There are many applications where derivatives need to be computed numerically. The simplest approach simply uses the definition of the the derivative (shown to the right) for some small numerical value of H << 1 .

$$\lim_{h \to 0} \left(\frac{f(x+h) - f(x)}{h} \right)$$

Consider a biology experiment where the location of a fish is measured optically on a video. Measurements for 30 seconds of the displacement in the x direction (horizontally) can be obtained by the file: Fish Displacement Data File.xls located at www.markeredwards.com (under CCHS/Precalculs).

Using the data from the down loaded file:

- plot the velocity and acceleration curves (in the x-direction) of the fish.
- determine the maximum velocity and when it occurs.
- determine maximum acceleration and when it occurs.
- use Excel and attempt to best fit curves for and determine the equations for:
  - the displacement
  - the velocity
  - the acceleration of the fish.

remember: $\text{velocity} = \frac{d}{dt}\text{displacement}$ where t is time

$$\text{acceleration} = \frac{d}{dt}(\text{velocity}) = \frac{d^2}{dt^2}(\text{displacement})$$