Modeling and Simulation with ODE for MSE

The exercises should be handed in during the week 06.11. – 10.11.!

Exercise 1 (An IVP)
In dependence of $y_0 \in \mathbb{R}$ determine the solution of the Initial value problem

$$xy'(x) + y^2(x) + 1 = 0, \quad y(1) = y_0,$$

and its maximal domain of definition.

Exercise 2 (Substitution)
(a) Solve the initial value problem

$$(3x^2y^2(x) - 2y(x)) - xy'(x) = 0, \quad y(1) = 1$$

via the substitution $u(x) = x^2y(x)$.

(b) Find a suitable substitution to solve the ODE

$$y'(x) = (\sin(x + y(x))), \quad y(0) = 0.$$

Exercise 3 Solve the problem

$$2x\sqrt{ax} - x^2y'(x) + a^2 + y^2(x) = 0, \quad y(a) = 0,$$

with a parameter $a \in \mathbb{R}$.

Exercise 4 (Another initial value problem, but a little tricky)
Determine the general solution of the ODE

$$xy' = y^2 + y.$$

Further solve the initial value problem with initial value $y(0) = 1$.

Information and material related to the lecture can be found at the lecture webpage

http://www-m15.ma.tum.de/Allgemeines/ModelingSimulation