Complex Numbers – Q5 (22/5/21)

Exam Boards

OCR : Pure Core (Year 2)

MEI: Core Pure (Year 2)

AQA: Pure (Year 2)

Edx: Core Pure (Year 2)

Find $(1+i)^{10}$ [7 marks]

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Solution

$\arg(1+i) = \frac{\pi}{4}$ & $|1+i| = \sqrt{2}$ [2 marks]

So $(1+i)^2 = 2e^{2\left(\frac{\pi}{4}\right)i} = 2e^{\frac{\pi i}{2}} = 2i$ [2 marks]

Then multiplication by $(1+i)^8$ results in a magnification of $\left(\sqrt{2}\right)^8 = 16$ and rotation of $8\left(\frac{\pi}{4}\right) = 2\pi$; ie no change [2 marks]

So $(1+i)^{10} = (2i)(16) = 32i$ [1 mark]

[Or $(1+i)^{10} = \left(\sqrt{2}e^{\frac{\pi i}{4}}\right)^{10} = 32e^{\frac{10\pi i}{4}} = 32e^{\frac{5\pi i}{2}} = 32e^{\frac{\pi i}{2}} = 32i$]