

# Gruppe10\_IT17tb\_S7\_Aufg4

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

$$\textcircled{1} \quad y^{(4)} = \sin(x) + 5 - 1.1y''' + 0.1y'' + 0.3y$$

$$\textcircled{2} \quad \begin{aligned} z_1(x) &= y(x) & z_3(x) &= y''(x) \\ z_2(x) &= y'(x) & z_4(x) &= y'''(x) \end{aligned}$$

$$\textcircled{3} \quad \begin{aligned} z_1'(x) &= y'(x) & (= z_2(x)) \\ z_2'(x) &= y''(x) & (= z_3(x)) \\ z_3'(x) &= y'''(x) & (= z_4(x)) \\ z_4'(x) &= y^{(4)}(x) \end{aligned}$$

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

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

$$\textcircled{4} \quad z' = \begin{pmatrix} z_1' \\ z_2' \\ z_3' \\ z_4' \end{pmatrix} = \begin{pmatrix} z_2 \\ z_3 \\ z_4 \\ \sin(x) + 5 - 1.1z_4 + 0.1z_3 + 0.3z_1 \end{pmatrix} = \underline{f(x, z)} \quad z(0) = z_0 = \begin{pmatrix} 0 \\ 2 \\ 0 \\ 0 \end{pmatrix}$$

$$x^2y'' + xy' + (x^2 - n^2)y = 0 \text{ mit } y(1) = y'(1) = 2$$

$$\textcircled{1} \quad \begin{aligned} x^2y'' &= -xy' - (x^2 - n^2)y \\ y'' &= \frac{-xy' - (x^2 - n^2)y}{x^2} \end{aligned}$$

$$\textcircled{2} \quad \begin{aligned} z_1(x) &= y(x) \\ z_2(x) &= y'(x) \end{aligned}$$

$$\textcircled{3} \quad \begin{aligned} z_1'(x) &= z_2(x) = y'(x) \\ z_2'(x) &= y''(x) = \frac{-xy' - (x^2 - n^2)y}{x^2} \\ &= \frac{-xz_2(x) - (x^2 - n^2)z_1(x)}{x^2} \end{aligned}$$

$$\textcircled{4} \quad z' = \begin{pmatrix} z_1' \\ z_2' \end{pmatrix} = \begin{pmatrix} z_2 \\ \frac{-xz_2 - (x^2 - n^2)z_1}{x^2} \end{pmatrix} \text{ mit } z(1) = z_0 = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$$