

Quadrature

Consider the following function:

$$f(x) = \exp(\sin(x) + 1)$$

and the integral

$$I = \int_{x=0}^2 f(x) \, dx$$

- (a) Can you find the exact answer to this integral?
- (b) Compute an approximation to I by using the midpoint formula on two subintervals of equal size.
- (c) Compute an approximation to I by using the trapezoidal formula on two subintervals of equal size.
- (d) Compute an approximation to I by using the Simpson formula on two subintervals of equal size.
- (e) Write a function to approximate I , using the Simpson formula on $n + 1$ subintervals.
- (f) Approximate I for $n = 2^k$, $k = 1, \dots, 10$. Call the results I_k . On a logarithmic scale, plot $|I_k - I_{k-1}|$ versus n . Can you explain the figure in terms of the error analysis for the Simpson formula?