Fachbereich Mathematik der Universität Hamburg **WiSe 2024/25**
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Differential Equations I for Students of Engineering Sciences

Homework 3

Problem 1: Write the following equations as *similarity differential equations* and solve them by a suitable change of variables. Are the solutions defined for all $t > 0$?

(a)
$$tu(t)^2u'(t) = u(t)^3 + t^3, \qquad t > 0.$$

(b)
$$tu'(t) - u(t) = te^{u(t)/t}, \qquad t > 0.$$

Problem 2: Consider the following *Riccati differential equation*:
$$u'(t) = \frac{1}{t-t^2}u(t) \; - \; \frac{t}{t-t^2}u(t)^2 \; + \; \frac{t-1}{t-t^2}, \qquad t \in (0,1).$$

(a) Find *one particular* solution u_0 for this equation.
Hint: There exists a constant solution.

(b) Find the general solution of the equation.

Submit by: 29. November 2024