$$z_1 = 2 + 1i$$

$$z_2 = 3 + 4i$$

Formula multiplicación

$(a + bc) \cdot (c + di)$

$ab + ac + bc + \underbrace{bd}_{i^2 = -1}$

$-(bd)$ sin le i

PRODUCTO

$z_1 \cdot z_2$

$6 + 8i + 3i + 4i^2$

$6 - 4 + 8i + 3i$

$\boxed{2 + 11i}$ ✓

SUMA

$z_1 + z_2 = 5 + 5i$

MODULO

$|z_2| = (2)^2 + (1i)^2$

$4 + 1$

$\sqrt{5} \approx 2.2$

$|z_1| = (3)^2 + (4i)^2 =$

$9 + 16 = 25$

$\sqrt{25} = 5$

$$\text{Arg}(z) \begin{cases} \arctan\left(\frac{y}{x}\right) & x > 0 \quad y \in \mathbb{R} \\ \arctan\left(\frac{y}{x} + \pi\right) & x < 0 \quad y \geq 0 \\ \arctan\left(\frac{y}{x} - \pi\right) & x < 0 \quad y < 0 \\ \left(\frac{\pi}{2}\right) & x = 0 \quad y > 0 \\ \left(-\frac{\pi}{2}\right) & x = 0 \quad y < 0 \\ \text{indefinido} & x = 0 \quad y = 0 \end{cases}$$

$\text{Arg}(z_1) = \arctan(1/2) = 26.56°$

$\text{Arg}(z_2) = \arctan(4/3) = 53.13°$

grados = radianes $\times \frac{180°}{\pi}$

Complejos 1

$$(1,0) + (x,y) + (x,y)(x,y) = (0,0)$$

- Suma $(a,b) + (c,d) = (a+c, b+d)$
  $a, b, c, d \in \mathbb{R}$
- Producto $(a,b) \cdot (c,d) = (ac - bd, ad + bc)$

~~$(1,0) + (x,y) + (x^2 - y^2, xy + yx)$?~~

$(1,0) + (x,y) + \underbrace{(x,y)(x,y)} = (0,0)$

$(x^2 - y^2, 2xy)$

$1 + x + (x^2 - y^2) = 0$

$0 + y + 2xy = 0$

$y + 2xy = 0 \rightarrow y(y/y + 2x y/y) = y(1 + 2x) = 0$ $\begin{cases} y = 0 \\ 1 + 2x = 0 \end{cases}$

$i \rightarrow$ Al quedar x fuera de $\mathbb{R}$ no nos vale

$1 + 2x = 0$

$2x = -1$

$x = -1/2$

$1 + -1/2 + (-1/2)^2 - y^2 = 0$

$1 + (-1/2) + (+1/4) + (-y^2)$

$1 - 1/4 - y^2$

$3/4 = y^2$

$y = \pm\sqrt{3/4} = \pm \sqrt{3}/2$

$\begin{cases} 1 + x + (x^2 - y^2) = 0 \\ 1 + x + (x^2 - 0^2) = 0 \\ 1 + x + x^2 = 0 \\ x + x^2 = 0 \\ x(x+1) = 0 \end{cases}$

$x = \frac{-1 \pm \sqrt{1-3}}{2}$

$x = \frac{-1 \pm \sqrt{3i}}{2}$

$2 + 2i \rightarrow \pi/4$ rad $= 45°$

Ej 3.

$$i\left(1-\sqrt{3}i\right)\left(\sqrt{3}+i\right) \overset{?}{=} 2\left(1+\sqrt{3}i\right)$$

$0 = re^{i\varphi} = 1e^{i\pi/2}$

$(1-\sqrt{3}i) = 2e^{i(-\pi/3)}$

$r = \sqrt{1^2+(\sqrt{3})^2} = \sqrt{4} = 2$

$\varphi = \arg\left(\frac{\sqrt{3}}{1}\right) = \arctg\left(-\sqrt{3}\right) = -\pi/3$

$(\sqrt{3}+i) = 2e^{i\pi/6}$

$r = \sqrt{\sqrt{3}^2+1^2} = \sqrt{4} = 2$

$\varphi = \arctg\left(\frac{1}{\sqrt{3}}\right) = \pi/6$

$e^{i\pi/2} \cdot 2e^{-i\pi/3} \cdot 2e^{i\pi/6}$

$4e^{i\left(\pi/2 + \left(-\pi/3\right) + \left(\pi/6\right)\right)}$

$3\pi/6 + -2\pi/3 + \pi/6 = 2\pi/6 +$

$4e^{i\,2\pi/6}$

$4e^{i\,\pi/2}$

$4\left(\cos(\pi/2) + i\sin(\pi/2)\right)$

$4\left(1/2 + i\sqrt{3}/2\right)$

$2\left(1+i\sqrt{3}\right)$

$2 + 2(\sqrt{3}i)$

$n = re^{i\varphi}$

$r = |n| = \sqrt{a^2+b^2}$

$\varphi = \arg(n) = \arctg(?)$

	0 (0°)	30 (π/6)	45 (π/4)	60 (π/3)	90 (π/2)
sin	0	1/2	$\sqrt{2}/2$	$\sqrt{3}/2$	1
cos	1	$\sqrt{3}/2$	$\sqrt{2}/2$	1/2	0
tg	0	$1/\sqrt{3}$	1	$\sqrt{3}$	∞

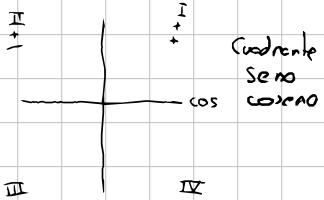
$e^{i\theta} = \cos(\theta) + i\sin(\theta)$

Argumento

$z = re^{i\varphi}$ módulo $r = |z|$ $\varphi = \arg(z)$

$|z| = \sqrt{a^2+b^2}$ b = imaginaria, a = real

$\varphi = \arg(z)$



$e^{i\varphi} = \cos(\varphi) + i\sin(\varphi)$

real, imaginaria

$1 - \sqrt{3}i$

4 cuadrante

$\text{Arg}(z)$

$$\begin{cases} \arctan\left(\frac{y}{x}\right) & x>0,\ y\in\mathbb{R} \\ \arctan\left(\frac{y}{x}+\pi\right) & x<0,\ y\geq 0 \\ \arctan\left(\frac{y}{x}-\pi\right) & x<0,\ y<0 \\ \left(\frac{\pi}{2}\right) & x=0,\ y>0 \\ \left(-\frac{\pi}{2}\right) & x=0,\ y<0 \\ \text{indefinido} & x=0,\ y=0 \end{cases}$$

grados $=$ radianes $\times \frac{180°}{\pi}$