Numerik 2: Serie 1

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Aufgabe 1a

$$f(x) = e^x, x_0 = 0$$

$$\text{Taylor: } f(x) = \sum_{k=0}^{n} \frac{f^{(k)}(x_0)}{k!}(x - x_0)^k$$

$$f(x) = \sum_{k=0}^{7} \frac{f^{(k)}(x_0)}{k!}(x - x_0)^k = 1 + \frac{f'(x_0)}{1!} \cdot (x - x_0) + \frac{f''(x_0)}{2!} \cdot (x - x_0)^2 + \frac{f'''(x_0)}{3!} \cdot (x - x_0)^3 + \frac{f^{(4)}(x_0)}{4!} \cdot (x - x_0)^4 + \frac{f^{(5)}(x_0)}{5!} \cdot (x - x_0)^5 + \frac{f^{(6)}(x_0)}{6!} \cdot (x - x_0)^6 + \frac{f^{(7)}(x_0)}{7!} \cdot (x - x_0)^7$$

$$\underline{\underline{p(x) = 1 + x + \frac{1}{2} \cdot x^2 + \frac{1}{6} \cdot x^3 + \frac{1}{24} \cdot x^4 + \frac{1}{120} \cdot x^5 + \frac{1}{720} \cdot x^6 + \frac{1}{5040} \cdot x^7}}$$

Aufgabe 1b

$$f(x) = e^x$$

$$f(1) = e \approx 2.71828...$$

$$p(1) = 1 + 1 + \frac{1}{2} + \frac{1}{6} + \frac{1}{24} + \frac{1}{120} + \frac{1}{720} + \frac{1}{5040} = \frac{685}{252}$$

$$\underline{\underline{\text{absoluter Fehler: } |f(1) - p(1)| = |e - \frac{685}{252}| = 2.7860 * 10^{-5}}}$$

Aufgabe 1c

$$\underline{\underline{e = \sum_{k=0}^{\infty} \frac{1}{k!}}}$$