

Aufgabe 1) Nullstellengleichung:  
 $e(x^2) + x^3 - 10 = 0$

Newton - Verfahren Startwert  $x_0 = 2$

Vereinfachte " "  $x_0 = 0.5$

Sekantenverfahren  $x_0 = 1.0$

$x_1 = -1.2$

4 Iterationen

$$f' = 2xe^{x^2} - 3x^{-4} \quad f = e^{x^2} + x^3 - 10 = 0$$

Newton:  $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

n	$x_n$
$x_0$	2
$x_1$	1.7350
$x_2$	1.6251
$x_3$	1.5308
$x_4$	1.5086

$$x_1 = 2 - \frac{e^4 + 0.125 - 10}{2 \cdot 2 \cdot e^4 - 3 \cdot 2^{-4}}$$

$$x_2 = 1.7350 - \frac{e^{1.7350^2} + 1.7350^3 - 10}{2 \cdot 1.7350 \cdot e^{1.7350^2} - 3 \cdot 1.7350^{-4}}$$

$$x_3 = 1.6251 - \frac{e^{1.6251^2} + 1.6251^3 - 10}{2 \cdot 1.6251 \cdot e^{1.6251^2} - 3 \cdot 1.6251^{-4}}$$

$$x_4 = 1.5308 - \frac{e^{1.5308^2} + 1.5308^3 - 10}{2 \cdot 1.5308 \cdot e^{1.5308^2} - 3 \cdot 1.5308^{-4}}$$

Sekantenverfahren

$$x_{n+1} = x_n - \frac{x_n - x_{n-1}}{f(x_n) - f(x_{n-1})} \cdot f(x_n)$$

$x_0$	-1.0
$x_1$	-1.2
$x_2$	-1.8610
$x_3$	-1.3434
$x_4$	-1.4326

$$x_2 = x_1 - \frac{x_1 - x_0}{f(x_1) - f(x_0)} \cdot f(x_1)$$

$$f: e^{x^2} + x^3 - 10$$

$$x_2 = -1.2 = \frac{-1.2 + 1.0}{-12.4925 + 6.2817} \cdot f(x_2) \quad f(-1.2) = e^{-1.2^2} - 1.2^3 - 10$$

$$x_3 = -1.8610 = \frac{-1.8610 + 1.2}{-12.4925 + 6.2817} \cdot f(x_3) \quad f(-1.0) = e^{-1.0^2} - 1.0^3 - 10$$

$$x_4 = -1.3434 = \frac{-1.3434 + 1.8610}{-12.5141 + 1.8610^3} \cdot f(x_4) \quad f(-1.8610) = -14.3530$$

Vereinfachtes Newton:  $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_0)}$

$$\text{Fixwert} = f'(0.5) = 2 \cdot 0.5 \cdot e^{0.5^2} - 3 \cdot 0.5^{-4} = -46.7160$$

$x_0$	0.5
$x_1$	0.4847
$x_2$	0.4857
$x_3$	0.4856
$x_4$	0.4856

$$x_1 = 0.5 - \frac{f(0.5) = -0.7160}{-46.7160} \quad f(0.5) = e^{0.5^2} + 0.5^3 - 10$$

$$x_2 = 0.4847 - \frac{f(0.4847)}{-46.7160}$$

$$x_3 = 0.4857 - \frac{f(0.4857)}{-46.7160}$$

$$x_4 = 0.4856 - \frac{f(0.4856)}{-46.7160}$$