

Time series and moving averages

About 50 minutes Calculator allowed 42 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/stats-time-series-and-moving-averages/

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

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| <p>A1 Needed today [2 marks]</p> <p>The ages of 7 people in a choir were 35, 130, 30, 50, 44, 49, 33. Which average best represents these values? Give its value and a reason.</p> <p>_____</p> <p>_____</p> | <p>A2 From chapter 4 [2 marks]</p> <p>A choropleth map shades hospital visits per 1000 people. District G had 171 hospital visits, which is 4.5 per 1000 people. How many more hospital visits would have put District G in the band "10 or more per 1000"?</p> |
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Answer

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| <p>A3 From chapter 7 [2 marks]</p> <p>For the masses, in grams, of some parcels at a depot, the mode is 38, the median is 32 and the mean is 25. Describe the skew of the distribution and say what it means in context.</p> <p>_____</p> <p>_____</p> | <p>A4 Last lesson [2 marks]</p> <p>A machine fills bags of rice. The target is 2000 g and the standard deviation of the sample means is 1.2 g. Work out the warning limits and the action limits for a control chart of sample means.</p> |
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Answer

B Examples, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

The graph shows a shop's ice cream sales each quarter for three years. Describe the trend and the seasonal pattern.



Hint The trend is what happens over the years. The seasonal pattern is what happens in the same quarter each year.

EXAMPLE 2

A museum had 42, 51, 48, 57, 54 and 63 visitors on six days, Monday to Saturday. Work out the 3-point moving averages. Which day is the first one plotted at?

Hint Average the first three days, then move along one day at a time.

EXAMPLE 3

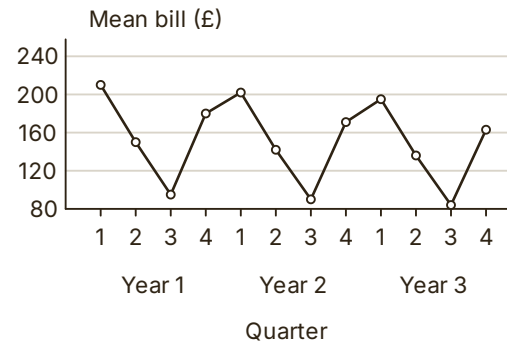
The table shows a hotel's bookings each quarter. Work out the 4-point moving averages. Where is the first one plotted?

	Q1	Q2	Q3	Q4
Year 1	120	150	210	140
Year 2	128	158	218	148

Hint Average Q1 to Q4 of year 1, then Q2 of year 1 to Q1 of year 2, and so on.

B1 The graph shows the mean household electricity bill each quarter for three years. [2 marks]

Describe the trend and the seasonal pattern.



B2 A radio show was sent 36, 45, 39, 48, 42, 51 and 45 texts on days 1 to 7. Work out the first two 3-point moving averages. Which day is the first one plotted at? [3 marks]

Answer

B3 The table shows a shop's coat sales each quarter. Work out the first three 4-point moving averages. Where is the first one plotted? [3 marks]

	Q1	Q2	Q3	Q4
Year 1	84	52	40	96
Year 2	92	60	48	104

Answer

EXAMPLE 4

Explain why a 4-point moving average is used for quarterly data.

Hint How many quarters does it take for the pattern to repeat?

- B4** A school shop records its uniform sales in each of the three terms of the year. Which moving average should it use to show the trend? Give a reason. [2 marks]

EXAMPLE 5

A 4-point moving average of quarterly sales is 62. Three of the four quarters had sales of 58, 70 and 51. Work out the sales in the fourth quarter.

Hint The four values must add up to 4×62 .

- B5** A 4-point moving average of a gym's quarterly new members is 47.5. Three of the four quarters had 40, 52 and 61 new members. Work out the number in the fourth quarter. [2 marks]

Answer

C Practice

- C1** A cafe sold 64, 70, 58, 73 and 61 cups of tea on five days, Monday to Friday. Work out the 3-point moving averages. [3 marks]

Answer

- C2** The table shows a chemist's sunscreen sales each quarter. Work out the three 4-point moving averages, and say where the last one is plotted. [3 marks]

	Q1	Q2	Q3	Q4
Year 1	18	64	92	26
Year 2	22	72		

Answer

- C3** Ellie records how many pupils buy lunch each school day (Monday to Friday) for four weeks. Which moving average should she use? Give a reason. [2 marks]

- C4** A 4-point moving average of a cinema's quarterly ticket sales (thousands) is 112. Three of the quarters had 96, 130 and 118. Work out the fourth. [2 marks]

Answer

D Exam-style questions

- D1** A train company carried 312, 285, 340 and 299 thousand passengers in the four quarters of one year. Zara says, "The 4-point moving average is 309, and I plot it at Q4." [3 marks]
- Is Zara correct? Show your working.

- D2** The table shows the number of rail passengers (thousands) at a station each quarter for three years. The 4-point moving averages are 52, 53.25, 54.25, a , 56.5, 57.5, 58.75, b and 61.

	Q1	Q2	Q3	Q4
Year 1	46	52	61	49
Year 2	51	56	66	53
Year 3	55	61	70	58

- (a) Work out the values of a and b . [2 marks]

Answer

- (b) Between which two quarters is the moving average 52 plotted? [1 mark]

Answer

- (c) Describe the seasonal pattern. [1 mark]

- (d) Use the moving averages to describe the trend. Give a value in your answer. [2 marks]

Total for D2: 6 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** For one firm's quarterly sales, the 4-point moving average of quarters 1 to 4 is 40, and the 4-point moving average of quarters 2 to 5 is 43. Sales in quarter 1 were 34. Work out the sales in quarter 5. [3 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1

Hint 1

Turn each moving average into the total of its four quarters.
- Hint 2

The totals are 160 and 172. They share quarters 2, 3 and 4.
- Hint 3

So quarter 5 is $172 - 160 = 12$ more than quarter 1.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can describe a time series by its trend and its seasonal pattern.
- I can work out 3-point and 4-point moving averages and plot each at the middle of its period.
- I can choose the order of a moving average from the repeating pattern.