

FURTHER MATHEMATICS
Teach Yourself Series
Topic 3: Time Series

SAMPLE

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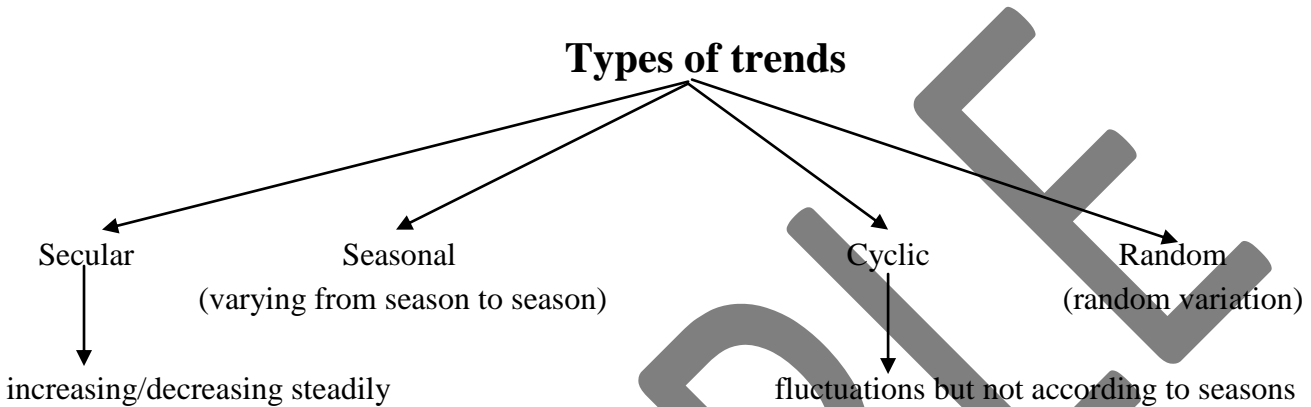
SAMPLE

Time Series

A time series is a set of measurements taken over equally spaced time intervals (hourly, daily, weekly, monthly, yearly). This concept helps us to see how some quantity varies over time.

Trend lines

As it appears in Unit 3



Example.

For the following, discuss whether the trends are likely to be secular, seasonal, cyclic or random.

- | | |
|--|--------------|
| (a) The number of tissues used as members of a family progressively catch colds, one after another (assume that no one recovers during the time period examined) | (a) Secular |
| (b) The number of Christmas trees held in stock by a department store | (b) Seasonal |
| (c) The number of football jumpers sold in Say-Mart | (c) Cyclical |
| (d) The number of ice-creams sold half-hourly at a cricket match | (d) Random |

Review Questions

1. For the following, discuss whether the trends are likely to be secular, seasonal, cyclic or random type.

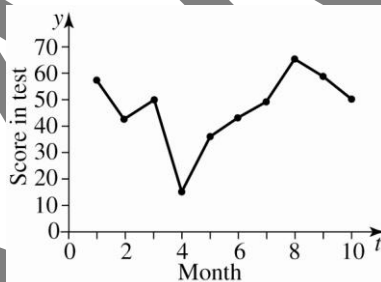
a. The volume of water held in a dam during drought in 2006.

b. Average weights of infants aged 2 months to 1 year.

c. Food sales figures of a restaurant in a particular year.

d. The price of apples over a period of 12 months.

2. The following figure shows the progressive scores in a Further Maths test over a 10 month period.



The data is:

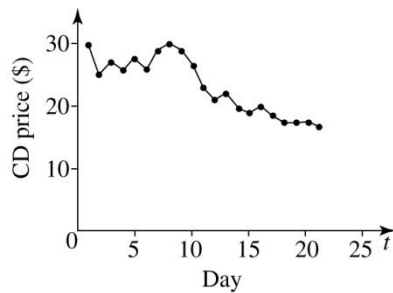
- A. cyclic
- B. seasonal
- C. secular
- D. random
- E. none of the above

Fitting trend lines

As it appears in Unit 3

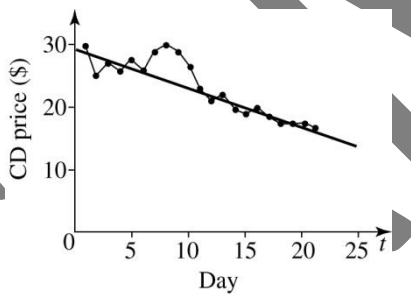
- Trend line is a straight line that represents the entire time series.
- Can be used to predict future values.
- Can be found in different ways –
 - 1) No smoothing (for linear time series): fit the line by eye or least squares method
 - 2) With smoothing (for random/cyclic/secular): fit the line using least squares method
 - 3) With deseasonalising (for seasonal only): fit the line using least squares method

Example. Consider the data in the following figure.



The data represent the price of CDs over a 3-week period.

(a) Fit a straight trend line to the data by eye.



(b) Predict the price on day 25.

\$14

Solutions to Review Questions

- 1.
- a. Secular trend
 - b. Secular trend
 - c. Seasonal trend
 - d. Seasonal trend

2. *Answer: D*

Explanation:

There is no trend so random.

- 3.
- a. $\text{Cost} = -0.2227 \times \text{day} + 66.1091$
 - b. $\text{Cost} = -0.2227 \times 15 + 66.1091 = 62.8$

4. *Answer: C*

Explanation:

$$0.325 \times 21 + 4.56 = 11.39$$

5. *Answer: D*

Explanation:

Find the median of last five points.