



S15-30min Time Series and Moving Averages: 30-minute Pack

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

Total Marks

--

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** State the name given to a pattern that rises and falls in the same way at the same point in every year, such as ice lolly sales rising every summer.

(Total for Question 1 is 1 mark)

- 2** For each statement about time series and moving averages, write down whether it is True or False.

(i) A time series is a set of observations recorded at successive points in time, usually at equal intervals. (1)

(ii) A 4-point moving average is found by adding 4 consecutive data values and dividing the total by 4. (1)

(iii) Each 4-point moving average value is plotted at the same time point as the last of the 4 values used to calculate it. (1)

(iv) The trend is the underlying long-term pattern that remains once a moving average has smoothed out seasonal variation. (1)

(Total for Question 2 is 4 marks)

- 3** A shop's quarterly sales are 34, 58, 82, 38. Work out the first 4-point moving average for this data.

(Total for Question 3 is 2 marks)

- 4** The trend line for a cafe's sales has a value of 48 in one quarter, and increases by 3 each quarter after that. Work out the trend value two quarters later.

(Total for Question 4 is 2 marks)

- 5** A shop's quarterly sales produce the following five successive 4-point moving averages, in order: 120, 118, 121, 125, 130.

- (a) State whether the trend is increasing, decreasing, or roughly constant. (1)
- (b) Give a reason for your answer, using values from the list. (1)
- (c) A student claims that, because the trend is increasing, Quarter 3 sales must always be the highest quarter of the year. Is the student correct? Write Yes or No, and give a brief reason. (2)

(Total for Question 5 is 4 marks)

6 A theme park manager wants to investigate whether monthly visitor numbers show a repeating seasonal pattern and a long-term trend, to help plan how many staff to employ each quarter.

(a) Plan: state an appropriate time interval over which to collect visitor number data, (2)
and explain why at least two full years of data should be collected before drawing any conclusion about seasonality.

(b) Collect: state one advantage of using the park's own turnstile records (a (1)
secondary data source) rather than carrying out a new visitor survey.

(c) Process: the table shows quarterly visitor numbers, in thousands, for two years. (3)

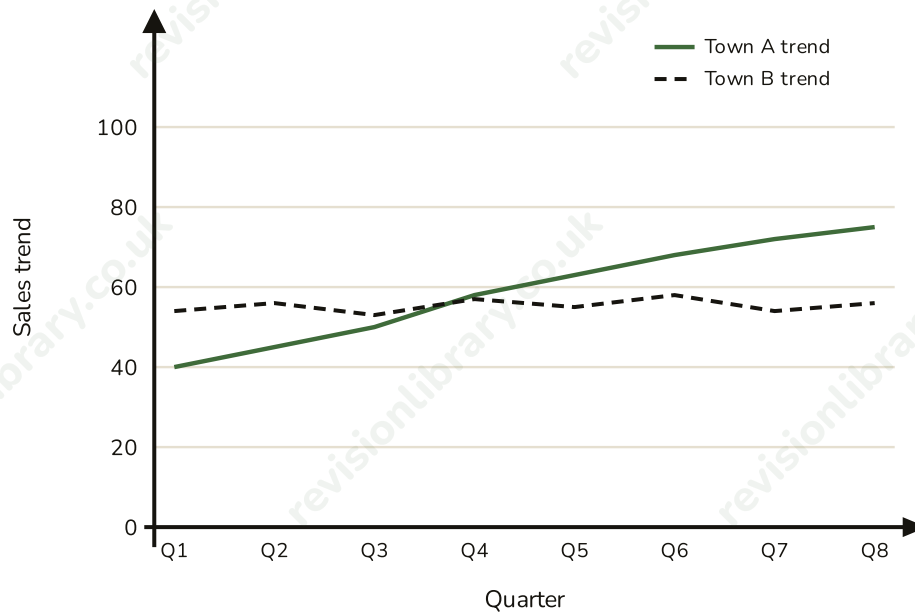
Quarter	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3	Y2 Q4
Visitors (thousands)	8	22	35	12	10	25	39	14

Calculate the first two 4-point moving averages for this data.

.....
(d) Interpret: three further moving averages, continuing from part (c), are 20.5, 21.5 (3)
and 22. Using all five values, describe the trend, and suggest one staffing decision the manager could make based on it, linking back to the original purpose of the investigation.

(Total for Question 6 is 9 marks)

- 7 The graph shows the moving-average trend lines for ice cream sales in two different towns over the same 8 quarters.



- (a) Identify which town shows an increasing trend, and which town shows a roughly constant (flat) trend. (2)
- (b) The manager of Town B says: 'Our trend line is flat, so our ice cream sales are never affected by the season.' Comment on whether this is a fair conclusion. (2)

(Total for Question 7 is 4 marks)

- 8 A garden centre's quarterly bedding-plant sales are 22, 58, 90, 34, 26, 62. Calculate the first three 4-point moving averages for this data, then state whether the trend is increasing, decreasing or roughly constant.

(Total for Question 8 is 4 marks)

Mark scheme · S15-30min Time Series and Moving Averages: 30-minute Pack

Question 1

- **B1** Seasonal variation cao
- **Answer: Seasonal variation**

Question 2

- (i) **B1** True cao
- **(i) Answer: True**
- (ii) **B1** True cao
- **(ii) Answer: True**
- (iii) **B1** False cao
- **(iii) Answer: False**
- (iv) **B1** True cao
- **(iv) Answer: True**

Question 3

- **M1** $34 + 58 + 82 + 38$, oe (=212)
- **A1** 53 cao
- **Answer: 53**

Question 4

- **M1** $48 + 3 + 3$, oe
- **A1** 54 cao
- **Answer: 54**

Question 5

- (a) **B1** Increasing cao
- **(a) Answer: Increasing**
- (b) **B1** compares the first and last values (e.g. 130 is greater than 120), or notes the values generally rise overall, oe
- **(b) Answer: The final moving average (130) is higher than the first (120), and the values generally rise across the list.**
- (c) **B1** No
- (c) **B1** moving averages smooth out/remove the seasonal variation between quarters, so the trend on its own cannot show which individual quarter is highest within a year, oe
- **(c) Answer: No - the moving average removes the seasonal variation between quarters, so it cannot show which individual quarter has the highest raw sales within a year.**

Question 6

- (a) **B1** states a suitable interval, e.g. quarterly (or monthly)
- (a) **B1** explains that at least two full cycles/years are needed to check that a pattern genuinely repeats, rather than being a one-off event in a single year, oe
- (a) **Answer: Collect visitor numbers each quarter, for at least two full years, so any pattern can be checked for repeating rather than being a one-off.**
- (b) **B1** e.g. the data already exists / records every visitor exactly / is quicker and cheaper than running a new survey, oe
- (b) **Answer: Turnstile records already exist and count every visitor exactly, so they are quicker and cheaper to use than collecting new survey data.**
- (c) **M1** correct method shown, e.g. $(8+22+35+12)/4$
- (c) **A1** 19.25 cao
- (c) **A1** 19.75 cao
- (c) **Answer: 19.25, 19.75**
- (d) **B1** trend is increasing (visitor numbers are rising from one year to the next), since 19.25, 19.75, 20.5, 21.5, 22 rises steadily
- (d) **B1** identifies that Quarter 3 remains the seasonal peak each year (raw data 35 then 39)
- (d) **B1** gives a sensible staffing recommendation linked to the purpose, e.g. schedule extra staff every Quarter 3, and gradually increase baseline staffing over time as the underlying trend rises, oe
- (d) **Answer: The trend is increasing; Quarter 3 is the seasonal peak each year, so the manager should schedule extra staff every Quarter 3 and gradually increase overall staffing as the rising trend continues.**

Question 7

- (a) **B1** Town A - increasing trend
- (a) **B1** Town B - roughly constant/flat trend
- (a) **Answer: Town A: increasing. Town B: roughly constant.**
- (b) **B1** not fair/not correct - a flat trend only means the underlying long-term average is not rising or falling
- (b) **B1** the raw quarterly sales can still rise and fall with the season around a flat trend; the moving average simply smooths/removes that seasonal variation from view, oe
- (b) **Answer: Not a fair conclusion. A flat trend line only shows that the long-term average is not changing - the raw quarterly sales in Town B could still rise and fall with the seasons; the moving average has simply smoothed that seasonal variation out of the graph.**

Question 8

- **M1** correct method shown, e.g. $(22 + 58 + 90 + 34) / 4$
- **A1** 51 cao
- **A1** 52 and 53 cao
- **B1** Increasing, ft (since 51, 52, 53 rise steadily)
- **Answer: 51, 52, 53; the trend is increasing**