DE NUMERICAL METHODS

Most real world DEs are not solvable by the myriad of methods that we learned. Don't despair. Along with the many wonderful methods that we learned to solve DEs exactly, there are many more methods to solve DEs numerically. This requires an initial value with the original DE. Through these solutions, we can make graphs and numerically solve DEs for specific situations. All of the following programs produce a matrix of xy values that may be graphed with PLOTT.

XACT – will only solve a DE when an exact solution to the f'(x) problem is given. This may be used for error analysis of the particular method that you are investigating. Error equations may be Relative Error = $\frac{\text{Exact} - \text{Approx}}{\text{Exact}}$ x 100%, or Absolute Error = |Exact − Approx|.

EULR – the original numerical method, which is the basis for all other numerical methods. This is a single step method with an error value of h^2 (h is the iteration size).

RK4 – a multi step method where the error is h^4. Multistep methods attempt to gain efficiency by keeping and using the information from previous steps rather than discarding it. The first of the multi steps is an Euler estimate, with the next two being midpoint, and Euler with the second step. The fourth step is a combination of the Euler and third step. The two central steps are then weighted.

RK0 – subroutine for ABAM. Simple a stripped down RK4, no input form.

[Method to convert higher order DE to 1st order. See DE Methods 2, p6.]

ABAM – uses RK4 to produce the first four steps, then recalculates these using two formulas, one a predicting formula, the second a correcting formula. ABAM then continues to the end of the iterations using these two formulas. Where all previous methods are considered predicting models, ABAM is a continuing method.