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Exercise 8.1

Scientific Computing - Homeworks

8.1

a) Compute the approximate value of the definite integral of x^3 from 0 to 1 :

$\int_0^1 x^3 dx$, first by midpoint rule and then by trapezoid rule.

with $f = x^3$:

midpoint rule : $M(f) = (1-0) f [(0+1)/2] = (1/2)^3 = 1/8$.

trapezoid rule : $T(f) = ((1-0)/2) (f(0) + f(1)) = 1/2$.

b) Use the difference between these two results to estimate the error in each of them.

$E(f) \sim (T(f) - M(f)) / 3 = (1/2 - 1/8) / 3 = 1/8$.

Error in $M(f)$ is about $1/8$, and error in $T(f)$ is about $-1/4$.

c) Combine these two results to obtain the Simpson's rule approximation to the integral.

$S(f) = (2/3) M(f) + (1/3) T(f) = (2/3) (1/8) + (1/3) (1/2) = 1/4$.

d) Would you expect the latte to be exact for this problem?

Yes .