Think of this as a lab write-up. More details.

9/10.

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Homework 1

Computational Physics
September 27, 2019

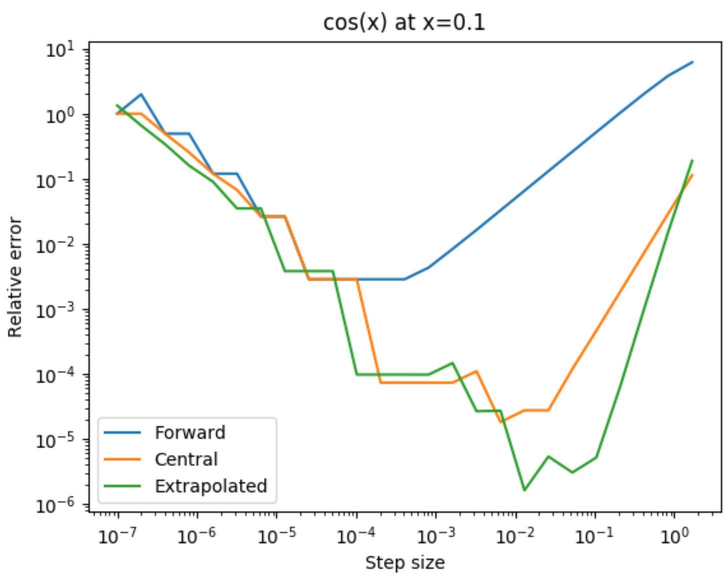
Problem 1

pos

Truncation error manifests itself on the negative sloping errors that tend to be seen on the left hand sides of each of the derivative curves.

neg

Roundoff error manifests itself on the positive sloping errors that tend to be seen on the right hand sides of each of the derivative curves.



more detail required. i.e. define your methods

Figure 1: Plot of the relative error between the derivative of cosine at 0.1 radians and the approximate derivative of cosine at 0.1 radians using the formulas for forward, central, and extrapolated derivatives.

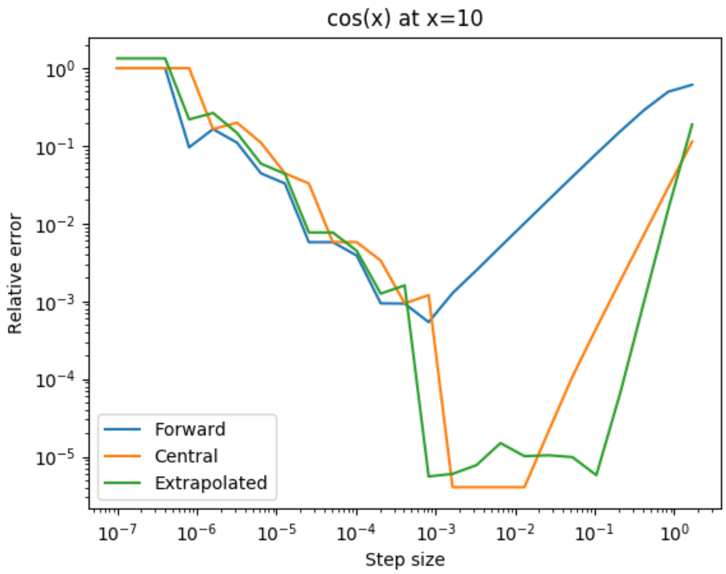


Figure 2: Plot of the relative error between the derivative of cosine at 10 radians and the approximate derivative of cosine at 10 radians using the formulas for forward, central, and extrapolated derivatives.

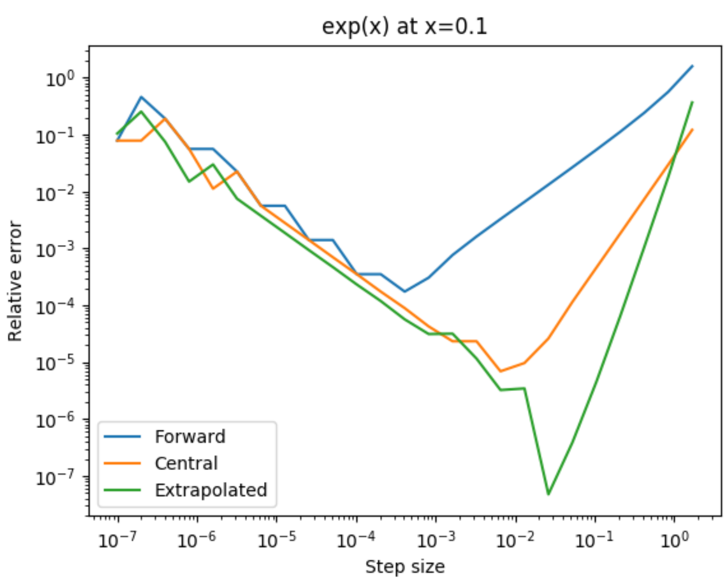


Figure 3: Plot of the relative error between the derivative of the Exp function at 0.1 and the approximate derivative of the Exp at 0.1 using the formulas for forward, central, and extrapolated derivatives.

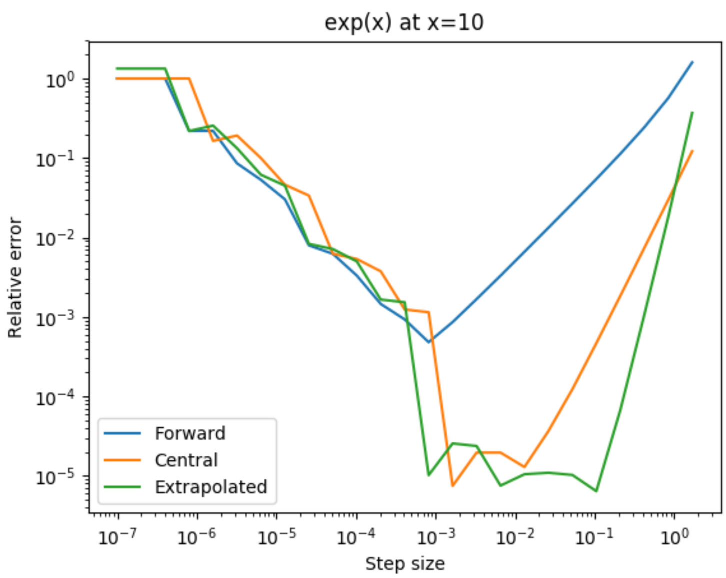


Figure 4: Plot of the relative error between the derivative of the Exp function at 0.1 and the approximate derivative of the Exp at 0.1 using the formulas for forward, central, and extrapolated derivatives.

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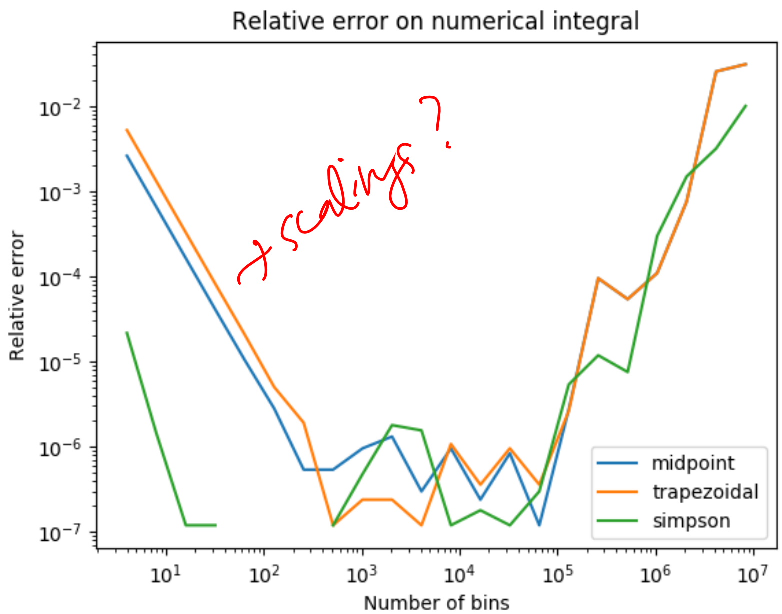
Problem 2

As expected, initially, Simpson's integration performs better than midpoint integration, which performs better than trapezoidal integration. As more bins are taken for integration, all integration methods perform better because the truncation error is reduced with more bins. However, after a certain point, which in my plots looks to be around 10^5, more bins can result in a larger relative error because of roundoff error.

but "better" means different things in these two comparisons.

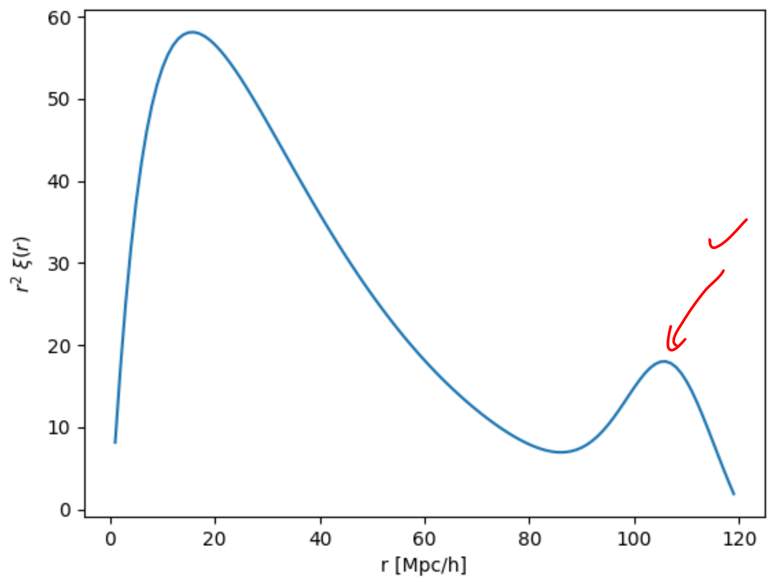


→ scalings?

Figure 5: Plot of relative errors of numerical integral as a function of number of bins used to calculate the error.

Problem 3

In this plot, the scale of the peak, also known as the "baryon acoustic oscillation" (BAO) peak, is around $r \approx 105$ [Mpc/h].



good

Figure 6: Scaled plot of the correlation function $\xi(r)$ as a function of r.