Exakter wert berechnen

$$t = \int_{20}^{5} \frac{10}{-v^{3/2}}\,dv = -10\int_{20}^{5} v^{-3/2}\,dv$$

$$t = 10\int_{5}^{20} v^{-3/2}\,dv = 10\cdot\left[-2v^{-1/2}\right]_{5}^{20}$$

$$t = 10\cdot\left(-2\cdot\frac{1}{\sqrt{20}} + 2\cdot\frac{1}{\sqrt{5}}\right) = 20\left(\frac{1}{\sqrt{5}} - \frac{1}{\sqrt{20}}\right)$$

$$t = 20\left(\frac{1}{2.2361} - \frac{1}{4.4721}\right) = 4.472\,s$$

Approximation

$$h = \frac{20-5}{5} = 3$$

Stützstellen

$v_0 = 5,\ v_1 = 8,\ v_2 = 11,\ v_3 = 14,\ v_4 = 17,\ v_5 = 20$

Funktionswerte

$$f(v) = \frac{10}{-v^{3/2}} = -10\cdot v^{-3/2}$$

v_i	$f(v_i)$
5	$-10/11.18 = -0.8944$
8	$-10/22.627 = -0.4420$
11	$-10/36.48 = -0.2742$
14	$-10/52.38 = -0.1909$
17	$-10/70.09 = -0.1427$
20	$-10/89.44 = -0.1118$

Rechteckregel

$$T_{rect} = h\cdot\sum_{i=0}^{4} f(v_i) = 3\cdot(-0.8944 - 0.4420 - 0.2742 - 0.1909 - 0.1427)$$

$$T_{rect} = 3\cdot(-1.9442) = -5.8326 \Rightarrow 5.8326_s$$

$$|Fehler| = |5.833 - 4.472| = 1.361_s$$

Trapezregel

$$T_{trap} = \frac{h}{2}\left(f(v_0) + 2f(v_1) + 2f(v_2) + 2f(v_3) + 2f(v_4) + f(v_5)\right) = \frac{3}{2}(-0.8944 + 2(-0.4420 - 0.2742 - 0.1909 - 0.1427) - 0.1118) = -4.6587 \Rightarrow 4.6587_s$$

$$|Fehler| = |4.6587 - 4.472| = 0.187_s$$

Simpsonregel

$$T_{simp} = \frac{h}{3}(f_0 + 4f_1 + 2f_2 + 4f_3 + 2f_4 + f_5) = \frac{3}{3}(-0.8944 + 4\cdot(-0.4420) + 2(-0.2742) + 4(-0.1909) + 2(-0.1427) - 0.1118) = -4.3716 \Rightarrow 4.3716_s$$

$$|Fehler| = |4.372 - 4.472| = 0.100$$