Fachbereich Mathematik der Universität Hamburg **Winter 2021/22**
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Differential Equations I for Students of Engineering Sciences

Sheet 2 (in-class)

Exercise 1:

a) Identify the type of the following differential equation and solve the initial value problem

$$y' = (x - y + 3)^2 \quad \text{with} \quad y(1) = 1.$$

b) Solve the following differential equation

$$xy'' - 3y' + 2x \;=\; 0\,.$$

Exercise 2:

a) Solve the following differential equations

(i) Linear homogeneous differential equation of 3rd order with constant coefficients

$$y''' + 2y'' - 5y' - 6y = 0\,.$$

Hint: There exist solutions of the form $y(x) = e^{\lambda x}$ for $\lambda \in \mathbb{R}$.

(ii) Euler's (linear homogeneous) differential equation of 3rd order

$$x^3y''' + x^2y'' - 6xy' + 6y = 0\,.$$

Hint: There exist solutions of the form $y(x) = x^\alpha$ for $\alpha \in \mathbb{R}$.

b) Show that each linear combination of the computed solutions is again a solution to the differential equation.

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