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Winter Term 2025/2026

Foundations of Audio Signal Processing
Exercise sheet 1

To be uploaded in eCampus till: 24.10.2025 22:00 (strict deadline)

The solutions of the exercises have to be handed in via eCampus (you have to upload them) till the date and time reported on top of each exercise sheet. For all the other information about the exercises please refer to the pdf under *Additional Material* on the eCampus page of the course.

Exercise 1.1

[2 + 2 + 2 + 2 + 2 = 10 points]

The following statements have a complex number $a + ib$ as a result. Please calculate explicitly the values of a and b. Do not use a calculator.

(a) $(4 - 3i)(2 + 2i)$

(b) $(3 - 5i)^{-1}$

(c) $2e^{i\pi/4} + 2e^{i\pi}$

(d) $6i \left(\frac{1 - i}{1 + i}\right)^2$

(e) $\frac{i(5 - i)}{(1 - i)(5 + i)}$

Exercise 1.2

[2 + 2 + 2 + 2 + 2 = 10 points]

Calculate (without using a calculator) the polar coordinate representation (in the form $e^{\varphi\pi i}$) of the following complex numbers. Draw also their position in the complex plane.

(a) $1 + i\frac{1}{\sqrt{3}}$

(b) 6

(c) $-4 + 4i$

(d) $\left(-1 + i\sqrt{3}\right)^4$

(e) $\frac{e^{-i\pi/6}}{1 - i\sqrt{3}}$