AshaSchwegler_S8_Aufg2

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$h = R(v) = -v\sqrt{v}$, $m = 10kg$, $v(0) = 20 m/s$, $v = 5 m/s$

$$t = \int_{v(t_0)}^{v(t)} \frac{m}{R(v)}\,dv = \int_{20}^{5} \frac{10}{-v\sqrt{v}}\,dv = 4.4721\,s.$$

a) $n = 5$, Summierte Rechtecksregel

$$h \cdot \sum_{i=0}^{n-1} f\left(x_i + \frac{h}{2}\right), \quad h = \frac{b-a}{n}, \quad x_i = a + i \cdot h$$

$h = \frac{5-20}{5} = -3$, $\frac{h}{2} = -1.5$

$$-3 \cdot \sum_{0}^{4} f(20 \cdot (-3i) - 1.5)$$

$t = 2.57s$ Fehler $|4.4721 - 2.57| = 1.9021$

b) $n = 5$, Summierte Trapezregel

$$h \cdot \left(\frac{f(a)+f(b)}{2} + \sum_{i=1}^{n-1} f(x_i)\right), \quad h = -3, \quad x_i = a + i \cdot h$$

$\frac{f(a)+f(b)}{2} = \frac{-0.112 - 0.894}{2} = -0.503$

$$-3 \cdot \left(-0.503 + \sum_{1}^{4} f(20i \cdot (-3))\right)$$

$t = 3.33\,s$ Fehler $|4.4721 - 3.33| = 1.1421$

c) $n = 5$, Summierte Simpsonregel

$$\frac{h}{3} \cdot \left(\frac{1}{2} f(a) + \sum_{i=1}^{n-1} f(x_i) + 2 \sum_{i=1}^{n} \left(\frac{x_{i-1} + x_i}{2}\right) + \frac{1}{2} f(b)\right)$$

$t = 2.59\,s$ Fehler $|4.4721 - 2.59| = 1.8821$