



eClassroom

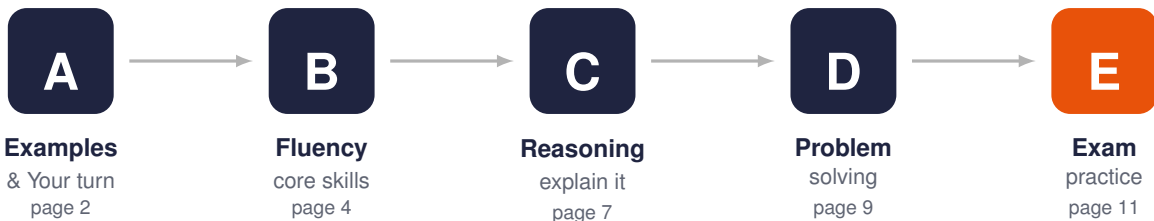
GCSE MATHEMATICS • DATA & STATISTICS

Time Series

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Free Time Series worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: read and plot time series graphs • describe the trend and any seasonal pattern • work out changes and percentage changes over time • make predictions and judge how reliable they are •
Higher: rates of change, predictions from seasonal patterns, and comparing two series.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER The same skills where Higher papers use them: rates of change, predictions from seasonal patterns, comparing series and growth. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	13	15
Higher marks	16	14	17	15
My score				

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A

Worked examples & Your turn

Read each example carefully. Cover it up, then answer the question beside it using the same method.

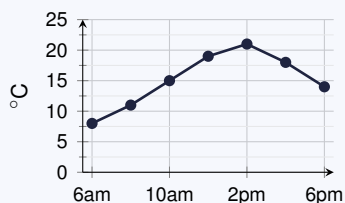
FOUNDATION

Everyone starts here

Worked example A1

The graph shows the temperature during a day. What was it at 10 am?

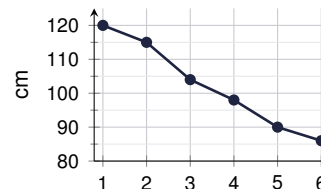
Go up from 10 am to the line, then across.



15°C

Your turn A1

The graph shows the water level in a tank. What was it on day 4?



Worked example A2

A town's population (thousands) from 2016 to 2021 was 42, 44, 45, 47, 50, 52. Describe the trend and find the total change.

The values rise over the period. Change = $52 - 42$

increasing; up 10 thousand

Your turn A2

The number of homes with a landline (thousands) from 2016 to 2021 was 30, 27, 25, 21, 19, 16. Describe the trend and find the total change.

Worked example A3

Quarterly heating bills (£): Year 1: 180, 90, 60, 150; Year 2: 190, 95, 62, 160. Which quarter is highest each year, and why?

Look for the pattern that repeats every year.

Q1: winter needs the most heating

Your turn A3

Quarterly sunscreen sales: Year 1: 20, 60, 90, 25; Year 2: 22, 66, 95, 28. Which quarter is highest each year, and why?



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HIGHER*Higher strategies: rates of change, comparing series and predictions***Worked example A4: percentage change over time**

Sales rose from 40 in January to 50 in June. Find the percentage change.

Change = 10. Divide by the starting value.

$$\frac{10}{40} \times 100$$

25% increase

Your turn A4

Sales fell from 80 in March to 68 in May. Find the percentage change.

Worked example A5: the average rate of change

A value was 120 in 2015 and 168 in 2023. Find the average change per year.

$168 - 120 = 48$ over 8 years.

6 per year

Your turn A5

A value was 95 in 2010 and 60 in 2020. Find the average change per year.

Worked example A6: comparing two series

Yearly sales, years 1 to 5. Shop A: 30, 34, 38, 42, 46. Shop B: 20, 27, 34, 41, 48. When does B first sell more than A?

Compare year by year: in year 4, $41 < 42$; in year 5, $48 > 46$

year 5

Your turn A6

Yearly sales, years 1 to 5. Shop A: 50, 48, 46, 44, 42. Shop B: 30, 35, 40, 45, 50. When does B first sell more than A?

Worked example A7: seasonal predictions

Heating bills in Q1 for three years were £180, £190, £204. Predict Q1 next year.

Compare the same quarter each year: increases of 10 and 14, a mean of 12

£216

Your turn A7

Heating bills in Q3 for three years were £60, £62, £67. Predict Q3 next year.



B**Fluency**

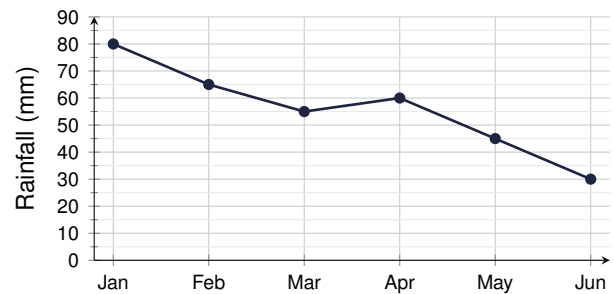
Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

FOUNDATION

Everyone starts here

B1 The graph shows the monthly rainfall at a town.

- (a) What was the rainfall in January?
 (b) Which month was wettest?
 (c) Which month was driest?
 (d) In which month did the rainfall increase?



[4 marks]

B2 Use the same graph.

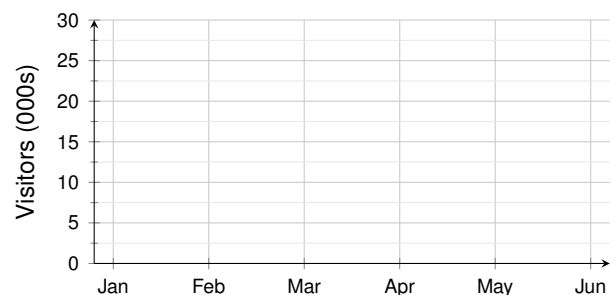
- (a) How much did the rainfall rise from March to April?
 (b) Find the total rainfall from January to March.
 (c) Find the mean monthly rainfall.
 (d) Find the range.

[4 marks]

B3 The table shows a museum's visitors (thousands).

Month	Jan	Feb	Mar	Apr	May	Jun
Visitors	12	15	14	18	21	26

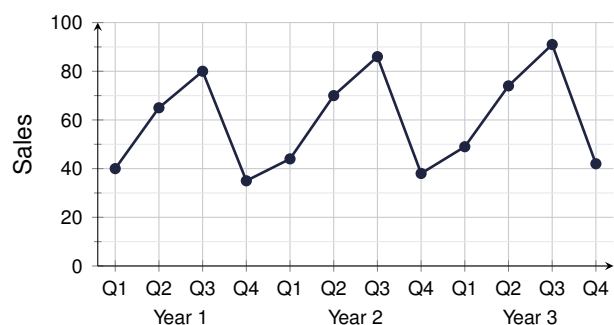
- (a) Plot the points and join them.
 (b) Describe the trend.
 (c) Between which months was the largest rise?
 (d) Predict the number in July.



[4 marks]

B4 The graph shows a shop's quarterly sales over three years.

- (a) What were the sales in Q3 of year 1?
 (b) Which quarter has the lowest sales each year?
 (c) Describe the trend.
 (d) Describe the seasonal pattern.



[4 marks]



FOUNDATION*continued: reading claims and misleading graphs*

B5 Use the quarterly sales graph in B4. Is each statement true or false?

(a) Q4 sales in year 3 were higher than Q4 sales in year 1

(b) Sales fell from Q3 to Q4 every year.

(c) Q1 had the lowest sales in year 2

[3 marks]

B6 Explain how each feature could make a time-series graph misleading.

(a) The vertical axis starts at 90 instead of 0 (b) The years on the time axis are not equally spaced

(c) There is no scale on the vertical axis (d) Only the last two months of data are shown [4 marks]

HIGHER*Higher tier only*

B7 Find the percentage change in each case.

(a) 40 to 46

(b) 80 to 60

(c) 125 to 150

(d) 2.4 to 3.0

[4 marks]

B8 Find the average change per year.

(a) 50 in 2010 to 80 in 2020 (b) 200 in 2012 to 160 in 2020

(c) 12.5 in 2000 to 20 in 2025 (d) 40 in Q1 of year 1 to 49 in Q1 of year 3

[4 marks]



HIGHER*continued: yearly figures and predictions*

B9 Use the quarterly sales graph in B4.

(a) Find the total sales in year 1 (b) Find the mean quarterly sales in year 2

(c) Find the mean quarterly sales in year 3 (d) By how much does the mean increase each year, on average? **[4 marks]**

B10 The table shows another shop's quarterly sales. Predict the sales in each quarter of year 4, using the mean increase in the same quarter.

	Q1	Q2	Q3	Q4
Year 1	22	48	61	30
Year 2	25	51	66	32
Year 3	29	55	70	36

(a) Q1

(b) Q2

(c) Q3

(d) Q4

[4 marks]





Reasoning

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** Tom looks at the quarterly sales graph in B4. He says, "Sales are going down, because they fell from Q3 to Q4 in year 3."
Explain why Tom is wrong. [2 marks]
- C2** On a time-series graph the points are joined with straight lines. Explain what a point on a line between two plotted points tells you. [2 marks]
- C3** A company's sales have risen every month for a year. Explain why it may be unreliable to use this to predict its sales in five years' time. [3 marks]
- C4** Monthly sales rose from 32 to 40. Show that this is a 25% increase. [3 marks]



HIGHER*Higher tier only*

- C5** A shop's sales rose from 42 in Q4 to 49 in the next Q1. The manager says, "Sales went up, so business is improving."
Explain why comparing Q1 with the previous Q4 can be misleading, and say what she should compare instead. **[3 marks]**
- C6** A value rose by an average of 6 per year from 2015 to 2023. Does this mean it rose by 6 every year? Explain. **[3 marks]**
- C7** Two time-series graphs show the sales of two shops, drawn with different vertical scales. Explain why you should not compare them just by how steep the lines look. **[3 marks]**
- C8** A town's population was 2000, 2200 and 2420 in three consecutive years.
(a) Show that the population increased by the same percentage each year.
(b) If this continues, predict the population two years after the 2420 year.
(c) Explain why a straight-line trend would give a smaller prediction. **[5 marks]**



D

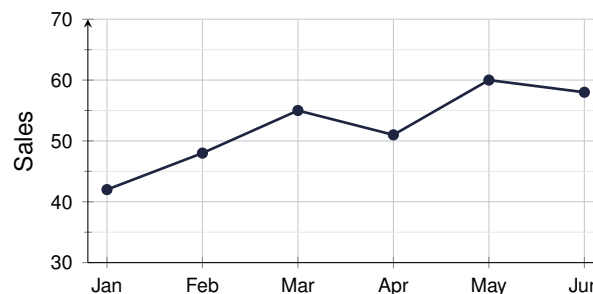
Problem solving

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

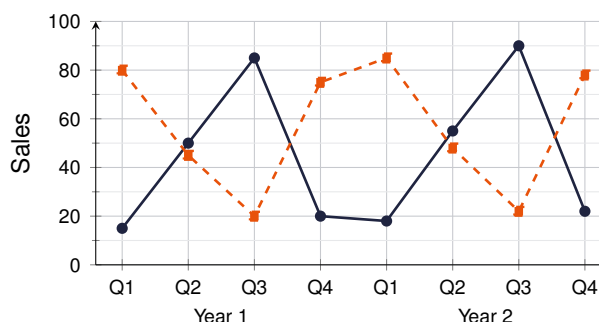
- D1** The graph shows a café's weekly sales (hundreds) from January to June. The owner's target is a mean of at least 50. Was the target met? Show your working.



[3 marks]

- D2** The graph shows a café's sales each quarter: ice creams (solid line) and hot drinks (dashed line).

- (a) Describe the seasonal pattern of each.
(b) Explain why the patterns are opposite.



[4 marks]

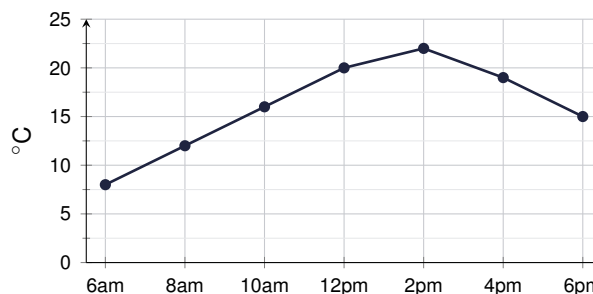
- D3** The table shows a shop's monthly sales. The mean for the six months was 45

Month	Jan	Feb	Mar	Apr	May	Jun
Sales	40	52	x	38	50	47

Find the sales in March.

[3 marks]

- D4** The graph shows the temperature during a day. For how long was the temperature above 18°C ?



[3 marks]



HIGHER*Higher tier only*

- D5** Use the quarterly sales graph in B4.
- (a) Find the total sales in each of the three years.
- (b) The total rises by the same amount each year. Does it rise by the same percentage each year? Show your working. [4 marks]
- D6** Yearly sales, years 1 to 5. Shop A: 120, 126, 131, 137, 142. Shop B: 90, 102, 116, 130, 145
- (a) In which year does B first sell more than A? (b) Find the percentage increase in B's sales from year 1 to year 5 [4 marks]
- D7** Use the quarterly sales graph in B4.
- (a) Predict the Q4 sales in year 4, using the mean increase in Q4
- (b) Give one reason why your prediction might be wrong. [4 marks]
- D8** A shop's sales in one year totalled 250. Q1 sales were 50 and Q2 sales were 70. Q4 sales were 37.5% less than Q3 sales.
- (a) Find the sales in Q3 and in Q4
- (b) What percentage of the year's sales were in Q3? [5 marks]



E

Exam practice

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION

Foundation and Higher crossover

- E1** The graph shows the visitors (hundreds) to a park each month.

(a) How many visitors were there in March?

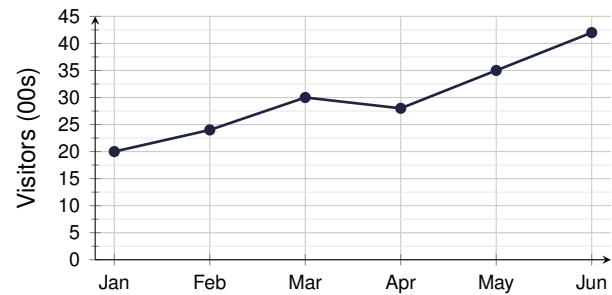
.....
(1)

(b) In which month were there the most visitors?

.....
(1)

(c) Work out the increase from May to June.

.....
(1)



(Total for Question E1 is 3 marks)

- E2** The table shows a plant's height. The first three points are plotted.

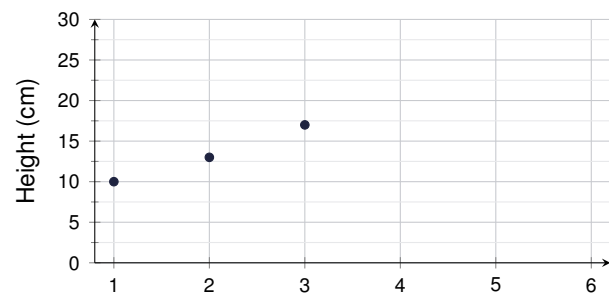
Day	1	2	3	4	5	6
Height (cm)	10	13	17	20	24	27

(a) Plot the other three points and join them.

(2)

(b) Describe the trend.

.....
(1)



(Total for Question E2 is 3 marks)



E3 The graph shows a shop's quarterly sales.

(a) Describe the trend.

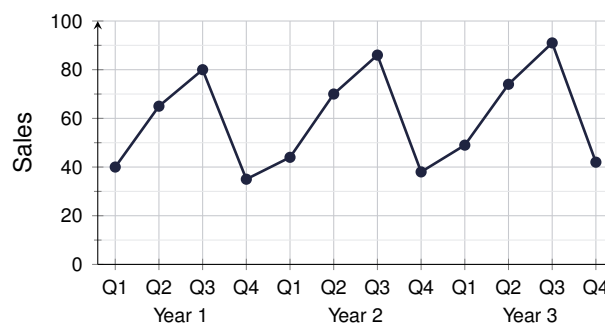
.....
(1)

(b) Describe the seasonal pattern.

.....
(1)

(c) Which quarter has the highest sales each year?

.....
(1)



(Total for Question E3 is 3 marks)

E4 Use the graph in E1. Work out the percentage increase in visitors from January to June.

.....
(Total for Question E4 is 3 marks)

E5 A company's yearly profits (£1000s) were 12, 15, 18, 21

(a) Predict the next year's profit.

.....
(1)

(b) What have you assumed?

(1)

(c) Why would a prediction for ten years' time be less reliable?

(1)

(Total for Question E5 is 3 marks)



HIGHER*Higher tier only*

- E6** Use the graph in E3. Work out the percentage increase in Q2 sales from year 1 to year 3, and explain why Q2 is compared with Q2.

.....
(Total for Question E6 is 3 marks)

- E7** The value of a painting was £36 000 in 2014 and £60 000 in 2022
Work out the average increase per year.

.....
(Total for Question E7 is 3 marks)

- E8** Yearly sales, years 1 to 5. Shop A: 50, 55, 58, 60, 61. Shop B: 30, 40, 50, 60, 70

(a) In which year were the sales of the two shops equal?

.....
(1)

(b) In year 5, what percentage of the two shops' total sales were made by shop B?

.....
(2)

(c) Compare the trends of the two shops.

(1)

(Total for Question E8 is 4 marks)



E9 Use the graph in E3.

(a) Work out the mean quarterly sales in each year, and the average increase in this mean per year.

.....
(2)

(b) In each year, work out how far the Q3 sales are above that year's mean, and find the average of these differences.

.....
(2)

(c) Use your answers to predict the Q3 sales in year 4

.....
(1)

(Total for Question E9 is 5 marks)

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