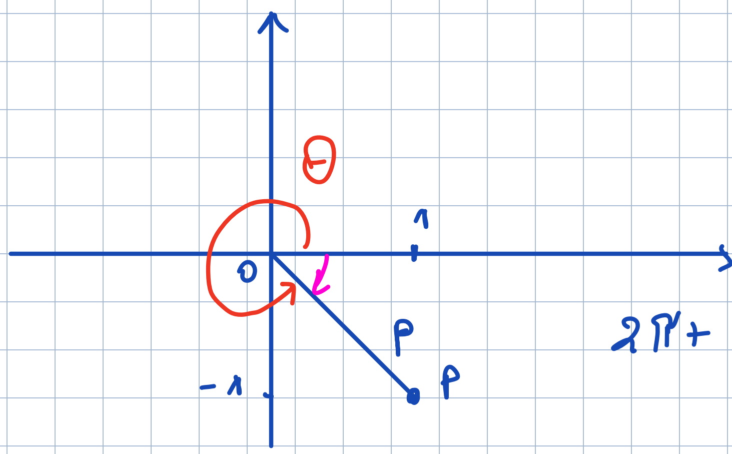
$$\rho = \sqrt{x^2+y^2}$$

$$\theta = \begin{cases} \arctan\left(\frac{y}{x}\right) & x>0 \wedge y \geq 0 \\ \pi/2 & x=0 \wedge y>0 \\ \pi + \arctan\left(\frac{y}{x}\right) & x<0 \longrightarrow 2° \text{ QUAD. e } 3° \text{ QUAD.} \\ \frac{3}{2}\pi & x=0 \wedge y<0 \\ 2\pi + \arctan\left(\frac{y}{x}\right) & x>0 \wedge y<0 \longrightarrow 4° \text{ QUAD.} \end{cases}$$



ES. 2.23 DETERMINARE LE COORDINATE POLARI DI

$(+1; -1)$



$$\rho = \sqrt{x^2+y^2} = \sqrt{1+1} = \sqrt{2}$$

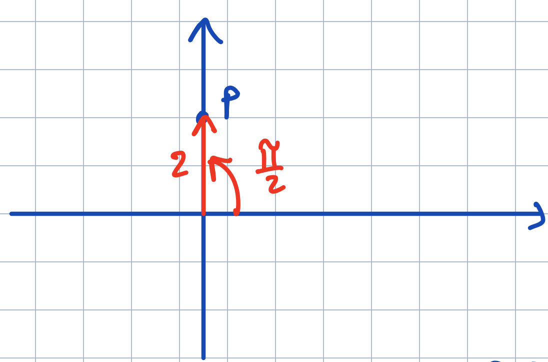
$$2\pi + \theta = \arctan\left(\frac{-1}{1}\right) + 2\pi = -\frac{\pi}{4} + 2\pi = \frac{7}{4}\pi$$

$P(1; -1)$ COORDINATE CARTESIANE

$P(\sqrt{2}; \frac{7}{4}\pi)$ COORDINATE POLARI

$(0; 2)$ $(-7\sqrt{3}; 7)$ $(-5; 0)$

1) $(0; 2)$



$$\rho = \sqrt{0^2+2^2} = \sqrt{4} = 2$$

$$x = 0 \wedge y > 0$$

$$\theta = \frac{\pi}{2}$$

$P(2; \pi/2)$

2) $(-7\sqrt{3}; 7)$

$$\rho = \sqrt{(-7\sqrt{3})^2 + (7)^2} = \sqrt{49 \cdot 3 + 49} = \sqrt{49(3+1)} = \sqrt{49} \cdot \sqrt{4} = 7 \cdot 2 = 14$$

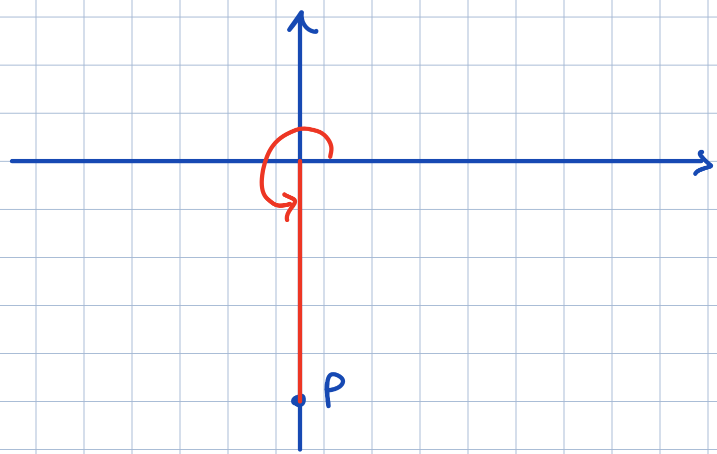
$$\theta = \pi + \arctan\left(\frac{7}{-7\sqrt{3}}\right) = \pi + \arctan\left(-\frac{1}{\sqrt{3}}\right) = \pi + \arctan\left(-\frac{\sqrt{3}}{3}\right) = \pi - \frac{\pi}{6} = \frac{5}{6}\pi$$

$P\left(14\,;\,\frac{5}{6}\pi\right)$

3) $P(0\,;-5)$

$\rho = \sqrt{5^2+0^2} = 5$

$\theta = \frac{3}{2}\pi$

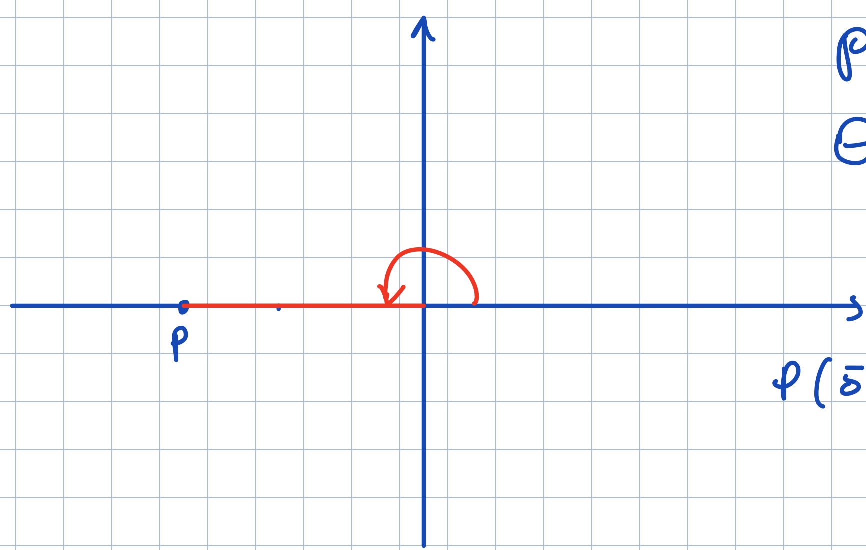


$P\left(5\,;\,\frac{3}{2}\pi\right)$

4) $P(-5\,;\,0)$

$\rho = 5$

$\theta = \pi$



$P(5\,;\,\pi)$

$\left(2\,;\,\frac{\pi}{3}\right)$ $\quad$ $(3\,;-3\pi)$ $\quad$ $\left(1\,;\,\frac{5}{4}\pi\right)$ $\quad$ $\left(6\,;\,\frac{23}{6}\pi\right)$

DETERMINARE LE COORDINATE CARTESIANE.

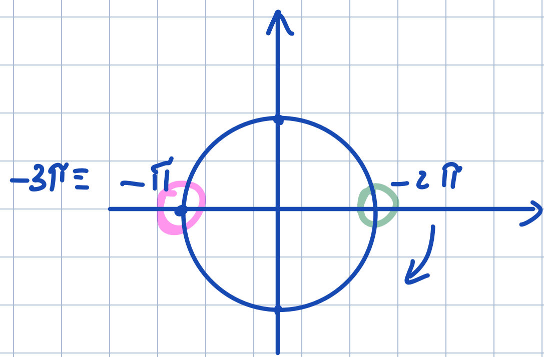
1) $\rho = 2$ $\quad$ $\theta = \frac{\pi}{3}$

$$\begin{cases} x = \rho\cos\theta \\ y = \rho\sin\theta \end{cases} \qquad \begin{cases} x = 2\cos\left(\frac{\pi}{3}\right) \\ y = 2\sin\left(\frac{\pi}{3}\right) \end{cases}$$

$$\begin{cases} x = \cancel{2} \cdot \dfrac{1}{\cancel{2}} \\ y = \cancel{2} \cdot \dfrac{\sqrt{3}}{\cancel{2}} \end{cases} \qquad \begin{cases} x = 1 \\ y = \sqrt{3} \end{cases}$$

2) $\rho = 3$ $\qquad \theta = -3\pi$

$$\begin{cases} x = 3\cos(-3\pi) = 3\cos(\pi) \\ y = 3\sin(-3\pi) = 3\sin(\pi) \end{cases}$$



$$\begin{cases} x = -3 \\ y = 0 \end{cases}$$

3) $\left(1; \frac{5}{4}\pi\right)$ $\qquad \rho = 1 \qquad \theta = \frac{5}{4}\pi = \frac{4+1}{4}\pi =$

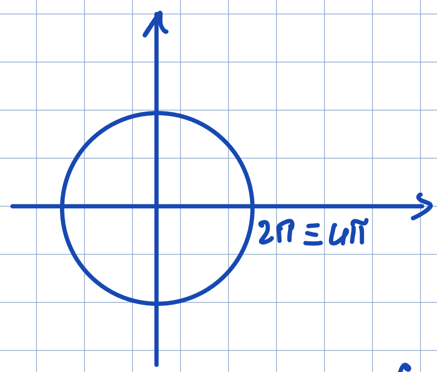
$= \frac{4}{4}\pi + \frac{\pi}{4}$

$= \pi + \frac{\pi}{4}$

$$\begin{cases} x = 1 \cdot \cos\left(\frac{5}{4}\pi\right) \\ y = 1 \cdot \sin\left(\frac{5}{4}\pi\right) \end{cases} \qquad \begin{cases} x = \cos\left(\frac{4+1}{4}\pi\right) \\ y = \sin\left(\pi + \frac{\pi}{4}\right) \end{cases}$$

$$\begin{cases} x = -\cos\left(\frac{\pi}{4}\right) = -\sqrt{2}/2 \\ y = -\sin\left(\frac{\pi}{4}\right) = -\sqrt{2}/2 \end{cases}$$

4) $\rho = 6$ $\qquad \theta = \frac{23}{6}\pi = \frac{24-1}{6}\pi = \frac{24}{6}\pi - \frac{\pi}{6} = 4\pi - \frac{\pi}{6}$



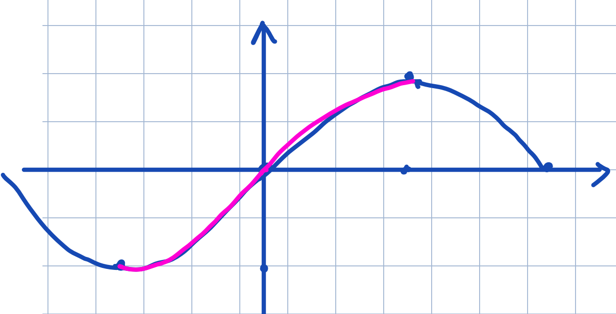
$$\begin{cases} x = 6\cos\left(4\pi-\frac{\pi}{6}\right) = 6\cos\left(2\pi-\frac{\pi}{6}\right) \\ y = 6\cdot\sin\left(4\pi-\frac{\pi}{6}\right) = 6\cdot\sin\left(2\pi-\frac{\pi}{6}\right) \end{cases}$$

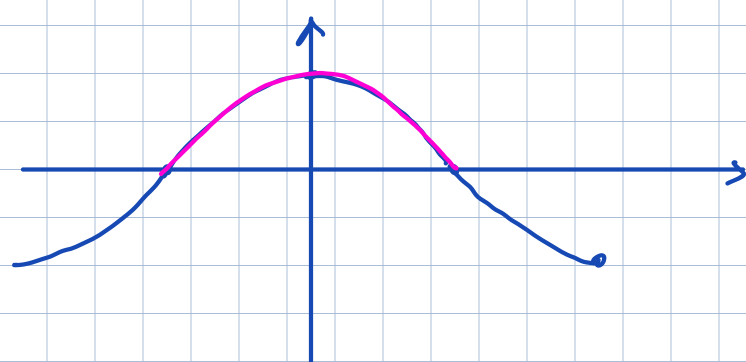
$$\begin{cases} x = 6\cos\left(\frac{\pi}{6}\right) = 6\cdot\frac{\sqrt{3}}{2} = 3\sqrt{3} \\ y = 6\cdot\left(-\sin\frac{\pi}{6}\right) = 6\left(-\frac{1}{2}\right) = -3 \end{cases}$$

ES. 9.25

TROVARE LA LEGGE PER OTTENERE SENO E COSENO DEGLI ANGOLI: $-x$; $x+\pi$; $\pi-x$; $\frac{\pi}{2}-x$ ESSENDO NOTI $\sin x$ E $\cos x$

- $\sin(-x) = -\sin(x)$ $\qquad$ $\cos(-x) = \cos(x)$





- $\sin(x+\pi) = \sin x\cdot\cos\pi + \sin\pi\cdot\cos x = -\sin x$
- $\cos(x+\pi) = \cos x\cdot\cos\pi - \sin x\cdot\sin\pi = -\cos x$

- $\sin(\pi-x) = \sin\pi\cos x - \cos\pi\sin x = -1(-1)\sin x = \sin x$

- $\cos(\pi - x) = \cos\pi \cos x + \sin x \cdot \sin\pi = -1 \cdot \cos x + 0 = -\cos x$

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

ES. 2.26

DETERMINARE SENO, COSENO E TANGENTE DI $-\frac{\pi}{6}$; $\frac{3}{4}\pi$

$$\sin\left(-\frac{\pi}{6}\right) = -\sin\left(\frac{\pi}{6}\right) = -\frac{1}{2}$$

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

$$\tan\left(-\frac{\pi}{6}\right) = \frac{\sin(-\pi/6)}{\cos(-\pi/6)} = \frac{-1/2}{\sqrt{3}/2} = -\frac{1}{2} \cdot \frac{2}{\sqrt{3}} = -\frac{1}{\sqrt{3}} = -\frac{\sqrt{3}}{3}$$

$$\sin\left(\frac{3}{4}\pi\right) = \sin\left(\frac{4-1}{4}\pi\right) = \sin\left(\pi - \frac{\pi}{4}\right) = \sin\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$$

$$\cos\left(\frac{3}{4}\pi\right) = \cos\left(\frac{4-1}{4}\pi\right) = \cos\left(\pi - \frac{\pi}{4}\right) = -\cos\left(\frac{\pi}{4}\right) = -\frac{\sqrt{2}}{2}$$

$$\tan\left(\frac{3}{4}\right) = \frac{\sin(3/4\,\pi)}{\cos(3/4\,\pi)} = \frac{\sqrt{2}/2}{-\sqrt{2}/2} = -1$$