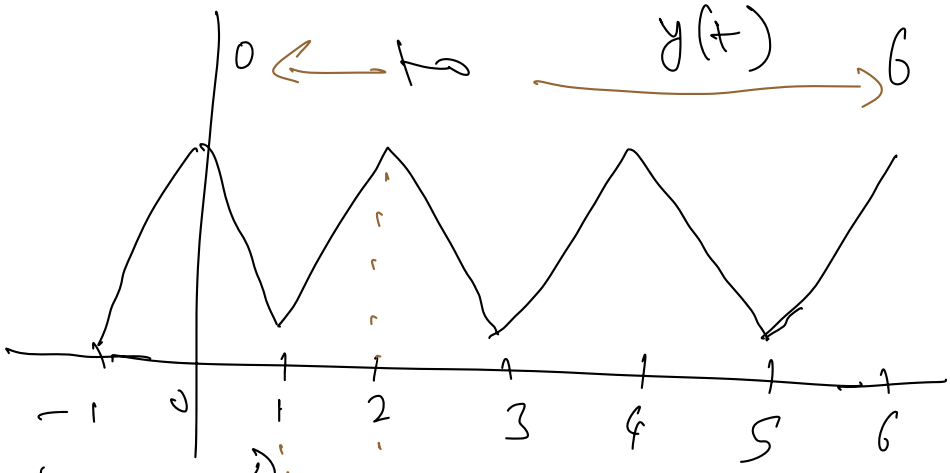
Last Class

1) Double exponential smoothing
2) Triple exponential smoothing
3) Stationarity
4) ~~Auto Correlation~~
5) ~~Partial Auto Correlation~~

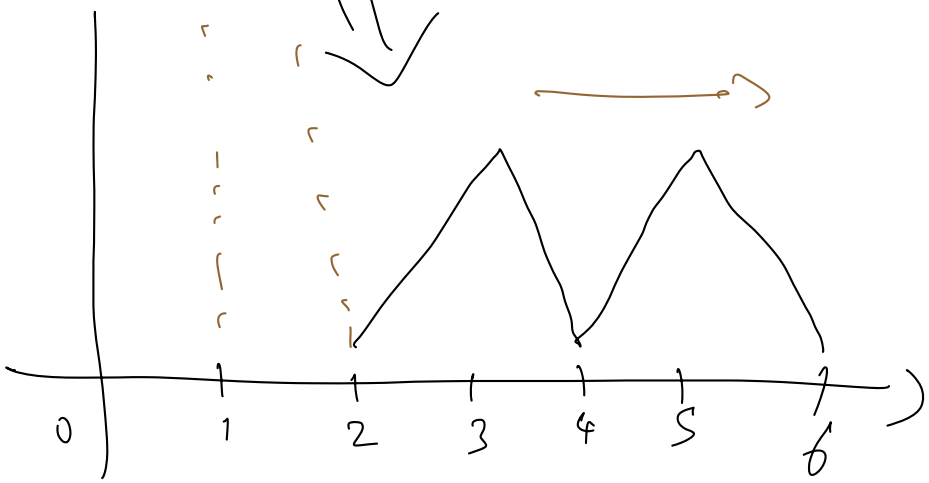
Today's class

1) Quizzes - Recap
2) Auto Correlation
3) Partial Auto Correlation
4) Correlation vs Causation
5) ARIMA family
   - Auto Regression (AR)
   - Moving Average (MA)
   - ARMA (AR + MA)
   - ARIMA
   - SARIMA

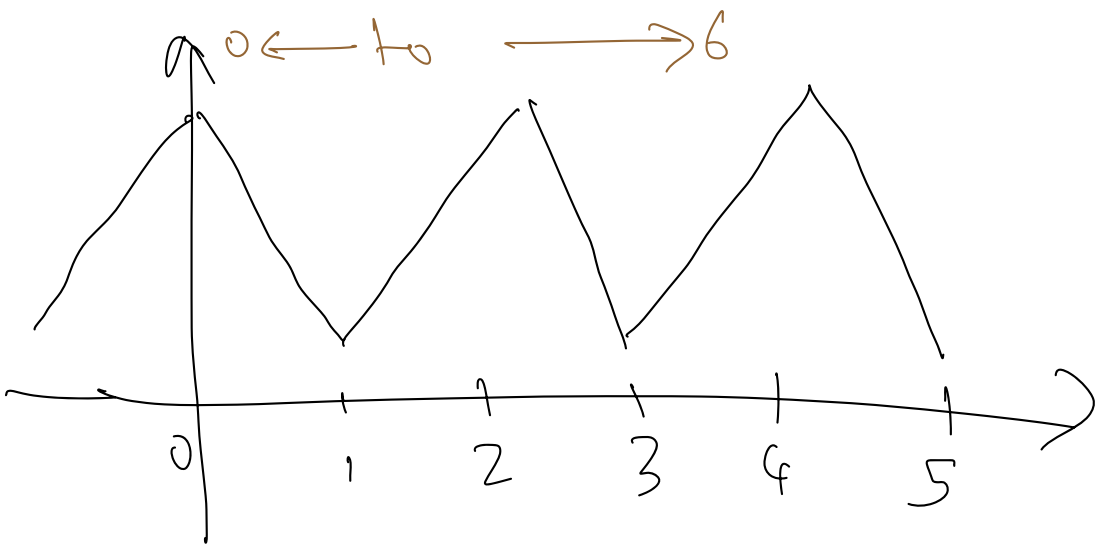


Periodicity
↓
2 units

$y(t-1)$ → Right shifting by 1



$y(t-2)$



$y(t)$ equal to $y(t-2)$

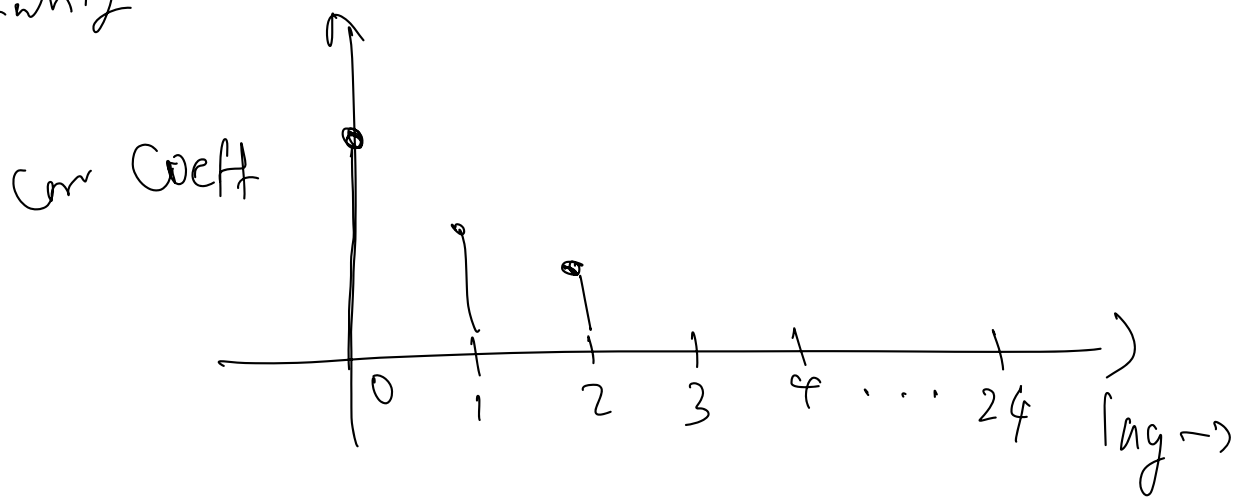
Corr $y(t)$, $y(t-2)$ should be 1

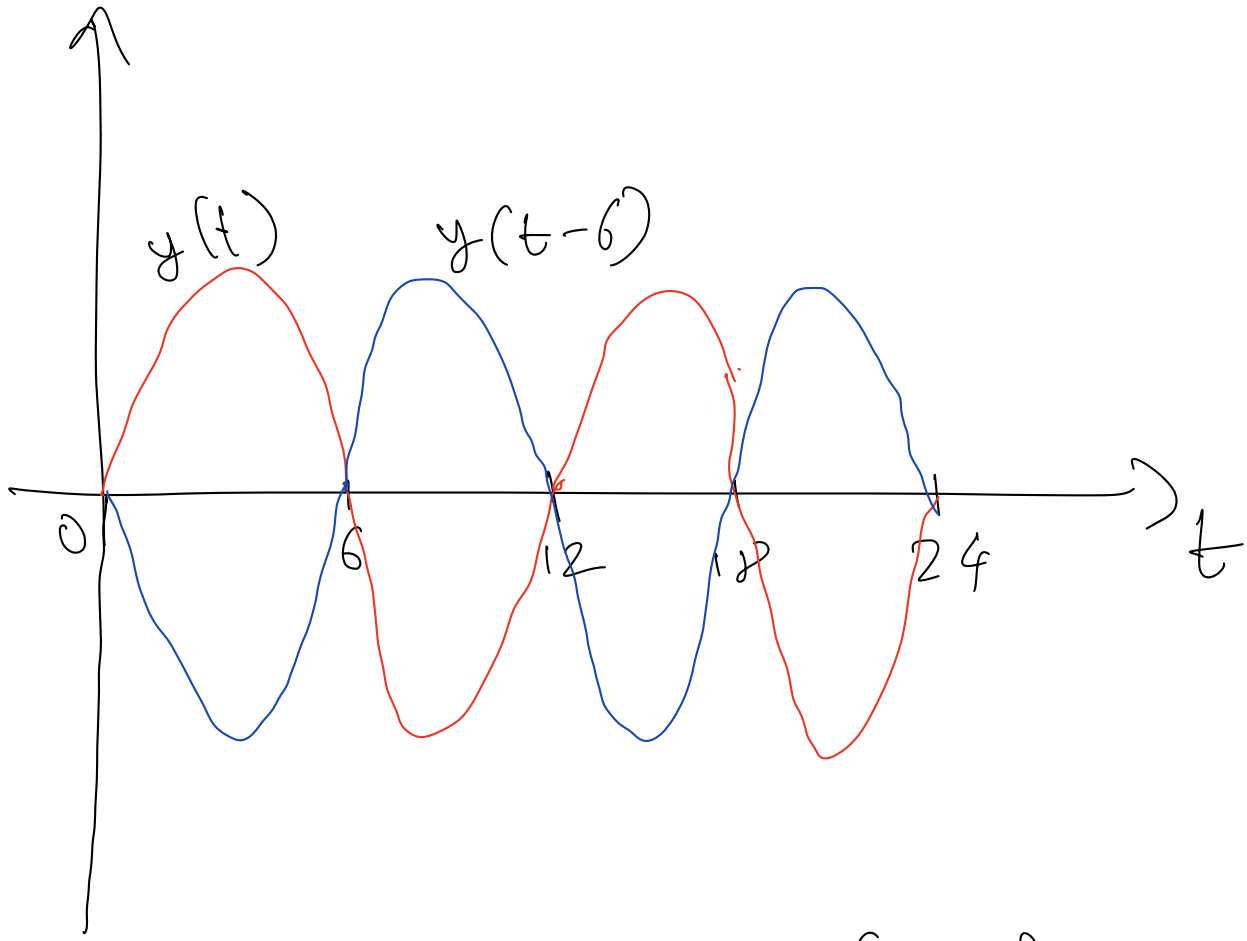
$y(t)$	$y(t-2)$	
v_1	y_1	Corr
v_2	y_2	
v_3	y_3	

lag	Corr
0	$v_1 \rightarrow 1$
1	v_2
2	v_3
⋮	⋮
m	$v_m \rightarrow 1$

↓

Sensitivity





corr between $y(t)$, $y(t-6)$

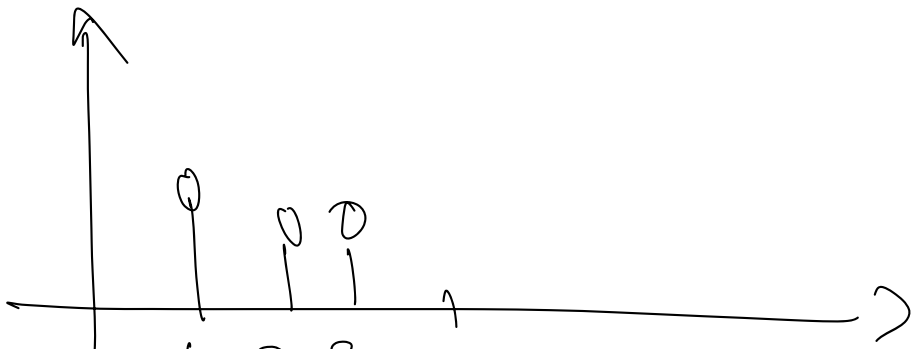
corr $\left(y(t), y(t-T/4)\right)$ T = time period

corr $\left(y(t), y(t-T/2)\right) \rightarrow -1$

$y(t)$, $y(t-1)$ → correlated

$y(t-1)$, $y(t-2)$ → correlated

$y(t)$, $y(t-2)$ → correlated



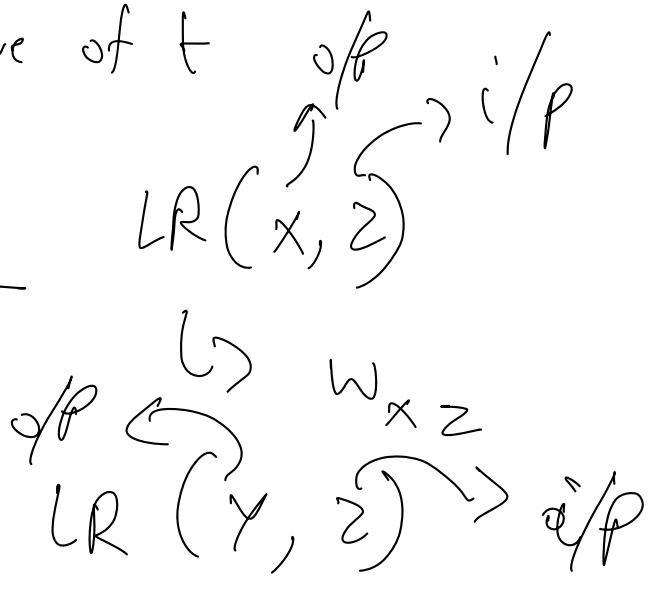
↳ correlated

$$y(t) = \alpha_1 y(t-1) + \alpha_2 y(t-2) + \alpha_3 y(t-3)$$

↓

for every value of t

X	Y	Z



$$x' = x - (W_{xz} \cdot z + b_{xz})$$

$$y' = y - (W_{yz} \cdot z + b_{yz})$$

x', y' → corr (x', y')

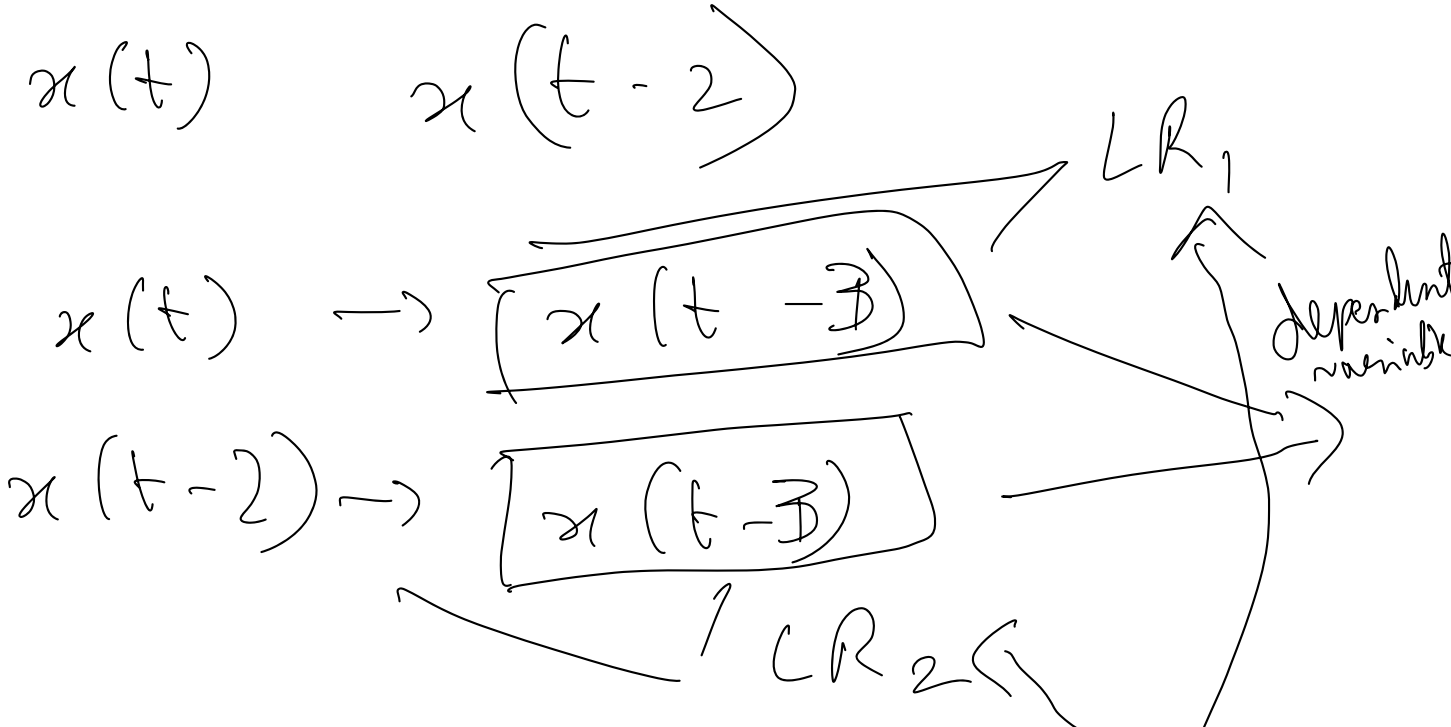
partial correlation

$$LR_{x2}(z) = \hat{x}$$

$$LR_{y2}(z) = \hat{y}$$

$$x' = x - \hat{x}$$

$$y' = y - \hat{y}$$



$x'(t) \longrightarrow x(t) - \hat{x}(t)$

$x'(t-2) \longrightarrow x(t-2) - \hat{x}(t-2)$

corr $\left(x'(t),\ x'(t-2) \right)$

↳ partial auto corr

$x(t-3)$, $x(t-4)$

$x(t-5) \rightarrow z_1$

$x(t-6) \rightarrow z_2$

z_3

PACF → $lag = 5$

$x(t)$, $x(t-5)$

$x(t-1)$

$x(t-2)$

$x(t-3)$

$x(t-4)$

$x(t-6)$

$x(t-7)$

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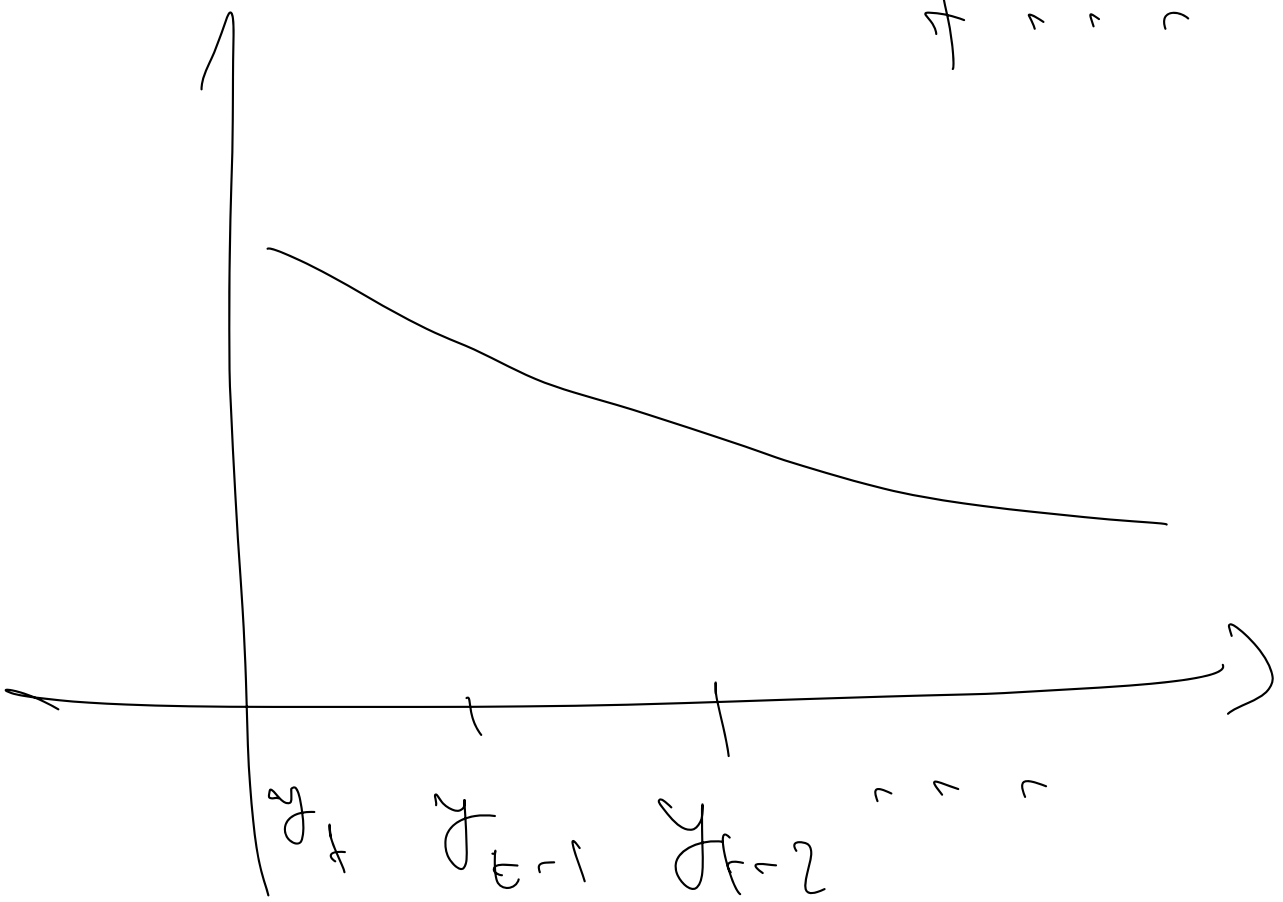
SES

$$\hat{y}_{t+1} = 0.8\, y_t + 0.7\, y_{t-1} + 0.6\, y_{t-2}$$



backward

diff

$y(0), y(1), y(2), y(3)$

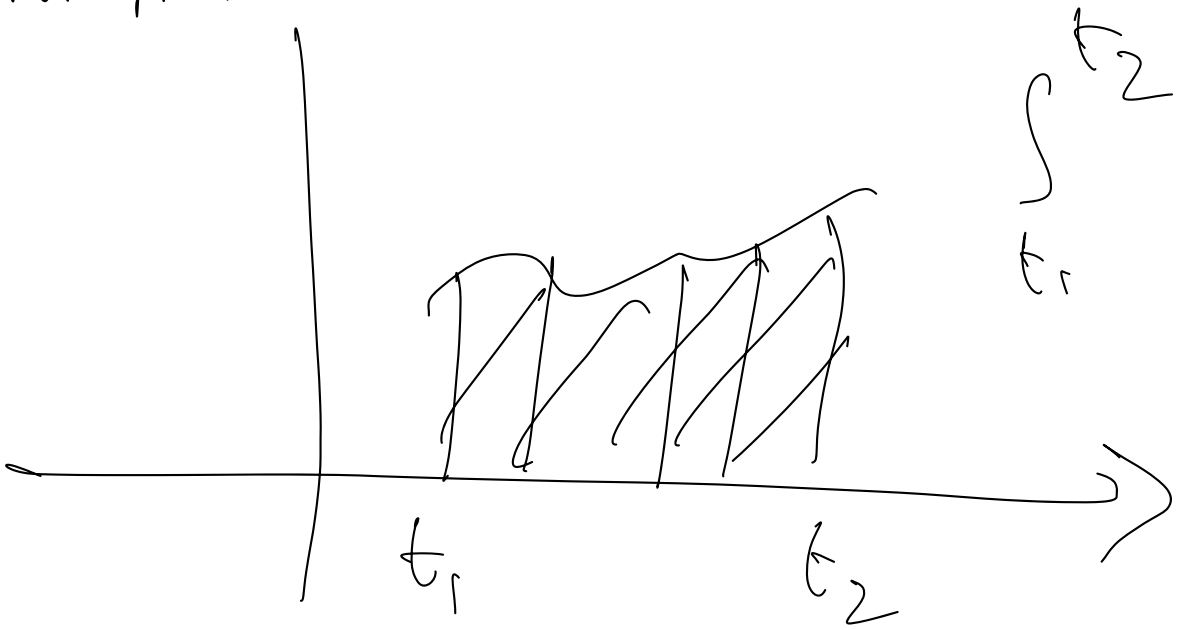
y_{10} / y_{21}, y_{32}

$$\int \frac{dy}{dt}\, dt = y + \boxed{C}$$

$C \rightarrow$ last value of train data

↓

integration → cumulative sum



test_data

train_data[-1]

→ last value