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

Sheet 0 (Presence Exercise)

Exercise A:
Suppose a tank is filled with 2000 liters of water where 60 kg of salt are dissolved. Starting in $t_0 = 0$, per minute 15 liters of saline solution flow out, at the same time 15 liters of water with a salt content of 3 kg flow into the tank and intermingle immediately.

a) What is the salt content $m(t)$ in kg in the tank at time $t > 0$?

b) At which level does the salt content in the tank stabilize?

Exercise B:
Consider the differential equation $y' = -\frac{y}{x}$.

a) Sketch the slope field,

b) compute solutions

c) and compute the solution for which it holds that $y(2) = 1$.

Exercise C:
When opening his parachute, a skydiver has a speed of $v_0 = 55$ (in ms^{-1}). Let the total mass of skydiver and parachute be M (in kg) and the braking force of the parachute be $Mg \cdot \frac{v^2}{25}$ (in N), where $g = 9.81$ (in ms^{-2}) is the gravitational acceleration. Compute the speed of the skydiver after the opening of the parachute as a function of time and, if applicable, the limit speed ($t \to \infty$). Does the limit speed depend on the speed of the skydiver when opening the parachute?

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