PHY 321, JANUARY 9, 2023

Discretization:

time $t \in [t_0, t_f]$

$t \to t_i$

$t_i = t_0 + i \Delta t$

$i = 0, 1, 2, \ldots n-1$

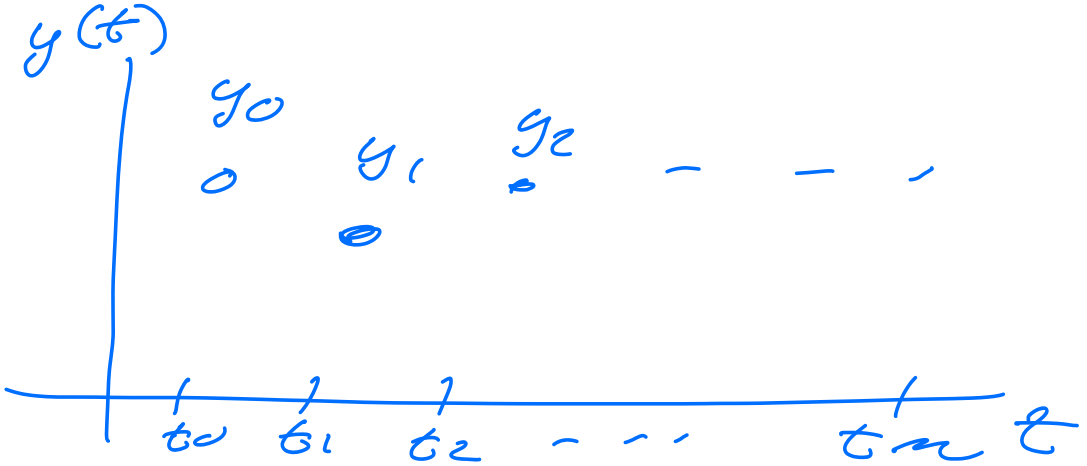
$t_f = t_n$

$t_n = t_0 + n \Delta t$

$$\Delta t = \frac{t_n - t_0}{n}$$

$y(t) \to y(t_i) = y_i$

$i = 0, 1, 2, \ldots, n-1$



We can define an average velocity

$$v(t) = \frac{y(t+\Delta t) - y(t)}{\Delta t}$$

$$v(t) \Rightarrow v(t_i) = v_i'$$

$$= \frac{y_{i+1} - y_i'}{\Delta t}$$

instantaneous velocity

$$\lim_{\Delta t \to 0} v(t) = \frac{y(t+\Delta t) - y(t)}{\Delta t}$$

$$= \frac{dy}{dt}$$

average acceleration

$$a_i = a(t_i) =$$

$$\frac{v_{i+1}' - v_i'}{\Delta t}$$

$$a(t) = \frac{dv}{dt} = \lim_{\Delta t \to 0} \frac{v(t+\Delta t) - v(t)}{\Delta t}$$

Scaling & dimensionless

$[r]$ = length, dimensionality
↑ distance — typical unit m.

$[m]$ = mass
unit kg

$[t]$ = time
unit s.

$[v]$ = length per time
unit m/s

$[a]$ = length over time squared
unit m/s^2

$[p]$ = mass-times-length over time
↑ momentum — unit kg m/s