VMII SO7

Aufg 4)

a) $y^{(4)} + 1.1y''' - 0.1y'' - 0.3y = \sin x + 5$ mit $y(0) = y''(0) = y'''(0) = 0$ und $y'(0) = 2$

$\rightarrow y^{(4)} = \sin x + 5 - 1.1y''' + 0.1y'' + 0.3y$

$z_1(x) = y(x) \qquad z_2(x) = y'(x) \qquad z_3(x) = y''(x) \qquad z_4(x) = y'''(x)$

$z_4'(x) = \sin x + 5 - 1.1y''' + 0.1y'' + 0.3y$

$= \sin x + 5 - 1.1 \cdot z_4(x) + 0.1 z_3(x) + 0.3 z_1(x)$

$$\rightarrow \quad z' = \begin{pmatrix} z_1' \\ z_2' \\ z_3' \\ z_4' \end{pmatrix} = \begin{pmatrix} z_2 \\ z_3 \\ z_4 \\ \sin x + 5 - 1.1 z_4 + 0.1 z_3 + 0.3 \cdot z_1 \end{pmatrix} = f(x, z) \quad \text{mit } z(0) = \begin{pmatrix} 0 \\ 2 \\ 0 \\ 0 \end{pmatrix}$$

b) $x^2 y'' + x y' + (x^2 - n^2) y = 0$ mit $y(1) = y'(1) = 2$

$\rightarrow y'' = \frac{1}{x^2}\left(-xy' - (x^2 - n^2) y\right)$

$z_1(x) = y(x) \qquad z_2(x) = y'(x)$

$\rightarrow z_2'(x) = \frac{1}{x^2}\left(-xy' - (x^2 - n^2) y\right)$

$= \frac{1}{x^2}\left(-x z_2 - (x^2 - n^2) z_1\right)$

$$\rightarrow z' = \begin{pmatrix} z_1' \\ z_2' \end{pmatrix} = \begin{pmatrix} z_2 \\ \frac{1}{x^2}\left(-x z_2 - (x^2 - n^2) z_2\right) \end{pmatrix} = f(x, z) \quad \text{mit } z(1) = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$$