

1. exercise sheet for Mathematics for Advanced Materials Science

1.1. (*Linear ordinary differential equations*)

Consider the differential equation

$$\ddot{x} + \dot{x} + x \stackrel{!}{=} 0. \quad (1)$$

- (a) Find a function $x : \mathbb{R} \rightarrow \mathbb{R}$ solving the differential equation (1) and satisfying $x(0) = 0$ and $\dot{x}(0) = 1$. (Hint: you may test your solution for correctness by verifying, using a calculator, that $x(1) \approx 0.533507$.)
- (b) Find *two different* solutions $x : \mathbb{R} \rightarrow \mathbb{R}$ to the differential equation (1) with $x(0) = 1$.

1.2. (*Computing with complex numbers*)

For this exercise, please read the rest of § 1.2 of the lecture notes (about one page) and note especially the examples at the end of that section. Write the following complex numbers in the form $a + ib$ with real numbers a and b .

- (a) $\frac{1}{2+i}$,
- (b) $\frac{2+4i}{1+3i} - 2 + i$,
- (c) $\left| \frac{1}{2+i} \right|$,
- (d) $\sqrt{3+4i}$.

(Hint for (d): find two complex numbers $z = a + ib$ with $z^2 = 3 + 4i$.)