FREE SAMPLE: THE FIRST QUESTION

Question One (15 marks)

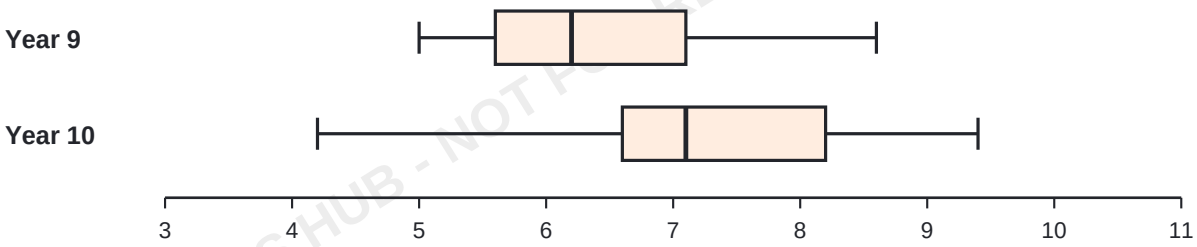
(a) The box plots show the time taken to run 1 km for a sample of students in Year 9 and a sample of students in Year 10.

(i) Use the box plots to find the median, the interquartile range and the range for each group.

(ii) Compare the two distributions, discussing centre, spread and shape, with numerical evidence, and decide which group has the slower values overall.

(iii) Estimate the percentage of the students in Year 9 who had time taken to run 1 km less than the median of Year 10. Explain how you know.

[7 marks]



Resource: box plots of the time taken to run 1 km for samples of students. Time (minutes) is shown on the scale.

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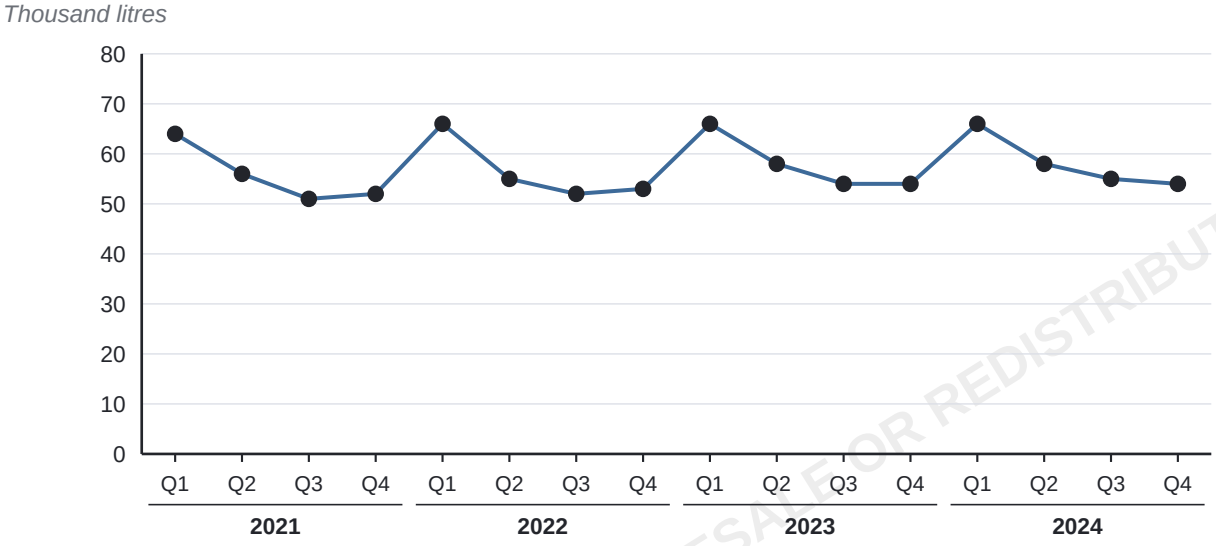
(b) The graph shows water used by a fictional Hamilton swimming pool for each quarter of the year.

(i) What was the value in Q3 of 2021? In 2021, by what percentage was the highest quarter greater than the lowest quarter?

(ii) Describe the trend over the four years, the repeating pattern within each year, and any unusual feature. Give evidence from the graph and a possible reason for the repeating pattern.

(iii) Predict the total for all four quarters of 2025. Explain how you made your prediction and how confident you are in it.

[8 marks]



Resource: water used by a fictional Hamilton swimming pool, by quarter, 2021 to 2024 (fictional data).

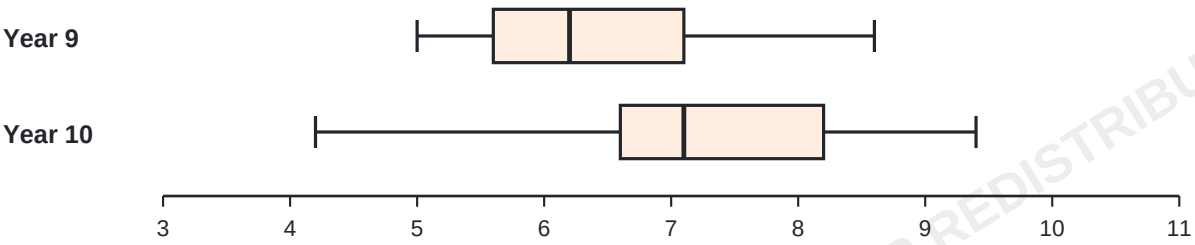
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THE WORKED ANSWER TO THAT QUESTION

Question 1 (15 marks) [Comparing groups and trends over time]

(a) The box plots show the time taken to run 1 km for a sample of students in Year 9 and a sample of students in Year 10. (i) Use the box plots to find the median, the interquartile range and the range for each group. (ii) Compare the two distributions, discussing centre, spread and shape, with numerical evidence, and decide which group has the slower values overall. (iii) Estimate the percentage of the students in Year 9 who had time taken to run 1 km less than the median of Year 10. Explain how you know.



Resource: box plots of the time taken to run 1 km for samples of students. Time (minutes) is shown on the scale.

(a) Answer: (i) Year 9: median 6.2, IQR 1.5, range 3.6; Year 10: median 7.1, IQR 1.6, range 5.2; (ii) Year 10 has the higher median; (iii) about 75%

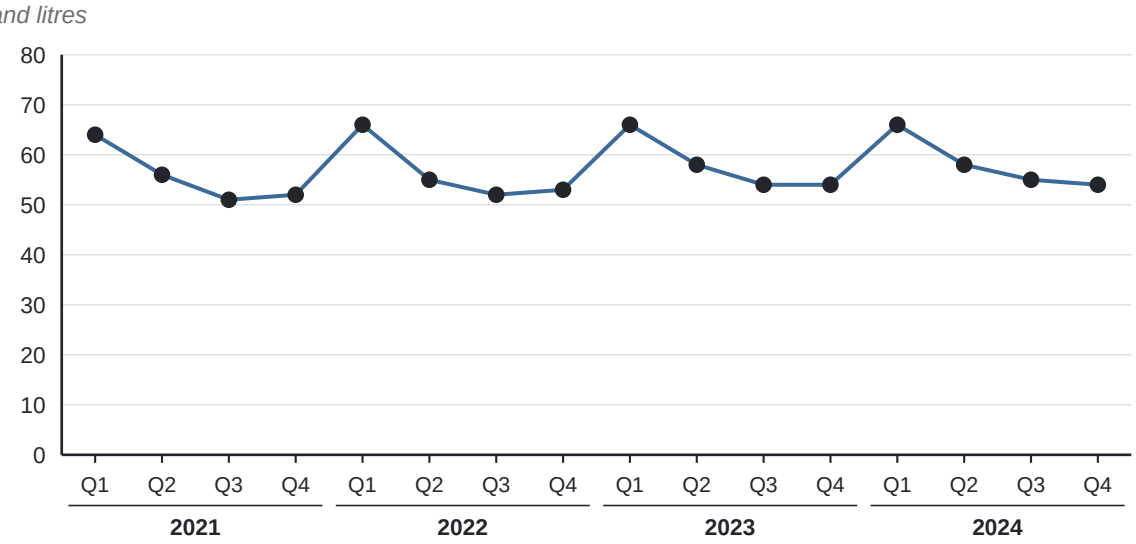
- Evidence level: Merit (reading the five-number summary from the box plots, then comparing centre, spread and shape).
- (i) Year 9: median 6.2, IQR = 7.1 − 5.6 = 1.5, range = 8.6 − 5 = 3.6. Year 10: median 7.1, IQR = 8.2 − 6.6 = 1.6, range = 9.4 − 4.2 = 5.2.
- Achievement: (ii) Compares the medians: Year 10 (7.1 against 6.2).
- Merit: Compares centre and spread with numbers: medians 6.2 and 7.1, IQR 1.5 and 1.6.
- Excellence: Full comparison: Year 10 has the higher median, so it is slower overall; the IQRs are 1.5 and 1.6, so the middle half of Year 10 is more spread out; the shape of Year 9 is skewed to the right and of Year 10 is skewed to the right; the boxes overlap, so the groups are not completely separate.
- (iii) The median of Year 10 (7.1) equals the upper quartile of Year 9 (7.1), and a quartile marks off a quarter of the data, so about 75% of Year 9 had time taken to run 1 km less than it.

KEY TAKEAWAY

Box plots: read the minimum, lower quartile, median, upper quartile and maximum; each section holds about a quarter of the data, so quartiles let you estimate percentages.

(b) The graph shows water used by a fictional Hamilton swimming pool for each quarter of the year. (i) What was the value in Q3 of 2021? In 2021, by what percentage was the highest quarter greater than the lowest quarter? (ii) Describe the trend over the four years, the repeating pattern within each year, and any unusual feature. Give evidence from the graph and a possible reason for the repeating pattern. (iii) Predict the total for all four quarters of 2025. Explain how you made your prediction and how confident you are in it.

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Resource: water used by a fictional Hamilton swimming pool, by quarter, 2021 to 2024 (fictional data).

(b) Answer: (i) 51 thousand litres; 25.5%; (ii) yearly totals 223, 226, 232, 233, peak in Q1; (iii) about 236 thousand litres

- Evidence level: Merit (reading values, calculating a percentage, and describing both the trend and the repeating pattern).
- (i) The value in Q3 of 2021 is 51. In 2021 the highest quarter (Q1) was 64 and the lowest was 51, so (64 − 51) ÷ 51 × 100 = 25.5%.
- Achievement: (ii) Describes the trend (yearly totals 223, 226, 232, 233) or the repeating pattern (peak in Q1).
- Merit: Describes both: the yearly totals 223, 226, 232, 233, going up; every year the peak is in Q1.
- Excellence: Full answer: the yearly totals 223, 226, 232, 233 show an overall rise of about 3.33 per year (the trend); each year Q1 is the highest (the seasonal pattern), likely because of the summer quarter; no single quarter breaks the pattern, so there is no outlier; the trend is clear but the seasonal pattern is stronger than the trend.
- (iii) Average change in the yearly total = (233 − 223) ÷ 3 = 3.33, so the 2025 total is about 233 + 3.33 = 236 thousand litres. Four years of data and a regular pattern make this reasonably reliable, but it assumes the trend continues; accept a total within about 9.0 of this.

KEY TAKEAWAY

Time series: describe the trend (the long-term direction), the repeating seasonal pattern and any unusual value, use numbers from the graph, and treat a prediction as an estimate that assumes the pattern continues.

LOS: Comparing groups and trends over time (91946)

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