

$$\begin{aligned} \textcircled{3} \frac{(5-3i)(2+i)}{4+2i} &= \frac{10+5i-6i-3i^2}{4+2i} = \frac{10+3-i}{4+2i} = \frac{13-i}{4+2i} \times \frac{4-2i}{4-2i} \\ &= \frac{52-4i-26i+2i^2}{16-4i^2} = \frac{52-30i-2}{16-4i^2} \\ &= \frac{50-30i}{16+4} = \frac{50-30i}{20} = \frac{5-3i}{2} = a+ib \end{aligned}$$

$$\begin{aligned} \textcircled{4} \frac{(1+i)(2+i)}{3+i} &= \frac{2+i^2+2i+i^2}{3+i} = \frac{2-1+3i}{3+i} \\ &= \frac{1+3i}{3+i} \times \frac{3-i}{3-i} = \frac{(1+3i)(3-i)}{3^2-i^2} \\ &= \frac{3-i+9i-3i^2}{9+1} = \frac{3+8i+3}{10} \\ &= \frac{6+8i}{10} = \frac{3+4i}{5} = \frac{3}{5} + \frac{4i}{5} \end{aligned}$$

Cube root

$z = ?$
 $n = ?$
 $\text{quadrant} = ?$
 $\theta = ?$

$1-i$

\Rightarrow Let $z = x+iy = 1-i$

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

$\alpha = \tan^{-1} \left| \frac{y}{x} \right| = \tan^{-1} \left| \frac{-1}{1} \right| = \frac{\pi}{4}$ radian

Here $z = 1-i = (1, -1)$ is in 4th quadrant

$\theta = 2\pi - \alpha = 2\pi - \frac{\pi}{4} = \frac{7\pi}{4}$

Therefore, $z = \sqrt{2} \left[\cos \left(\frac{7\pi}{4} \right) + i \sin \left(\frac{7\pi}{4} \right) \right]$

or $z = \sqrt{2} \left[\cos \left(\frac{2k\pi + 7\pi}{4} \right) + i \sin \left(\frac{2k\pi + 7\pi}{4} \right) \right]$