ME 3001 Lecture - Numerical Solutions to ODEs
A Generalized Solution Approach

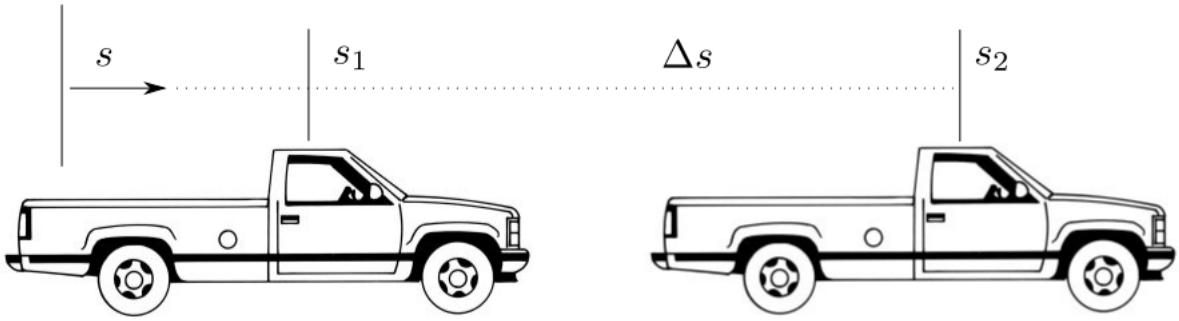
- **What is a Numerical Method?**

  "Numerical methods for ordinary differential equations are methods used to find numerical approximations to the solutions of ordinary differential equations (ODEs). Their use is also known as "numerical integration", although this term is sometimes taken to mean the computation of integrals." - wikipedia

  - A method for **approximating** a solution to a differential equation
  - Generally easier then finding the exact solution to a complex ODE
  - Appropriate for **linear** and **non-linear** problems
  - Generally more **computationally intensive** than finding exact solution

- **Method 1 - Euler's Forward Integration (Euler's Method)**

  - Consider the truck below at position s_1 traveling at 70 $\frac{mi}{hr}$



  - After 2 hours how far has the truck traveled?

  - Did you know that you just **integrated**? Why? How?

  - This idea is the basis of a family of numerical methods for solving **I**nitial **V**alue **P**roblems known a *Forward Integration Techniques.*

- **Method 1 - Euler's Forward Integration (continued)**

$$y(x + \Delta x) = y(x) + f(x, y)\Delta x$$

or with subscript notation shown below

$$y_{i+1} = y_i + f(x_i, y_i)\Delta x$$