



Interpreting data from Time series - TSN

Mana Maths

Time Series: Read the Graph First



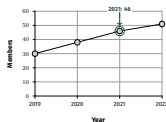
Key idea

A **time series** records one variable in time order. Read the axes, units and time interval first.

Read a value

At 2021 the point is 46, so membership was **46 members**.

Locate time, then value



Common mistake

Do not read across from the wrong year or omit the unit.

 = **copy this into your book.** Boxes without a pencil are just to read.

T = Trend



Key idea

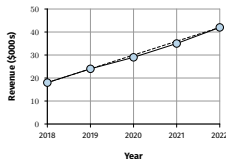
Trend is the long-term direction. Use **increasing**, **decreasing**, or **no clear trend**.

Quantify it

From 18 to 42: increase = $42 - 18 = 24$.

Percentage increase = $\frac{24}{18} \times 100 \approx 133\%$.

Describe the overall movement



Common mistake

Say **increasing trend**, not “positive trend” or only “it goes up”.

 = **copy this into your book.** Boxes without a pencil are just to read.

S = Seasonality



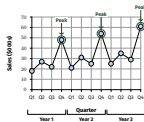
Key idea

Seasonality repeats at regular intervals. State the cycle length and the usual peak and trough.

Quarterly cycle

The pattern repeats every 4 quarters (1 year). Q4 is the peak and Q1 is the trough.

Compare the same period each cycle



Common mistake

A repeating rise and fall is not noise. Check whether it occurs at the same point in each cycle.

 = **copy this into your book.** Boxes without a pencil are just to read.

N = Noise and Prediction

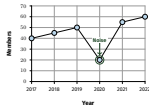


Key idea



Noise is unusual variation that does not fit the pattern. The 2020 dip is noise because later values return to the earlier increasing trend.

A one-off departure



Common mistake

A high or low point is not automatically noise. Compare it with the surrounding pattern.



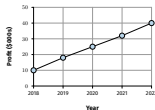
= copy this into your book. Boxes without a pencil are just to read.

Start Tasks

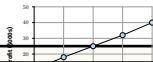


Read values directly off the time series graph and describe the trend in words.

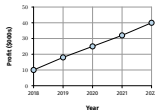
1. What was the profit in 2020?



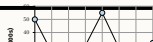
2. Describe the trend across all 5 years in one full sentence. Use “increasing” or “decreasing” – not “positive” or “negative.”



3. By how much did profit increase from 2019 to 2021?



4. In which month do ice-cream sales reach their peak? In which month do they reach their trough (lowest point)? What TSN component does this repeating pattern show?



Start Tasks – Answers



1. What was the profit in 2020?



Solution

Profit in 2020 = 25
(i.e. \$25,000)

3. By how much did profit increase from 2019 to 2021?



Solution

$32 - 18 = 14$
(i.e. \$14,000)

2. Describe the trend across all 5 years in one full sentence. Use “increasing” or “decreasing” – not “positive” or “negative.”



Solution

Profit is increasing every year from 10 to 40

4. In which month do ice-cream sales reach their peak? In which month do they reach their trough (lowest point)? What TSN component does this repeating pattern show?



Solution

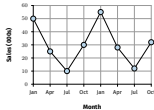
Peak Jan, trough Jul
(seasonal)

Start Tasks

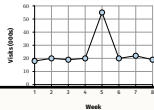


Read a further value, then spot the point that doesn't fit the pattern.

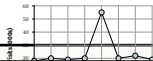
- 5.** What were the ice-cream sales in July of Year 2?



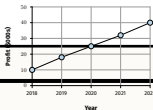
- 7.** What is the value of the spike in week 5, and by how much does it exceed the value in week 4?



- 6.** Website visits are usually steady week to week. In which week does an unusual spike happen? What TSN component is this?



- 8.** True or false: the trend in this profit graph should be described as “positive.” Explain using the correct TSN language.



Start Tasks — Answers



5. What were the ice-cream sales in July of Year 2?



Solution

July, Year 2 = 12

6. Website visits are usually steady week to week. In which week does an unusual spike happen? What TSN component is this?



Solution

Week 5 (55) is far above the 19-22 range – noise

7. What is the value of the spike in week 5, and by how much does it exceed the value in week 4?



Solution

Spike = 55; week 4 = 20.
Exceeds by $55 - 20 = 35$

8. True or false: the trend in this profit graph should be described as “positive.” Explain using the correct TSN language.



Solution

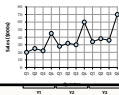
False – say “increasing”

Build Tasks

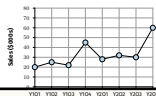


Read the trend and seasonality together from one graph, and quantify what you see.

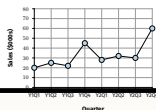
1. Describe the trend and seasonality. How many quarters make one cycle?



2. Calculate the percentage increase in Q4 sales from Year 1 to Year 2.



3. Calculate the percentage increase in Q1 sales from Year 1 to Year 2.



4. Describe the trend of Product A and the trend of Product B separately.



Build Tasks — Answers



1. Describe the trend and seasonality.
How many quarters make one cycle?

Solution

Increasing trend; Q4
peaks
each year. Cycle = 4
quarters



2. Calculate the percentage increase in
Q4 sales from Year 1 to Year 2.

Solution

45 → 60:

$$15/45 \times 100 \approx 33.3\%$$



3. Calculate the percentage increase in
Q1 sales from Year 1 to Year 2.

Solution

20 → 28:

$$8/20 \times 100 = 40\%$$



4. Describe the trend of Product A and
the trend of Product B separately.

Solution

A: steadily increasing.

B: steadily decreasing



Build Tasks



Compare two series, then use a dashed trend line to make a prediction.

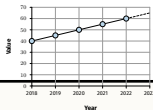
- 5.** In which month are Product A and Product B's sales closest together, and what is the difference in that month?



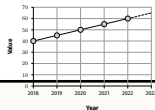
- 6.** By how much did Product A's sales increase from January to June?



- 7.** The dashed line shows the trend continuing. Using it, what value is predicted for 2023?



- 8.** Explain one reason why a trend-based prediction like the one in Q7 might turn out to be wrong.



Build Tasks — Answers



5. In which month are Product A and Product B's sales closest together, and what is the difference in that month?



Solution

April: $|20 - 22| = 2$

6. By how much did Product A's sales increase from January to June?



Solution

$30 - 10 = 20$ units

7. The dashed line shows the trend continuing. Using it, what value is predicted for 2023?



Solution

Pattern is $+5/\text{yr}$:
 $2023 = 65$

8. Explain one reason why a trend-based prediction like the one in Q7 might turn out to be wrong.



Solution

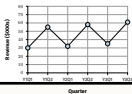
An unexpected future event could break it

Push Tasks

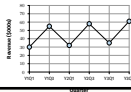


Uncover a trend that strong seasonality is masking, by comparing same-quarter values across cycles.

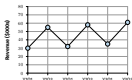
1. Compare the Q1 values alone, then the Q3 values alone. What underlying trend do you find?



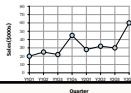
2. Calculate the percentage increase in Q1 revenue from Year 1 to Year 3.



3. Calculate the percentage increase in Q3 revenue from Year 1 to Year 3.



4. A student says this graph has no trend since values zig-zag. Explain why, using the figures.



Push Tasks – Answers



1. Compare the Q1 values alone, then the Q3 values alone. What underlying trend do you find?



Solution

Q1: 30,32,35 rising.

Q3: 55,58,61 rising –
both increase yearly

2. Calculate the percentage increase in Q1 revenue from Year 1 to Year 3.



Solution

30 → 35:

$$5/30 \times 100 \approx 16.7\%$$

3. Calculate the percentage increase in Q3 revenue from Year 1 to Year 3.



Solution

55 → 61:

$$6/55 \times 100 \approx 10.9\%$$

4. A student says this graph has no trend since values zig-zag. Explain why, using the figures.



Solution

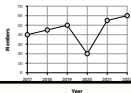
Zig-zag = seasonality;
Q4 still rises yearly

Push Tasks

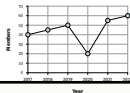


Distinguish noise from a genuine change in trend, and write a full quantified TSN description.

- 5.** Membership dips sharply in 2020. Is this noise, or a new trend? Justify using 2021 and 2022.

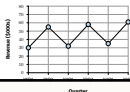


- 6.** Ignoring the 2020 dip as noise, predict the 2023 membership value from the underlying trend.



- 7.** Explain why telling noise apart from a genuine trend change matters for a decision-maker, e.g. before investing in expansion.

- 8.** State this graph's trend (%), its seasonal cycle (peak/trough), and whether noise is present.



Push Tasks – Answers



5. Membership dips sharply in 2020. Is this noise, or a new trend? Justify using 2021 and 2022.



Solution

Noise – 2021/2022 (55,60)
resume the pre-2020 rise

6. Ignoring the 2020 dip as noise, predict the 2023 membership value from the underlying trend.



Solution

Trend +5/yr from 60:
2023 = 65

7. Explain why telling noise apart from a genuine trend change matters for a decision-maker, e.g. before investing in expansion.

Solution

A wrong call can cost dearly

8. State this graph's trend (%), its seasonal cycle (peak/trough), and whether noise is present.



Solution

Increasing; Q3 peak, Q1 trough; no noise