

1. Naive Method

$$Y_{t+1} = Y_t$$

— previous periods value -
is used for the current period.

2. Moving Average Technique.

- Centred Window
- Trailing Window

3. Exponential Smoothing

Moving Average \rightarrow Window size (3).

Trailing Window:

| | Time (t) | y | \hat{y} |
|------|-------------|---|-----------|
| Natl | Jan 2000. | — | NaN |
| — | Feb 2000. | — | NaN |
| — | Mar 2000. | — | — |
| — | Apr 2000 | — | — |
| — | May 2000 | — | — |
| | Jun 2000 | — | — |
| | Jul 2000 | — | |
| | Aug 2000 | — | |

Centred Window \leftarrow

\rightarrow Trailing Window

Even Window - Centred technique

— two step

← Exponential Smoothing →

1. Single Exponential Smoothing (SES)

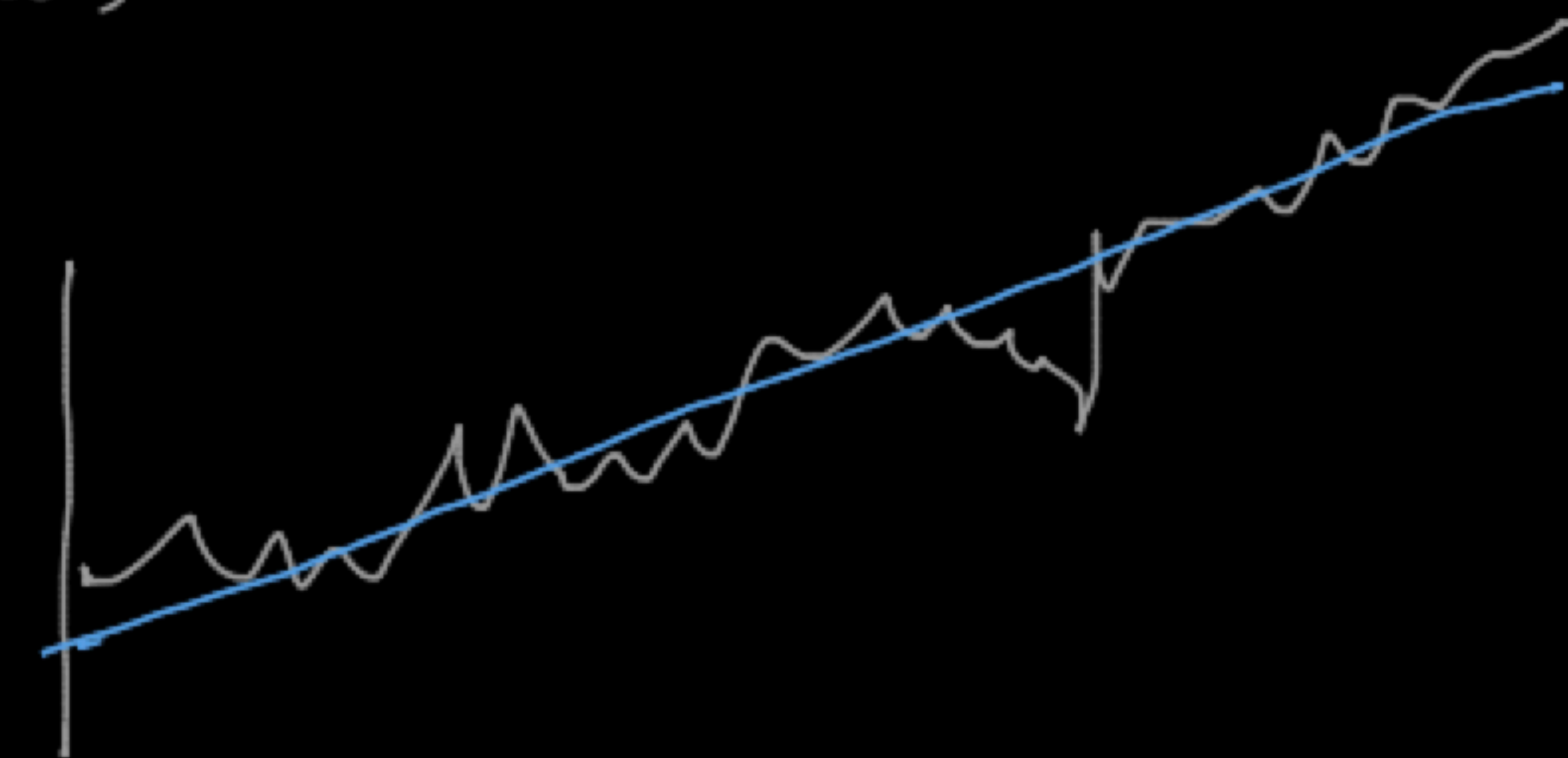
— No trend, No seasonality



2. Double Exponential Smoothing (Holt's method)

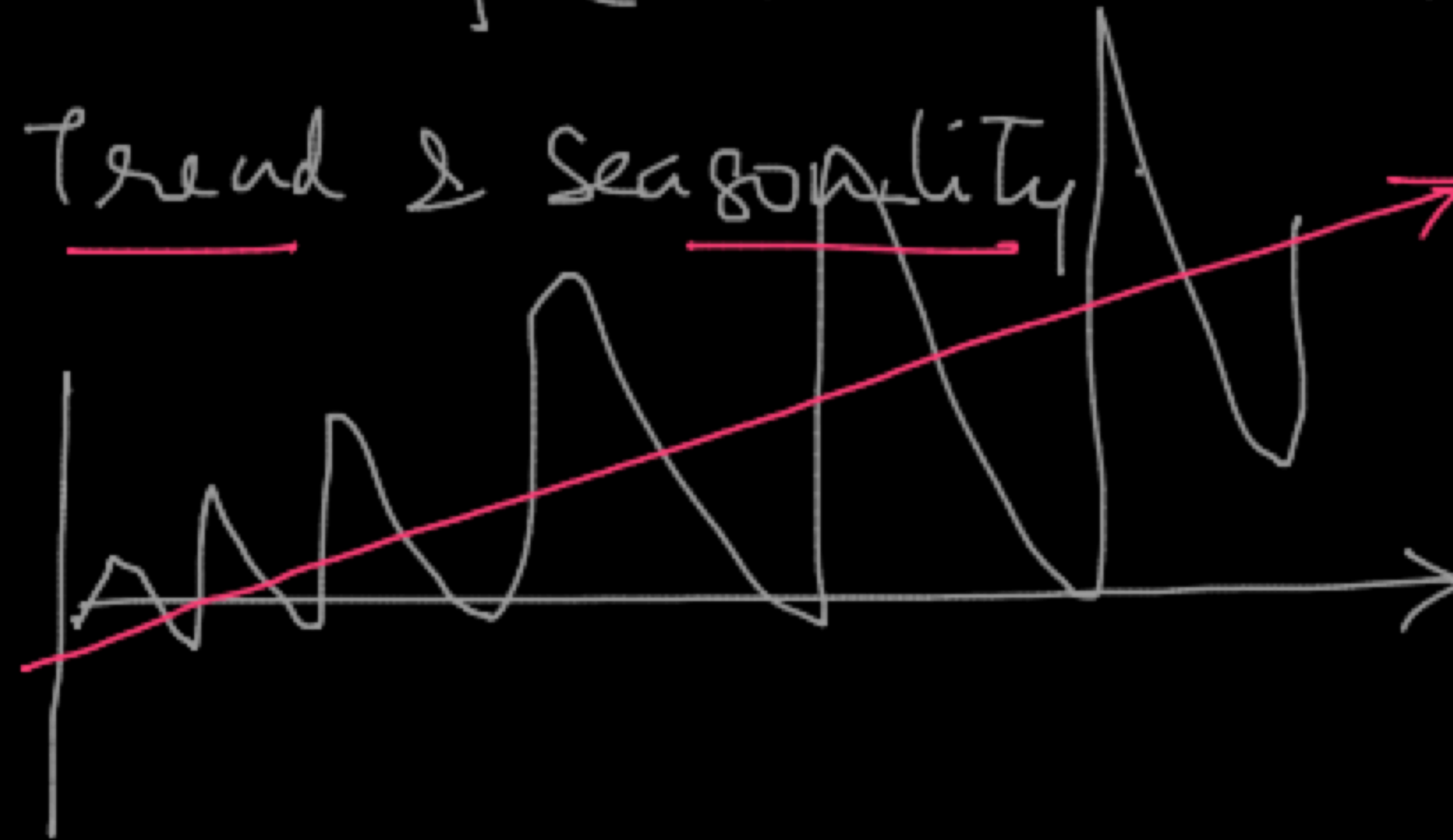
— includes trend like data.

Trend present, No seasonality

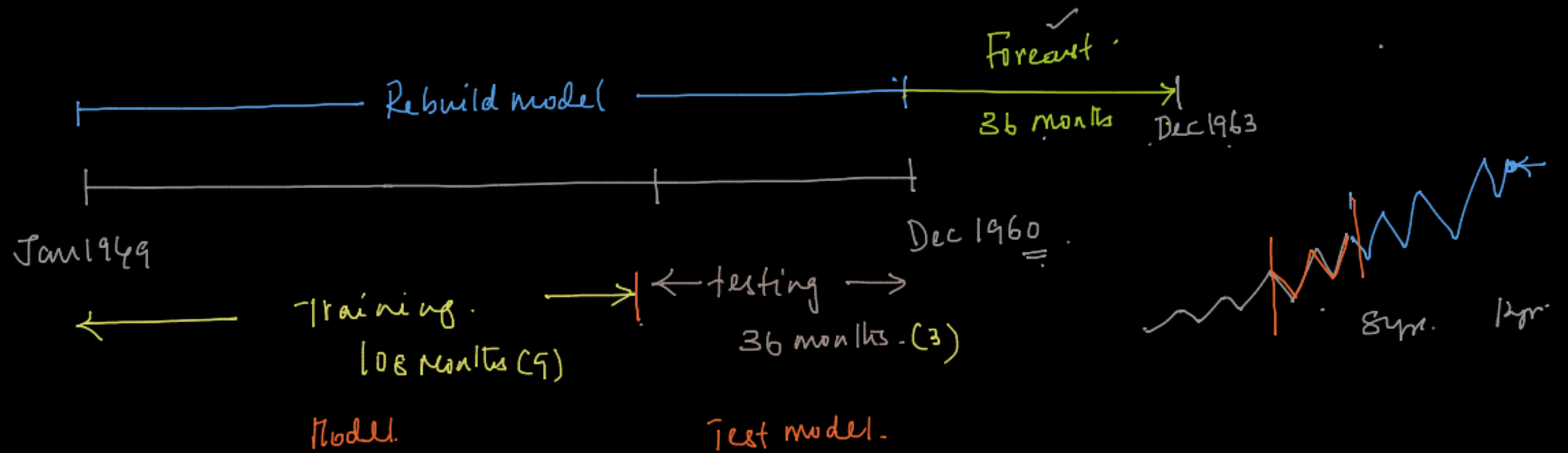


3. Triple Exponential Smoothing (Holt-Winter's Method).

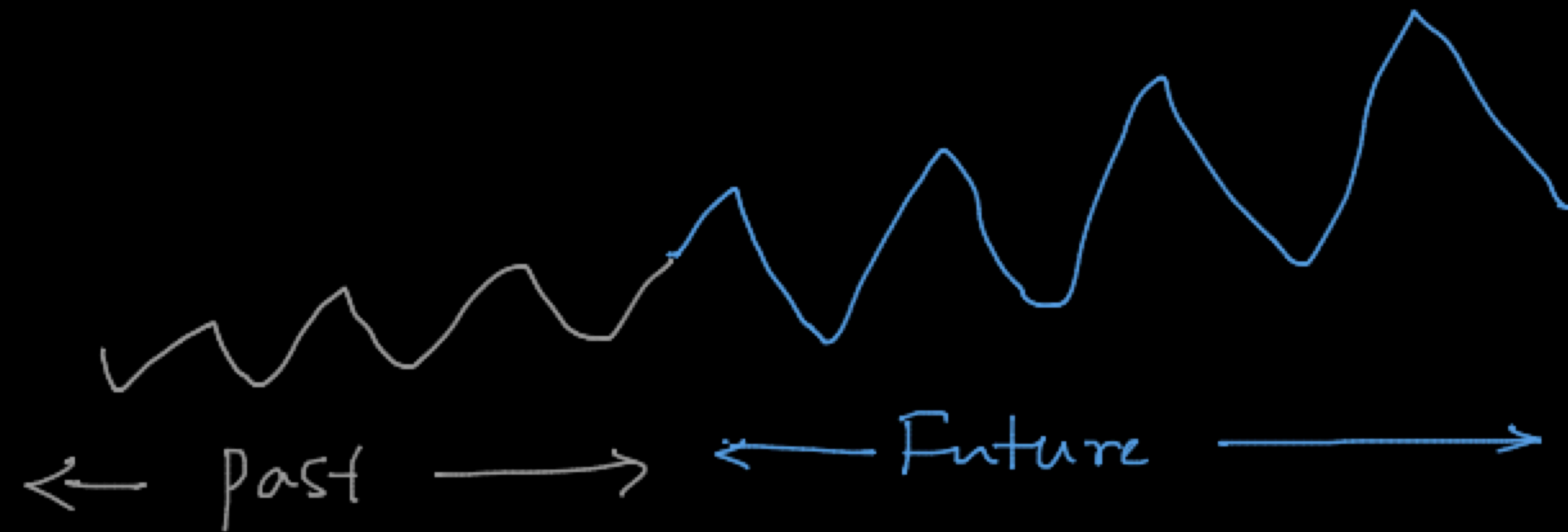
— includes Trend & Seasonality



10.15 am



'Future values depend on past values'

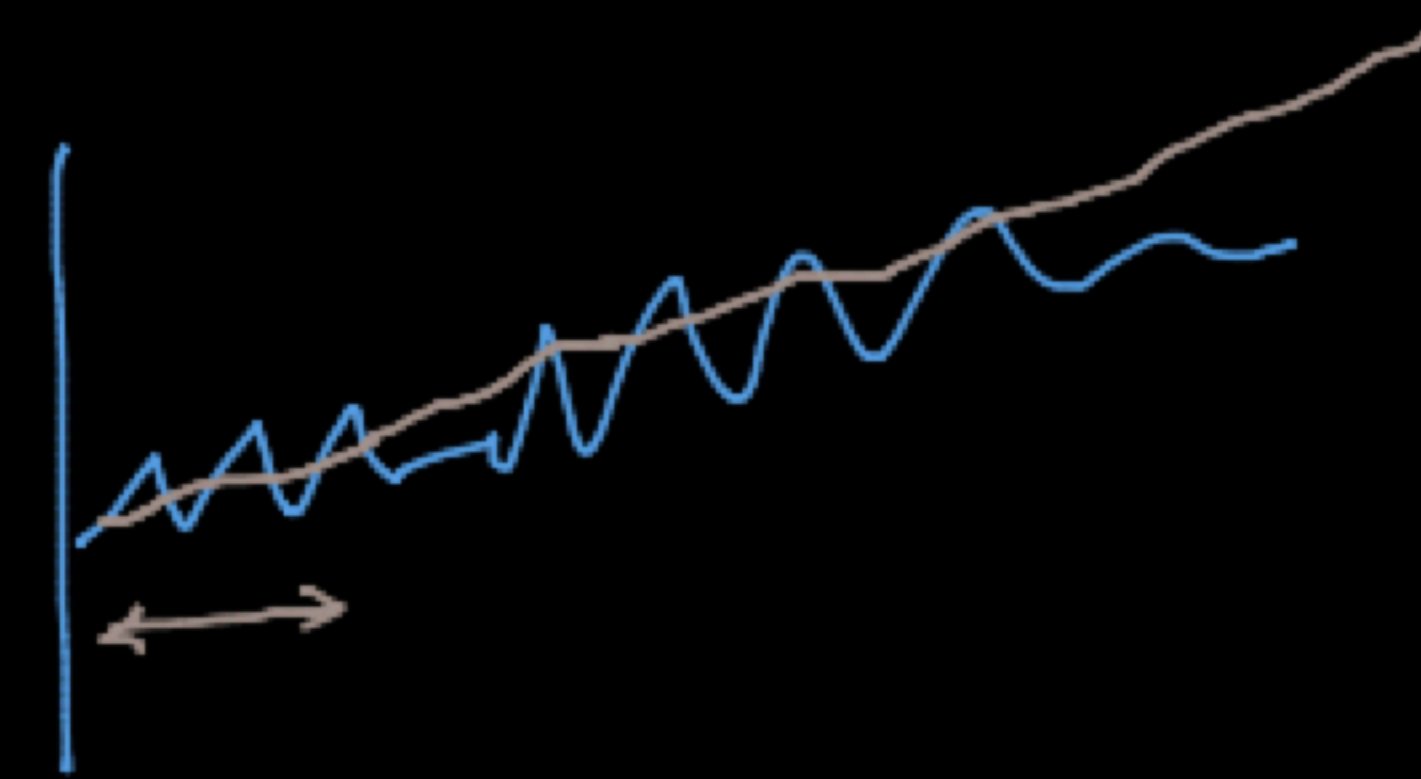


Simple Exponential Smoothing

[illegible]
$$y_t = \frac{(1-\alpha)^2}{(1-\alpha)} \uparrow$$

→ How many periods.

→ Weighted average of previous values.

 $\alpha_1 \rightarrow \text{smoothing constant (fraction)}$
$$\rightarrow 0.6$$


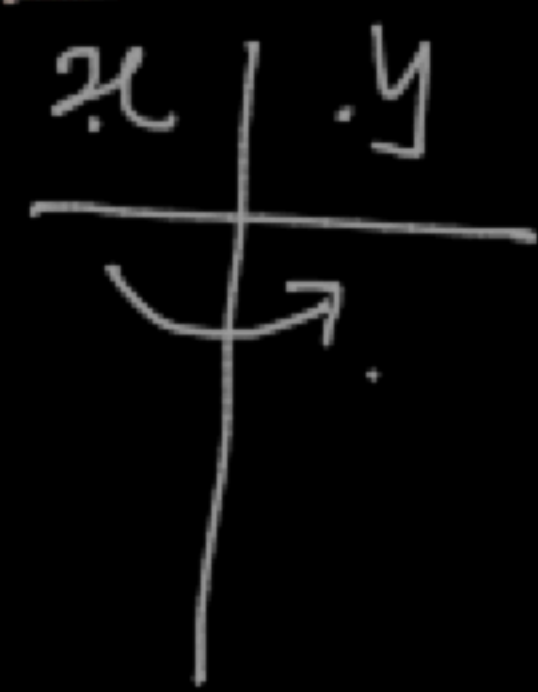
$$y_t = \alpha y_{t-1} + (1-\alpha)y_{t-2} + (1-\alpha)^2 y_{t-3} + (1-\alpha)^3 y_{t-4} + \dots$$

→ Weighted Moving Average -

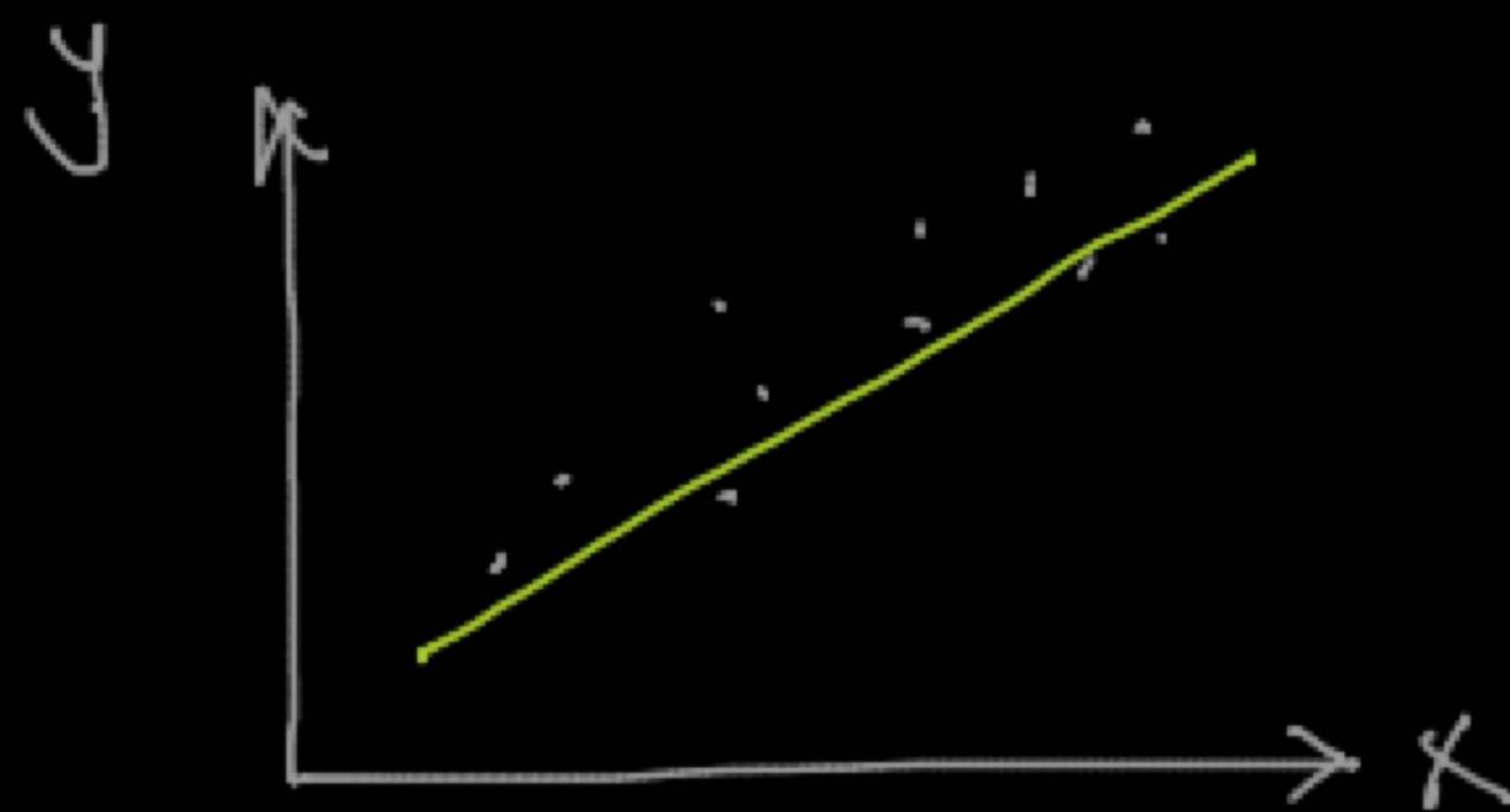
Auto Regression Models.

— Regression applied on single column.

Simple linear Reg.

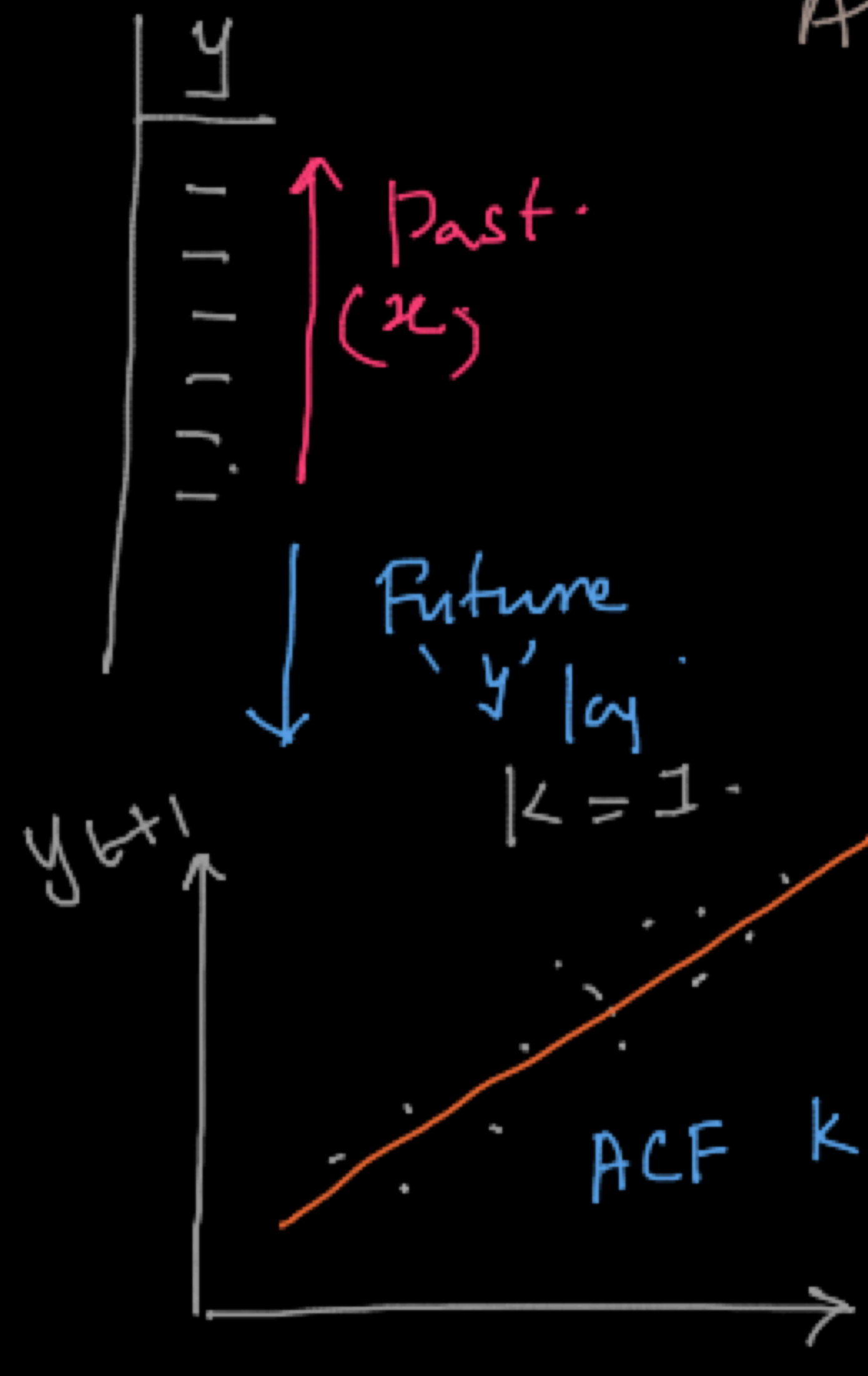


Correlation between
 x & y . (r).



Scatter plot.

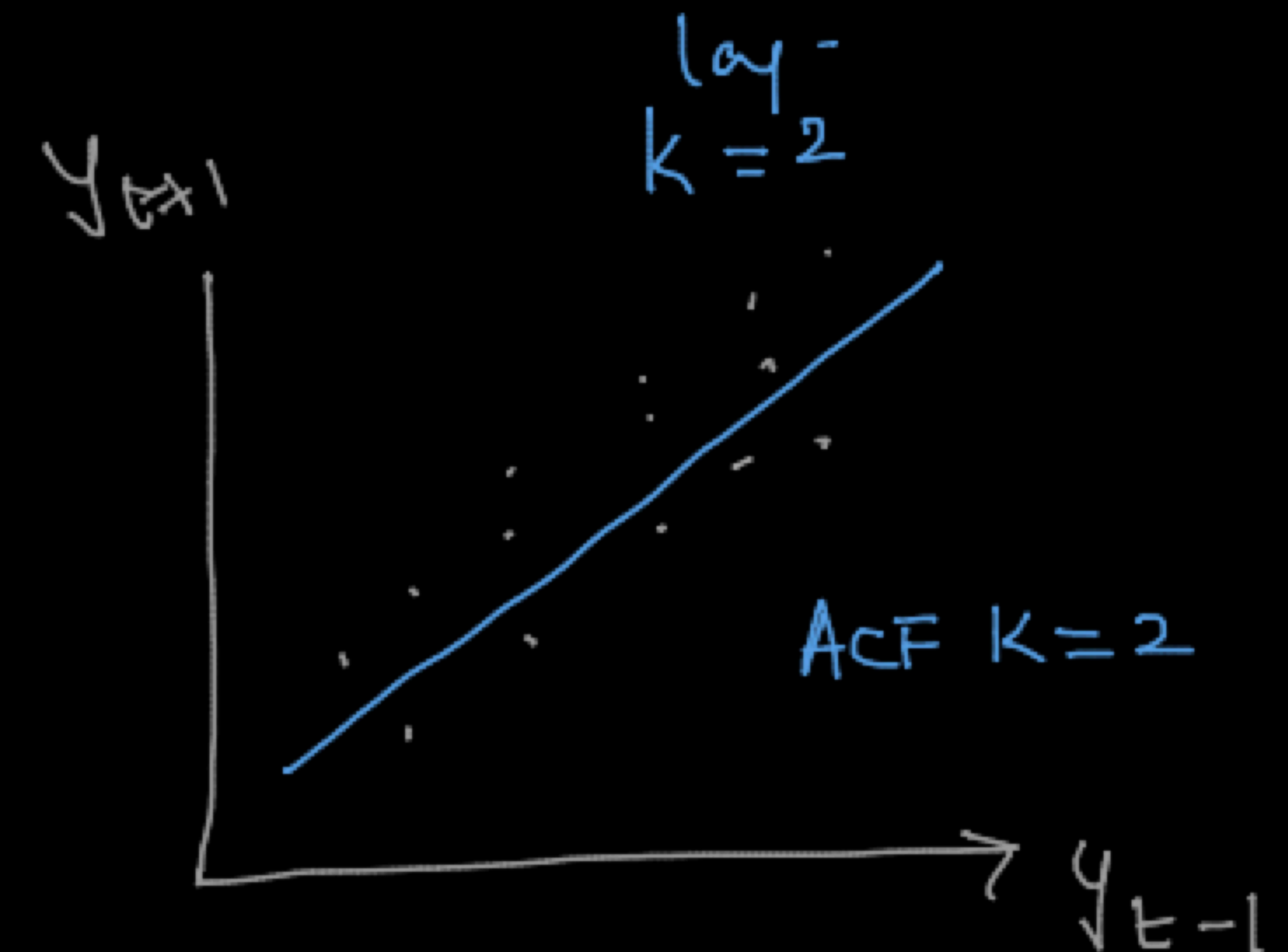
Auto Reg.



Lag plot:

Auto-correlation between
Past (y) and future (y).

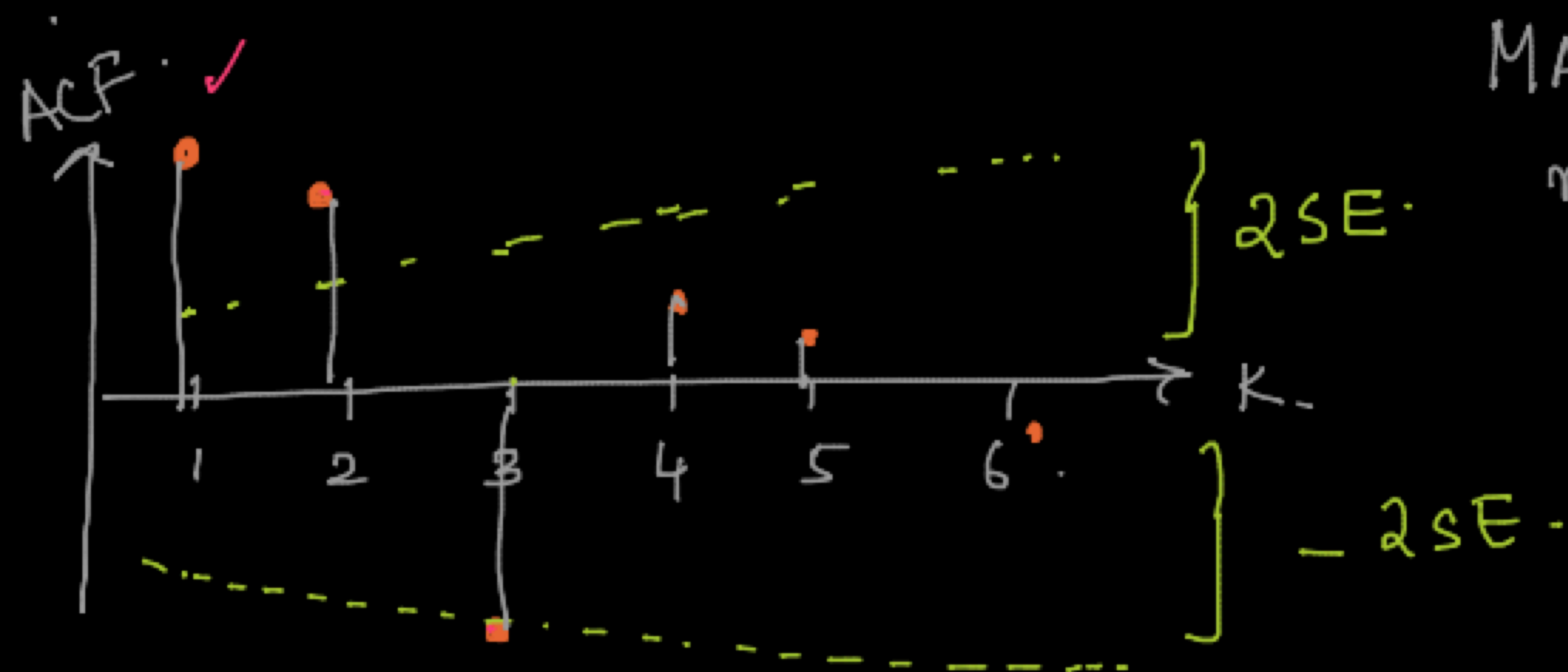
ACF & PACF



ACF.

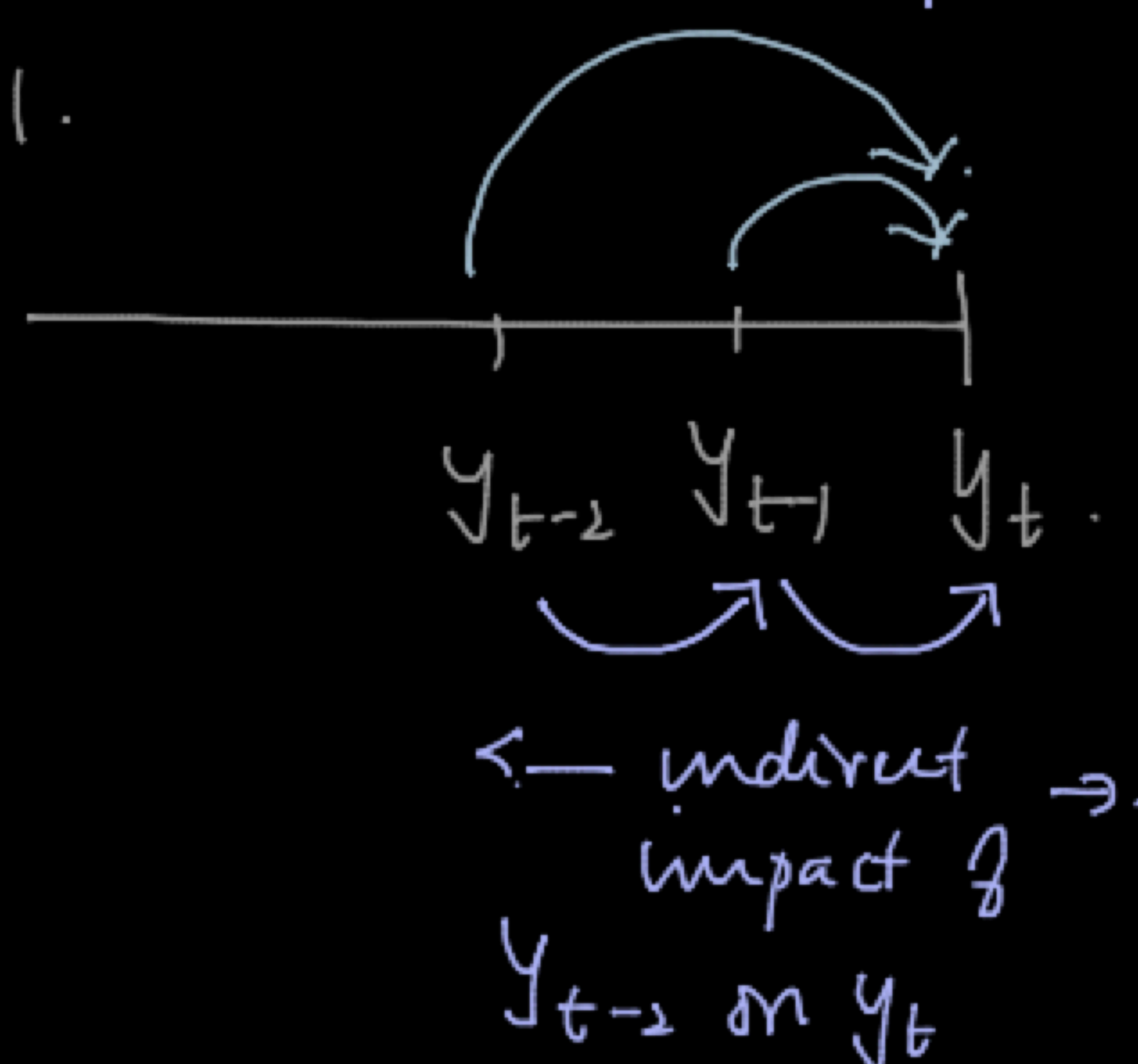
MA-Models

— ACF decides how many periods to include



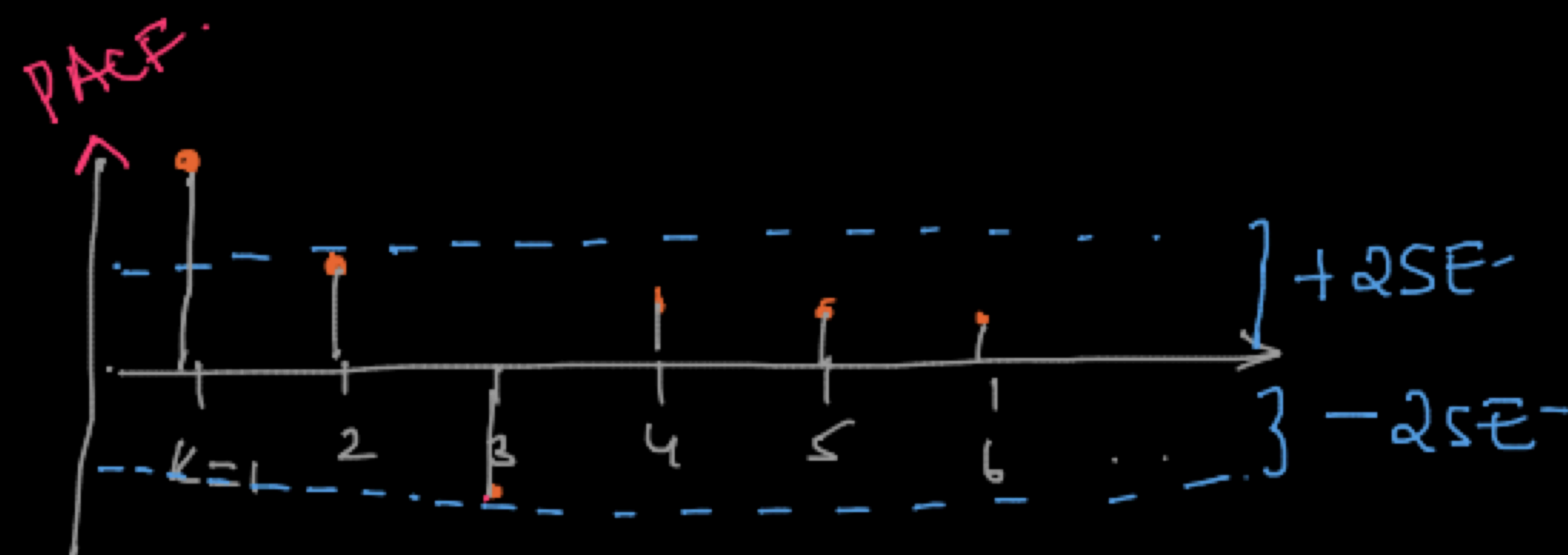
MA(3)
model.

Direct Impact -



ACF \rightarrow Direct + Indirect Effect -

PACF \rightarrow only the direct impact



$$y = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots$$

$\beta_3 y_{t-3}$ \rightarrow order

AR Models

\rightarrow PACF decides how many periods to include

$$y = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots$$

AR(2) model.

AR. \rightarrow AR(2) ✓

MA \rightarrow MA(3).

ARMA \rightarrow .

AR Model: Order of MA = 0.

| | | | |
|---|---|---|--|
| { | AR(2) MA(0) \rightarrow AR(2), | } | Data should be stationary \rightarrow No trend, No Season. |
| | AR(0) MA(3) \rightarrow MA(3), | | |
| | AR(2) MA(3) \rightarrow ARMA. | | |
| | AR(2) I(2) MA(3) \rightarrow ARIMA. \rightarrow Includes Trend. | | |

SARIMA \rightarrow .