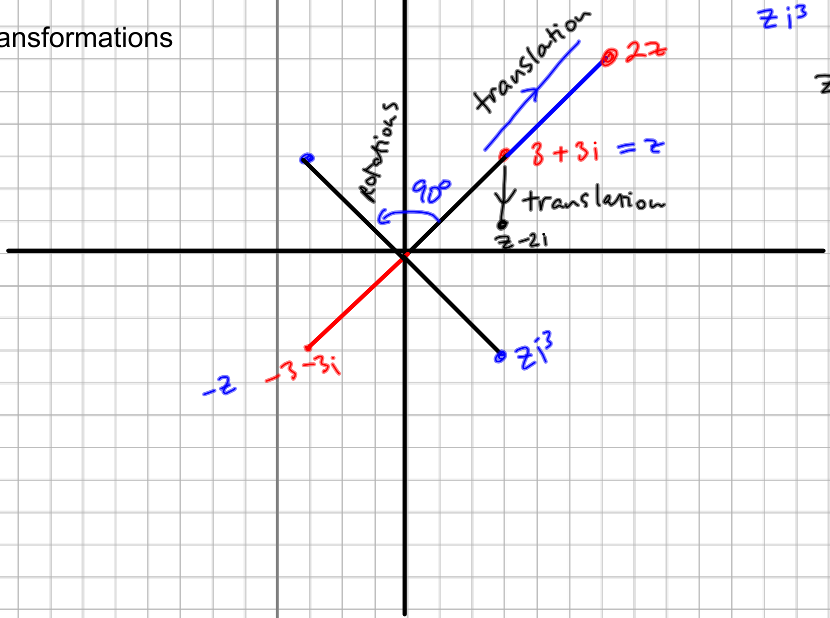
$i(3+3i) = 3i + 3i^{2}$
$= -3+3i$

z
$2z$
$-z = zi^2$
zi
zi^3

$z-2i$

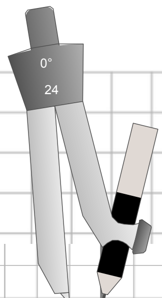
Transformations

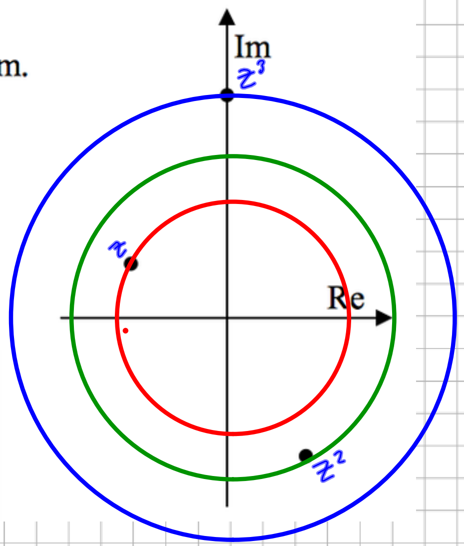


dulus greater than 1.
d z^3 are shown on the Argand diagram.
ginary axis, as shown.

e diagram to show which point
number.

of z.





$r\,cis\,\theta$

$(2\,cis\,\theta)^2 = 2^2\,cis\,2\theta$
$= 4\,cis\,2\theta$

i pattern

i

$i^2 = -1$

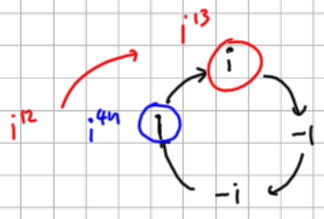
$i^3 = -i$

$i^4 = 1$

$i^5 = i$

$i^6 = -1$

i^{13}



i^{2012}

$i^{2012} = i^{4(503)} = 1$

DOTS

$(a+bi)(a-bi)$

$= a^2 + b^2$

$(2+3i)(2-3i)$

Q4 Solve

$z_1 = 4-3i$

$z_2 = 5(1+i)$

If $z_1 + t z_2 = k$

find t and k

Q3

$4z_1 + 3z_2 = 5 + 13i$ (1)

$z_1 + i z_2 = -1$ (2)

let $z_1 = a+bi$

$z_2 = c+di$

(1) $4(a+bi) + 3(c+di) = 5 + 13i$

$4a + 4bi + 3c + 3di = 5 + 13i$

Re = Re

Im = Im

$4a + 3c = 5$ (3) | $4b + 3d = 13$ (4)

(2) $(a+bi) + i(c+di) = -1 + 0i$

$a + bi + ci - d\cancel{i^2} = -1 + 0i$

$a - d = -1$ | $b + c = 0$

$a = d - 1$ (5) | $b = -c$ (6)

Sub (5) & (6) into (3)

$4(d-1) + 3(-b) = 5$

$4d - 4 - 3b = 5$

$4d - 3b = 9$ (7)

use (4) & (7) to solve

(4) $3(4b + 3d = 13) \Rightarrow 12b + 9d = 39$

(7) $4(4d - 3b = 9) \Rightarrow -12b + 16d = 36$

$25d = 75$

$\Rightarrow \boxed{d=3}$ (5) $a = 3-1 \Rightarrow \boxed{a=2}$

(4) $4b + 3(3) = 13 \Rightarrow \boxed{b=1}$ (6) $\boxed{c=-1}$

Complex nos $z_1 = 2+i$

$z_2 = -1+3i$

Q.10

$2-3i$ is a root of
$z^3 + az^2 + bz - 52 = 0$

$f(2-3i) = 0$

$(2-3i)^3 + a(2-3i)^2 + b(2-3i) - 52 = 0$

$-46-9i - 5a - 12ai + 2b - 3bi - 52 = 0 + 0i$

$-98 - 5a + 2b - 9i - 12ai - 3bi = 0 + 0i$

$(2-3i)^2 = 4 - 12i + 9i^2$
$= -5 - 12i$

$(2-3i)^3 = (-5-12i)(2-3i)$
$= -10 + 15i - 24i + 36i^2$
$= -46 - 9i$

$-98 - 5a + 2b = 0$ | $-9 - 12a - 3b = 0$

$\boxed{-5a + 2b = 98}$ ① | $\boxed{4a + b = -3}$ ②

① $-5a + 2b = 98$
$-2$② $-8a - 2b = 6$
$-13a = 104$ $\Rightarrow \boxed{a = -8}$

Sub $a = -8$ into ②
$4(-8) + b = -3$
$-32 + b = -3$ $\Rightarrow \boxed{b = 29}$

Q.9

Solve a cubic equation

① Conjugate is root.

② Work out quadratic from complex roots
$X^2 - \underset{\text{Roots}}{\text{Sum}}\ X + \underset{\text{Roots}}{\text{product}} = 0$

$z + \bar{z} =$
$z.\bar{z} =$

③ Divide by quadratic

④ Write real root

POLAR : $r \operatorname{Cis}\theta$

$r = ?$ modulus

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

$\theta = ?$ argument

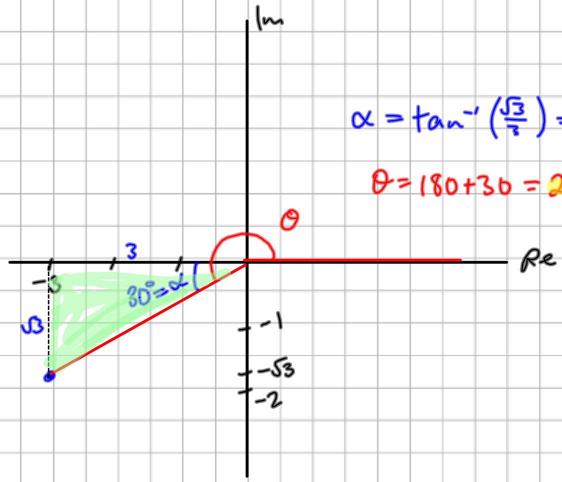
$\sqrt{3} \approx 1.7$

$-3-\sqrt{3}\,i$ in Polar form

$r = \sqrt{(-3)^2+(-\sqrt{3})^2} = \sqrt{12}$. $\boxed{r = 2\sqrt{3}}$

$\alpha = \tan^{-1}\left(\frac{\sqrt{3}}{3}\right) = 30^\circ$

$\theta = 180+30 = 210^\circ$



$-3-\sqrt{3}\,i = 2\sqrt{3} \operatorname{Cis} 210^\circ$

OR $= 2\sqrt{3}\left(\cos 210^\circ + i \sin 210^\circ\right)$

OR $= 2\sqrt{3}\left(\cos \frac{7\pi}{6} + i \sin \frac{7\pi}{6}\right)$

Multiply and Divide in polar form.

$z_1 = 2 \operatorname{Cis} \pi$

$z_2 = 4 \operatorname{Cis} \frac{\pi}{2}$

Divide the moduli and subtract arguments

$\frac{z_2}{z_1} = 2 \operatorname{Cis}\left(-\frac{\pi}{2}\right)$

Multiply moduli and add arguments

$z_1 . z_2 = 8 \operatorname{Cis}\left(\frac{3\pi}{2}\right)$

$$(r \operatorname{cis} \theta)^n = r^n \operatorname{cis} n\theta$$

demoivre :

1. expand
2. roots / solve
3. trigonometry identity.