



MMP I

Exercise Sheet 7

HS 21
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<https://www.physik.uzh.ch/en/teaching/PHY312>

Issued: 04.11.2021
Due: 11.11.2021

Exercise 1 [Ordinary differential equations (4 points)]

a) Solve the differential equation

$$y' = \frac{\sin^2 x - \sin x \sin y}{\cos^2 y - \cos x \cos y}.$$

An implicit solution of the form $f(x, y(x)) = 0$ is sufficient.

b) A particle of mass m and charge q moving in a constant magnetic field $\vec{B} = B\vec{e}_z$ experiences a force

$$\vec{F} = q\vec{v} \times \vec{B}, \text{ with } \vec{v} = \dot{\vec{r}}.$$

Solve the equation of motion

$$m\ddot{\vec{r}} = q\dot{\vec{r}} \times \vec{B}.$$

Exercise 2 [Systems of Differential Equations (6 points)]

Find the fundamental system of solutions for the following systems of linear differential equations:

a)

$$\begin{aligned}x' &= 3x + 6y \\y' &= -2x - 3y\end{aligned}$$

b)

$$\begin{aligned}x' &= 8x + y \\y' &= -4x + 4y\end{aligned}$$

– please turn over –

c)

$$x' = x - y + 2z$$

$$y' = -x + y + 2z$$

$$z' = x + y$$

d)

$$x' = -x + y - z$$

$$y' = 2x - y + 2z$$

$$z' = 2x + 2y - z$$