Example 23.2:

a) The *system* of *differential equations*

$$y_1' = \frac{y_1}{2 \cdot y_1 + 3 \cdot y_2}$$

$$y_2' = \frac{y_2}{2 \cdot y_1 + 3 \cdot y_2}$$

with the *initial conditions*

$y_1(0) = 1$, $y_2(0) = 2$

has the exact solution

$$y_1(x) = \frac{x}{8} + 1 \quad , \quad y_2(x) = \frac{x}{4} + 2$$

The *numerical solution* using MATHCAD with the **rkfixed** *numerical function* is performed as follows:

$$\mathbf{y} := \begin{pmatrix} 1 \\ 2 \end{pmatrix} \qquad \mathbf{D}(x, \mathbf{y}) := \begin{pmatrix} \dfrac{y_1}{2 \cdot y_1 + 3 \cdot y_2} \\ \dfrac{y_2}{2 \cdot y_1 + 3 \cdot y_2} \end{pmatrix}$$

Y := **rkfixed** (**y** , 0 , 2 , 10 , **D**)

$$\mathbf{Y} = \begin{pmatrix} 0 & 1 & 2 \\ 0.2 & 1.025 & 2.05 \\ 0.4 & 1.05 & 2.1 \\ 0.6 & 1.075 & 2.15 \\ 0.8 & 1.1 & 2.2 \\ 1 & 1.125 & 2.25 \\ 1.2 & 1.15 & 2.3 \\ 1.4 & 1.175 & 2.35 \\ 1.6 & 1.2 & 2.4 \\ 1.8 & 1.225 & 2.45 \\ 2 & 1.25 & 2.5 \end{pmatrix}$$

MATHCAD calculates in the *result matrix* **Y** in the columns 2 and 3 the function values for the solution functions

$y_1(x)$ and $y_2(x)$

for the x-values 0 , 0.2 , 0.4 , ... , 2 of the first column.