

TIME-BASED DATA

1 MARK QUESTIONS

- The variations which occur due to change in climate, festivals or weather conditions are known as
(A) Secular variations (B) cyclic variations (C) seasonal variations (D) irregular variations
[March, 2025]
- For the given values 23, 32, 40, 47, 58, 33, 42; the 5-yearly moving averages are :
(A) 38, 40, 42 (B) 40, 42, 44 (C) 40, 42, 46 (D) 42, 44, 46
[March, 2024]
- The straight line trend is represented by the equation :
(a) $y_c = a + bx$ (b) $y_c = a - bx$ (c) $y_c = na + b\sum x$ (d) $y_c = na - b\sum x$
[March, 2023, July, 2025]
- If for a data, $n = 6$, $\sum y = 84$, $\sum xy = 108$, $\sum x^2 = 70$ and $\sum x = 0$, then the equation of the straight line trend is :
(A) $y_c = 14 + 1.54x$ (B) $y_c = 1.54 + 14x$ (C) $y_c = 14 + 3.08x$ (D) $y_c = 3.08 + 14x$
[July, 2024]
- For the given values 15, 23, 28, 36, 41, 46, the 3-yearly moving averages are :
(a) 24, 29, 35, 41 (b) 22, 28, 35, 41 (c) 22, 29, 35, 41 (d) 24, 28, 35, 41
[July, 2023]
- Match the following columns to complete the sentence and choose the correct option:

Trend Component	Pattern of variation	Time period of variation
I. Secular trend	a. is a regular periodic variability	i. over a period more than a year
II. Cyclic trend	b. has smooth, regular variations	ii. withing a period of one year
III. seasonal trend	c. has oscillatory variation	iii. over a long-term

 (A) I - a - ii; II - b - iii; III - c - i (B) I - b - iii; II - c - i; III - a - ii
 (C) I - b - ii; II - c - i; III - a - iii (D) I - b - ii; II - a - iii; III - c - i
 [SQP 25-26]
- The component of a time series attached to long term variations is termed as
(A) Seasonal variations (B) Irregular variations
(C) Secular trend variations (D) Cyclic variations
[SQP 24-25]
- For the given five values 35, 70, 36, 59, 64, the three years moving averages are given by
(a) 47, 53, 55 (b) 53, 47, 45 (c) 47, 55, 53 (d) 45, 55, 57
[SQP 23-24]
- A factory production is delayed for three weeks due to breakdown of a machine and unavailability of spare parts. Under which trend oscillation does this situation fall under?
a) Seasonal b) Cyclical c) Secular d) Irregular
[SQP 22-23]
- For predicting the straight-line trend in the sales of scooters (in thousands) on the basis of 6 consecutive years data, the company makes use of 4-year moving averages method. If the sales of scooters for respective years are a, b, c, d, e and f respectively, then which of the following average will not be computed?
 (A) $\frac{a + b + c + d}{4}$ (B) $\frac{b + c + d + e}{4}$ (C) $\frac{a + c + d + e}{4}$ (D) $\frac{c + d + e + f}{4}$
 [SQP 22-23]

2 MARKS QUESTIONS

11. The following table shows the annual rainfall (in mm) recorded for Cherrapunji, Meghalaya :

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Rainfall	1.2	1.9	2	1.4	2.1	1.3	1.8	1.1	1.3

Determine the trend of rainfall by 3-year moving average.

[March, 2022]

12. Fit a straight line trend by the method of least squares and find the trend value for the year 2008 for the following data :

Year	2001	2002	2003	2004	2005	2006	2007
Production (in lakh tonnes)	30	35	36	32	37	40	36

[March, 2022]

13. Find the trend values by taking five yearly moving averages for the following data :

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual Production (million tons)	16	14	20	18	22	17	19	21	20

[July, 2024]

14. For the following data, calculate trend values, using 3-yearly moving averages:

Year	2011	2012	2013	2014	2015	2016	2017
Production	412	438	446	454	470	483	490

[July, 2022]

15. Find the trend values using 3 yearly moving average for the loans sanctioned to farmers by a particular branch of a bank in a village.

Year	2016	2017	2018	2019	2020	2021
Amount (in Rs lakh)	25	30	32	40	45	50

[SQP 21-22]

3 MARKS QUESTIONS

16. Given below is the data of workers welfare expenses (in lakh ₹) in steel industries during 2016 – 2020 :

Year	2016	2017	2018	2019	2020
Workers welfare expenses (in lakh Rs)	106	185	220	300	510

Find the best fitted trend line by the method of least squares and tabulate the trend values.

[July, 2024]

17. Fit a straight line trend by the method of least squares to the following data:

Year	2010	2012	2013	2014	2015	2016	2019
Sales (in lakh Rs)	65	68	70	72	75	67	73

[July, 2022]

18. The following table shows the quarterly sales (in ₹crore) of a real estate company. Compute the trend by quarterly moving averages.

Years	Q1	Q2	Q3	Q4
2018	12	14	18	20
2019	18	16	20	22
2020	27	24	30	36

[SQP 21-22]

19. Fit a straight line trend by the method of least squares and estimate the trend for the year 2023.

Year	2014	2015	2016	2017	2018	2019	2020
Sales (in Rs lakh)	26	26	44	42	108	120	166

[SQP 21-22]

5 MARKS QUESTIONS

20. Compute the season indices by 4-year moving averages from the given data of production of paper (in thousand tons):

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Index number	2450	1470	2150	1800	1210	1950	2300	2500	2480	2680

[March, 20205]

21. Fit a straight-line trend by method of least squares for the following data: [5M]

Year	2011	2012	2013	2014	2015	2016
Production (in tons)	210	225	275	220	240	235

[March, 2025]

22. Fit a straight line trend by method of least squares to the following data and find the trend values :

Year	2010	2012	2013	2014	2015	2016	2019
Sales (in lakh Rs)	65	68	70	72	75	67	73

[March, 2023]

23. Fit a straight line trend by the method of least squares to the following data and find the trend values.

Year	2010	2012	2013	2014	2015	2016	2019
Sales (in lakh Rs)	65	68	70	72	75	67	73

[July, 2025]

24. Find the trend values by taking 4-yearly moving averages for the following data.

Year	2015	2016	2017	2018	2019	2020	2021	2022
Sales (in thousand Rs)	108	112	110	120	140	120	100	135

[July, 2025]

25. The annual rice production (in million tonnes) in a particular state over the past five years is as follows:

Year	2017	2018	2019	2020	2021
Rice Production (million tonnes)	9.5	10	10.5	11.2	12

Find the best fitted trend line by the method of least squares and tabulate the trend values that represents the rice production. Also predict the production for the year 2025.

[SQP 25-26]

26. The following data shows the number of vehicles passing through a busy traffic intersection on a specific road in National Capital of India during the months of March to December in 2023:

Month	March	April	May	June	July	August	September	October	November	December
Number of vehicles (in thousands)	30	35	38	36	40	42	39	45	48	47

Calculate the 3-month moving average for the given data and determine the trend. Plot the graph to represent the trend values.

[SQP 25-26]

27. Fit a straight-line trend by using the method of least squares for the following data and calculate the trend values.

Year	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Production (in tonnes)	2	4	3	4	4	2	4	9	7	10	8

[SQP 24-25]

28. The quarterly profits of a small-scale industry (₹ in thousands) are as follows

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2020	39	47	20	56
2021	68	59	66	72
2022	88	60	60	67

Calculate 4-quarterly moving averages.

[SQP 24-25]

CASE-BASED QUESTIONS

29. When observed over a long period of time, a time series data can predict trends that can forecast increase or decrease or stagnation of a variable under consideration. Such analytical studies can benefit a business for forecasting or prediction of future estimated sales or production.

The table below shows the sale of an item in a district during 1996 – 2001 :

Year	1996	1997	1998	1999	2000	2001
Sales (in lakh Rs)	6.5	5.3	4.3	6.1	5.6	7.8

Based on the above information, answer the following questions :

- (i) Determine the equation of the straight-line trend.
(ii) (a) Tabulate the trend values of the years and also compute expected sales trend for the year 2002.

OR

- (ii) (b) Fit a straight-line trend by the method of least squares for the following data :

Year	2004	2005	2006	2007	2008	2009	2010
Profit (Rs '000)	114	130	126	144	138	156	164

[March, 2024]

30. The following data shows the percentage of rural, urban and sub-urban Indians who have high speed internet connection at home.

Year	Rural	Urban	Sub-urban
2016	3	9	9
2017	6	18	17
2018	9	21	23
2019	16	29	29
2020	24	38	40

Based on the above information, answer the following questions :

(a) Derive straight-line trend by the method of least squares for the rural students.

OR

(a) Derive straight-line trend by the method of least squares for the urban Indians.

(b) What is the forecast for the year 2021 for urban group using trend equation ?

(c) What is the forecast for the year 2021 for rural group using trend equation ?

[July, 2023]

31. When observed over a long period of time, a time series data can predict trend that can forecast increase or decrease or stagnation of a variable under consideration. Such analytical studies can benefit a business for forecasting or prediction of future estimated sales or production

The table below shows the welfare expenses (in lakh) of Steel Industry during 2001-2005. Fit a straight line trend by the method of least squares and estimate the trend for the year 2008.

Year	2001	2002	2003	2004	2005
Welfare expenses	160	185	220	300	510

[SQP 23-24]

32. The annual rainfall(in mm) was recorded in Cherrapunji, Meghalaya

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Rainfall	1.2	1.9	2	1.4	2.1	1.3	1.8	1.1	1.3

Determine the trend of rainfall by three years moving average and draw the moving averages graph.

[SQP 23-24]

33. When observed over a long period of time, a time series data can predict trend that can forecast increase or decrease or stagnation of a variable under consideration. Such analytical studies can benefit a business for forecasting or prediction of future estimated sales or production.

Mathematically, for finding a line of best-fit to represent a trend, many methods are available. Methods like moving-averages and least-squares squares are some of the techniques to predict such trends.

Mrs. Shamita runs a bread factory and the record of her sales of bakery items for the period of 2015 - 2019 is as follows:

Year	2015	2016	2017	2018	2019
Sales (in thousand Rs)	35	42	46	41	48



Based on the above information, answer the following questions. Show steps to support your answers.

- (i) By taking year 2017 as origin, use method of least-squares to find the best-fit trend line equation for Mrs. Shamita's business. Show the steps of your working.

OR

- (i) Demonstrate the technique to fit the best-suited straight-line trend by the method of 3-years moving averages. Also draw the trend line.

- (ii) What are the estimated sales for Mrs. Shamita's business for year 2022?

- (iii) Mrs Shamita wishes to grow her business to yearly sale of ₹ 67400. In which year will she be able to reach her target?

[SQP 22-23]

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