Lecture 9b

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Determine the number of intervals necessary to approximate the value the integral to within .0001 using the Trapezoid rule.

$$\int_0^3 \sqrt{2x+1}dx$$

Then $f(x) = \sqrt{2x+1}$, so $f'(x) = \frac{1}{\sqrt{2x+1}}$ so $f''(x) = -\frac{1}{(2x+1)^{3/2}}$.

Note that $f'''(x) = \frac{3}{2}\frac{1}{(2x+1)^{5/2}}$. Thus $f''(x) < 0$ and $f'''(x) > 0$ in the domain of $0 \le x \le 3$.

Thus $f''(x)$ is negative and increasing. Hence $|f''(x)|$ is bounded by $|f''(0)| = 1$ so $K = 1$ in the formula

$$E_T \le \frac{K(b-a)^3}{12n^2}$$

Since we want $E_T \le .0001$, solve for n in

$$.0001 \ge \frac{1 \cdot (3-0)^3}{12n^2}$$

gives us

$$\begin{aligned} 12n^2 &\ge \frac{3^3}{.0001} = 270000 \\ n^2 &\ge 3240000 \\ n &\ge 1800 \end{aligned}$$