Box Plots

Name: _____ Date: _____ Score: _____ / 24

Quick Review

A **box plot** (or box-and-whisker plot) shows data using five numbers: the **minimum**, Q_1, the **median**, Q_3, and the **maximum**. The **box** stretches from Q_1 to Q_3 and holds the middle half of the data; a line inside marks the median. The **whiskers** reach from the box out to the minimum and maximum. The width of the box is the **IQR** $= Q_3 - Q_1$, and the whole plot's width is the **range**. A box plot makes it easy to compare center and spread.

◇ **Example:** For the data $4, 6, 8, 10, 12, 14, 16$, give the five-number summary.

⇒ The data is already in order, which makes this easier. The minimum is 4 and the maximum is 16. With 7 values, the median is the 4th one, 10. The lower half is $4, 6, 8$, so Q_1 is its middle, 6. The upper half is $12, 14, 16$, so $Q_3 = 14$. That gives the five-number summary: minimum 4, $Q_1 = 6$, median 10, $Q_3 = 14$, maximum 16.

Answer: $4,\ 6,\ 10,\ 14,\ 16$

PRACTICE

Find the requested value from each data set or box plot summary.

1. Median of $4, 6, 8, 10, 12, 14, 16$ _____
2. Q_1 of $4, 6, 8, 10, 12, 14, 16$ _____
3. Q_3 of $4, 6, 8, 10, 12, 14, 16$ _____
4. IQR of $4, 6, 8, 10, 12, 14, 16$ _____
5. Range of $4, 6, 8, 10, 12, 14, 16$ _____
6. Minimum of $5, 7, 9, 11, 13, 15, 17, 19$ _____
7. Maximum of $5, 7, 9, 11, 13, 15, 17, 19$ _____
8. Median of $5, 7, 9, 11, 13, 15, 17, 19$ _____
9. Q_1 of $5, 7, 9, 11, 13, 15, 17, 19$ _____
10. Q_3 of $5, 7, 9, 11, 13, 15, 17, 19$ _____
11. IQR of $5, 7, 9, 11, 13, 15, 17, 19$ _____
12. A box plot has min 20, Q_1 24, median 32, Q_3 40, max 44. Find the IQR. _____
13. Same box plot: min 20, max 44. Find the range. _____
14. Same box plot: what value is the median? _____
15. Median of $20, 24, 28, 32, 36, 40, 44$ _____
16. Q_1 of $20, 24, 28, 32, 36, 40, 44$ _____
17. Q_3 of $20, 24, 28, 32, 36, 40, 44$ _____
18. A box plot has Q_1 6 and Q_3 18. Find the IQR. _____
19. A box plot has min 2 and max 22. Find the range. _____
20. Range of $20, 24, 28, 32, 36, 40, 44$ _____

♦ Word Problems

21. The number of minutes 11 students practiced piano were $2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22$. Give the five-number summary. _____

22. A box plot of jump-rope counts shows minimum 5, $Q_1 = 8$, median 12, $Q_3 = 16$, maximum 19. What is the IQR, and what does it represent? _____

23. Two box plots compare quiz scores. Class X has median 32 and IQR $= 16$. Class Y has median 32 and IQR $= 8$. Which class has scores that are more spread out? _____

24. A box plot of plant heights shows minimum 20 cm, $Q_1 = 24$, median 32, $Q_3 = 40$, maximum 44. Between which two values do the middle half of the plants fall? _____

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Answer Keys

1. $\boxed{10}$
2. $\boxed{6}$
3. $\boxed{14}$
4. $\boxed{8}$
5. $\boxed{12}$
6. $\boxed{5}$
7. $\boxed{19}$
8. $\boxed{12}$
9. $\boxed{8}$
10. $\boxed{16}$
11. $\boxed{8}$
12. $\boxed{16}$
13. $\boxed{24}$
14. $\boxed{32}$
15. $\boxed{32}$
16. $\boxed{24}$
17. $\boxed{40}$
18. $\boxed{12}$
19. $\boxed{20}$
20. $\boxed{24}$
21. $\boxed{2,\ 6,\ 12,\ 18,\ 22}$
22. $\boxed{\text{IQR} = 8}$
23. $\boxed{\text{Class X}}$
24. $\boxed{\text{between } 24 \text{ cm and } 40 \text{ cm}}$

Step-by-Step Explanations

1. With 7 ordered values, the median is the 4th one: 10.
2. The lower half is $4, 6, 8$, and its middle value is 6.
3. The upper half is $12, 14, 16$, and its middle value is 14.
4. IQR $= Q_3 - Q_1 = 14 - 6 = 8$.
5. Maximum minus minimum: $16 - 4 = 12$.
6. The smallest value listed is 5.
7. The largest value listed is 19.
8. With 8 values, average the 4th and 5th: $(11 + 13) \div 2 = 12$.
9. The lower half is $5, 7, 9, 11$; its median is $(7 + 9) \div 2 = 8$.
10. The upper half is $13, 15, 17, 19$; its median is $(15 + 17) \div 2 = 16$.
11. IQR $= Q_3 - Q_1 = 16 - 8 = 8$.
12. IQR $= Q_3 - Q_1 = 40 - 24 = 16$.
13. Range is maximum minus minimum: $44 - 20 = 24$.
14. The median is given directly in the five-number summary: 32.
15. With 7 ordered values, the median is the 4th: 32.
16. The lower half is $20, 24, 28$; its middle value is 24.
17. The upper half is $36, 40, 44$; its middle value is 40.
18. IQR $= 18 - 6 = 12$ — the width of the box.
19. Range is $22 - 2 = 20$.
20. Maximum minus minimum: $44 - 20 = 24$.
21. The minimum is 2 and the maximum is 22. With 11 values, the median is the 6th, 12. The lower half $2, 4, 6, 8, 10$ has median $Q_1 = 6$, and the upper half $14, 16, 18, 20, 22$ has median $Q_3 = 18$.
22. IQR $= Q_3 - Q_1 = 16 - 8 = 8$. It represents the spread of the middle half of the jump-rope counts — the width of the box.
23. Both classes have the same median, so we compare spread. Class X has the larger IQR ($16 > 8$), so its middle half of scores is more spread out.
24. The box of a box plot stretches from Q_1 to Q_3, and that box holds the middle half of the data. So the middle half of the plants are between 24 cm and 40 cm.

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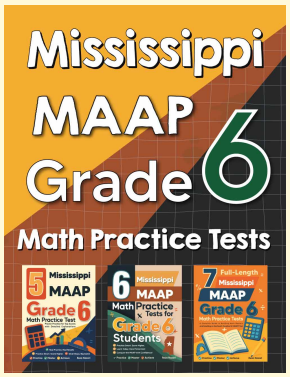

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