

Foundations of Audio Signal Processing - Exercise sheet 1

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26. October 2018

Exercise 1.1

(a)

$$(4 - i) * (2 + i) = (4 * 2 + 1 * 1) + (4 * 1 - 1 * 2)i = 9 + 2i$$

(b)

$$(1 + 2i)^{-1} = \frac{1}{1+2i} = \frac{1}{1+2i} * \frac{1-2i}{1-2i} = \frac{1-2i}{1+2i-2i+4} = \frac{1-2i}{5} = \frac{1}{5} - \frac{2}{5}i$$

(c)

$$2e^{2\pi i} + e^{i\pi 3/2} = 2(\cos(2\pi) + i(\sin(2\pi))) + \cos(\frac{3\pi}{2}) + i(\sin(\frac{3\pi}{2})) = 2(1 + 0i) + 0 - i = 2 - i$$

(d)

$$4\left(\frac{1-i}{1+i}\right)^2 = 4((1-i)(1+i)^{-1})^{-2} = 4((1-i)\left(\frac{1}{2} + \frac{1}{2}i\right))^2 = 4 * \left(\left(\frac{1}{2} - \frac{1}{2}\right) + \left(-\frac{1}{2} - \frac{1}{2}i\right)\right)^2 = 4(-i)^2 = -4$$