Comp Physics Hw 1

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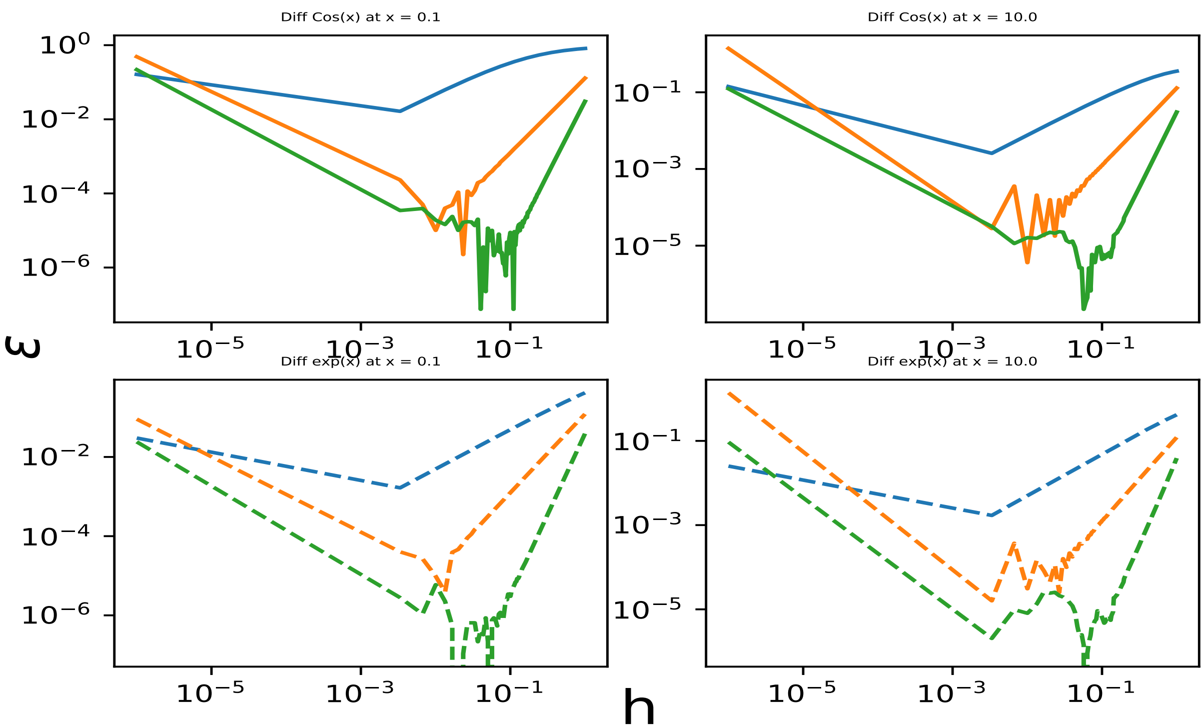


Figure 1: Plot of the relative errors $\varepsilon = |y' - dy/dx|/|y'|$ for each given function evaluated at their respective x values.

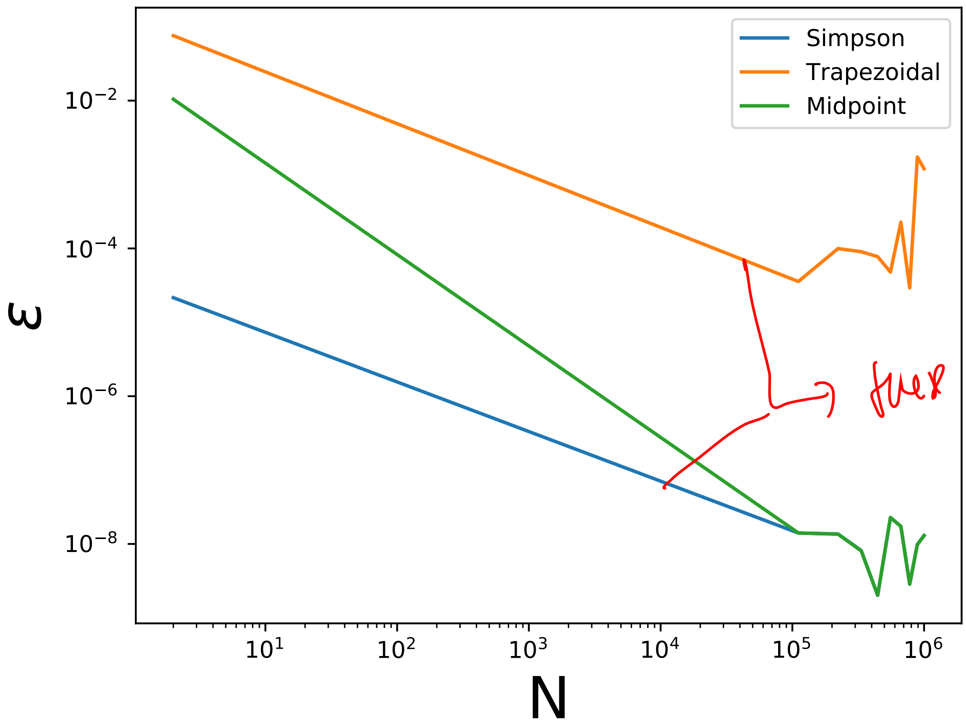
1. Truncation and roundoff error manifest themselves in different regimes in these plots. Clearly identify these regimes.

   Answer:
   As shown in the above figure, once the steo size h becomes too small, we expose the calculation to round-off error due to $y(x+h) - y(x)$ differing by only one's machines precision. The round-off error can be approximated as

$$\epsilon_{ro} \approx \frac{\epsilon_m}{h}$$

   To find such an h value that introduces such errors, one can equation the round-off error equation above to the respective approximation errors for the different integration methods:

$$\frac{\epsilon_m}{h} \approx \epsilon_{fd}, \qquad \frac{\epsilon_m}{h} \approx \epsilon_{cd}, \qquad \frac{\epsilon_m}{h} \approx \epsilon_{ed}$$



these don't have proper scaling w/ N.

-1

Figure 2: Integration plot

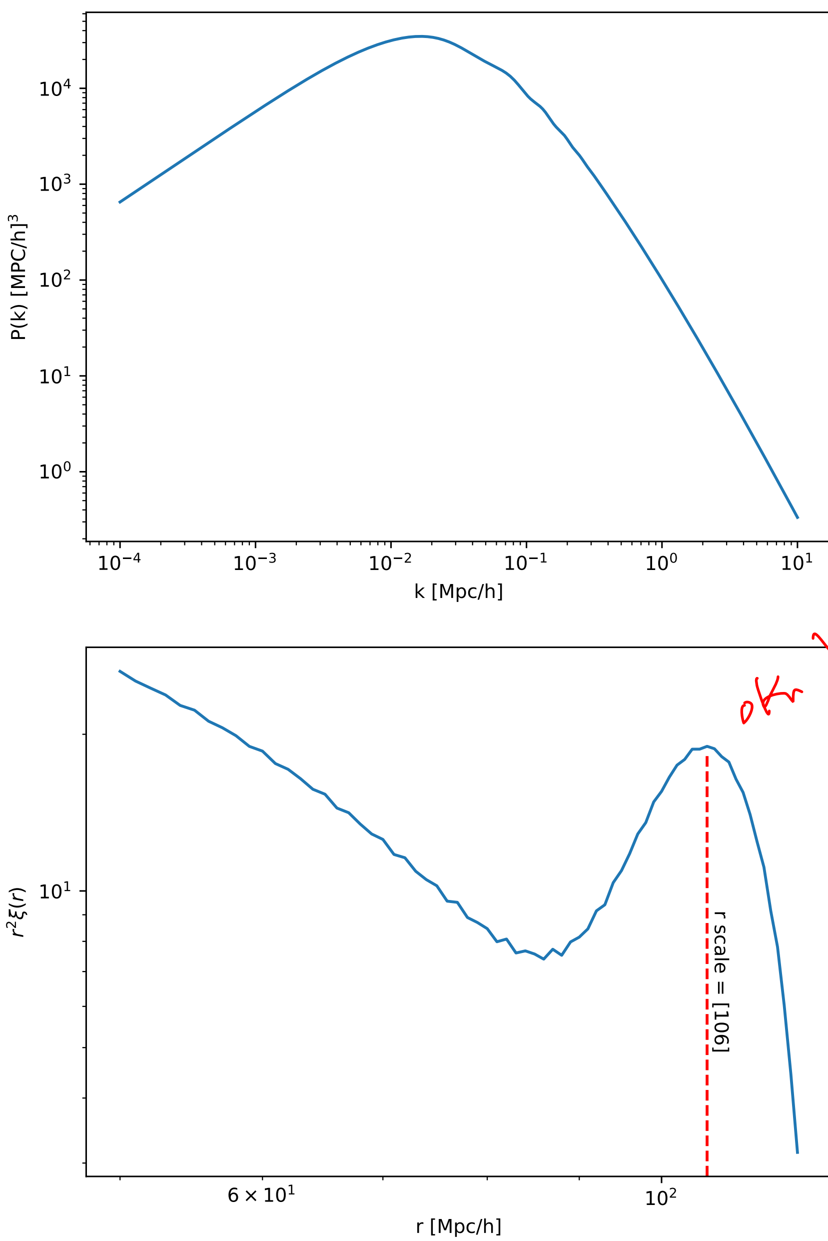
Depending on one's precision for the calculation, the machine precision ϵ_m may vary which of course affects the resultant minimum h values. These behaviors are seen in the left-half of the plots in the above figure where the step size became too small; thus, introducing larger errors.

2. Explain what you see in the plot.

Solution:
Although this plot is not at all like to one shown in class, I believe the overall premise is the same. The relative error falls as the bin size increases, but there becomes a point such that the bin sizes decrease the incremental step size h far below values that would differentiate the terms in each of the integral-sum formulas.

well, simpsons should scale best, not be parallel w/ trapezoid.

3. The BAO peak is shown to be at around $r \approx 106[Mpc/h]$, consistent with previous results.



ok. Your integration is obviously noisy, though.

Figure 3: Caption include captions next time.