GROUP WORKSHEET

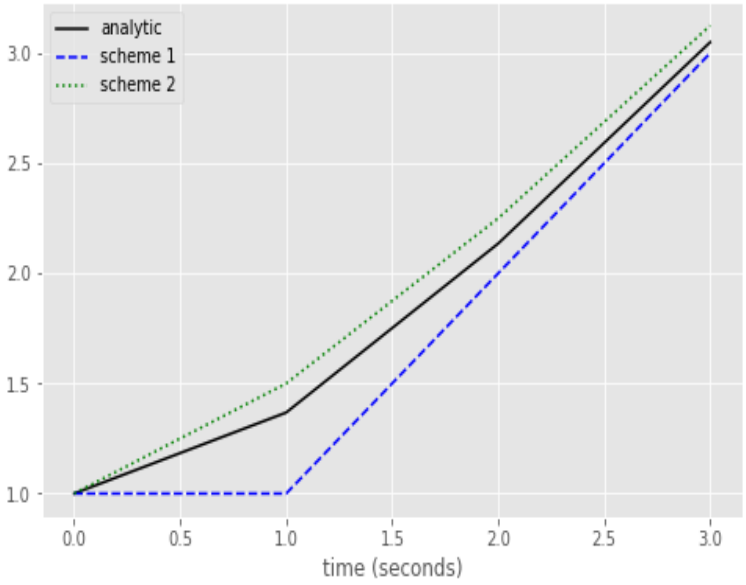
Names (First only, no student numbers):

Before you begin you should have read and worked through Lab 4.

All questions should be done by hand (not by computer) and show your steps.

1. Local and Global Errors

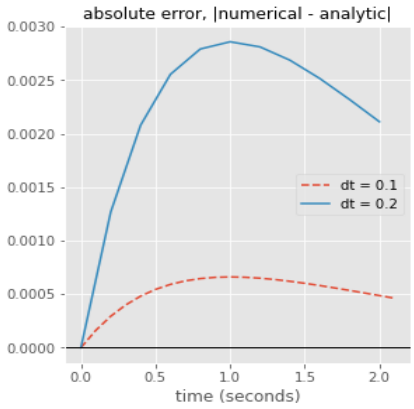
   (a) The figure below solves the system $\frac{dy}{dt} = -y+t+1$ with the initial condition $y(0) = 1$; this has an exact solution $y(t) = t + e^{-t}$. For scheme 1, label the global and local errors at $t = 1.0s$.



   (b) For scheme 1, label the global error and your best estimate of the local error at $t = 2.0s$ on the figure .

   (c) Which scheme do you think is most likely to be the highest order. Give your reasoning below, including how certain you are. What extra information would help you know for sure (beyond knowing what the schemes are!)?

2. Errors and scheme order

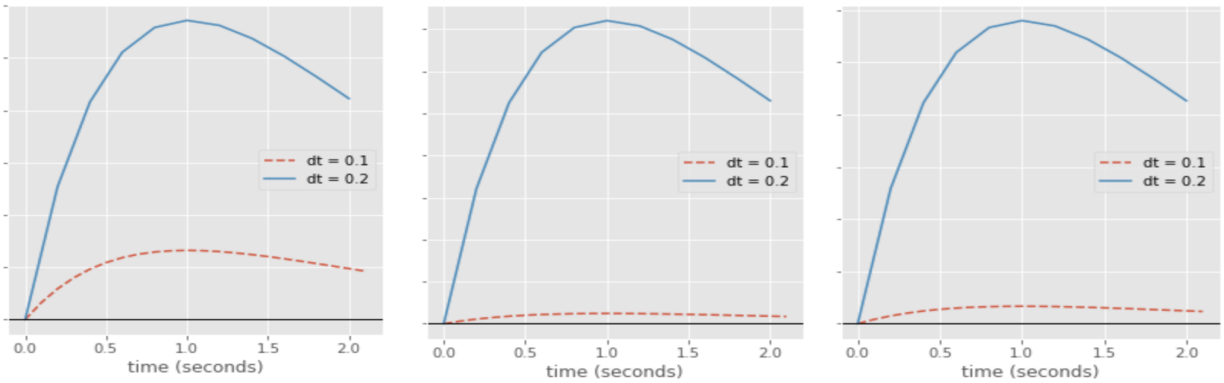


(a) For the figure above, what is the global error for $dt = 0.1$ and $dt = 0.2$ at $t = 2.0$?

(b) What is the order of the global error? What is the order of the scheme?

3. Comparing schemes

(a) From the 3 figures below (which have the y axis values removed deliberately), rank the schemes by their order, O($\Delta t^?$), from highest to lowest.



(a) scheme A (b) scheme B (c) scheme C

Figure 1: Absolute error $|numerical - analytic|$ for three different numerical schemes. Black horizontal line is the $y = 0$ axis.

(b) By looking at how the global error scales with dt, estimate the order of each scheme.

4. Optional extra question if time: repeat the analysis for Q3b with the local error.