

# Box Plots and IQR

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

A **box plot** displays a data set's **five-number summary**: the *minimum*, the **first quartile**  $Q_1$ , the **median**, the **third quartile**  $Q_3$ , and the *maximum*. To find them, sort the data, find the median (the middle), then  $Q_1$  is the median of the *lower half* and  $Q_3$  is the median of the *upper half*. (When the count is odd, leave the overall median out of both halves.) The **interquartile range** is  $IQR = Q_3 - Q_1$  — it measures the spread of the *middle half* of the data and is not affected by extreme values.

◇ **Example:** Find the five-number summary and IQR of 5, 7, 9, 11, 13, 15, 17.  
 ⇒ The data is already sorted, and there are 7 values, so the **median** is the 4th value: 11. The *lower half* is 5, 7, 9 (everything before the median), so  $Q_1$  is its middle value, 7. The *upper half* is 13, 15, 17, so  $Q_3$  is its middle value, 15. The minimum is 5 and the maximum is 17. Finally,  $IQR = Q_3 - Q_1 = 15 - 7 = 8$ .

**Answer:** min 5,  $Q_1$  7, med 11,  $Q_3$  15, max 17; IQR = 8

## PRACTICE

Find the five-number summary and IQR of each data set.

- |                                |       |   |       |
|--------------------------------|-------|---|-------|
| 1. 2, 4, 6, 8, 10              | _____ | 11. 2, 5, 8, 11, 14, 17, 20, 23                 | _____ |
| 2. 1, 3, 5, 7, 9, 11, 13       | _____ | 12. 9, 9, 9, 9, 15                              | _____ |
| 3. 10, 12, 14, 16, 18, 20      | _____ | 13. 10, 20, 30, 40, 50, 60                      | _____ |
| 4. 5, 7, 9, 11, 13, 15, 17, 19 | _____ | 14. 5, 5, 10, 10, 15, 15                        | _____ |
| 5. 3, 3, 5, 7, 9               | _____ | 15. 2, 4, 4, 6, 8, 10, 12                       | _____ |
| 6. 2, 2, 4, 6, 8, 10, 12       | _____ | 16. 7, 8, 9, 10, 11, 12, 13                     | _____ |
| 7. 4, 8, 12, 16, 20, 24        | _____ | 17. For 5, 8, 12, 16, 19, find the range        | _____ |
| 8. 11, 13, 15, 17, 19          | _____ | 18. If $Q_1 = 14$ and $Q_3 = 22$ , find the IQR | _____ |
| 9. 6, 6, 6, 10, 14, 18         | _____ | 19. If $Q_1 = 30$ and $IQR = 25$ , find $Q_3$   | _____ |
| 10. 1, 4, 7, 10, 13, 16, 19    | _____ | 20. For 6, 6, 6, 6, find the IQR                | _____ |

## ◆ Word Problems

21. A class scored 60, 70, 80, 90, 100 on a quiz. Find the five-number summary and the IQR. \_\_\_\_\_
22. Daily high temperatures were 58, 62, 66, 70, 74, 78, 82 degrees. Find the IQR and explain what it tells you. \_\_\_\_\_
23. Two stores' wait times (minutes) are Store A: 2, 4, 6, 8, 10 and Store B: 4, 5, 6, 7, 8. Which store's middle half is more spread out? \_\_\_\_\_
24. A coach records long-jump distances (ft): 9, 11, 13, 15, 17, 19. Find  $Q_1$ ,  $Q_3$ , and the IQR. \_\_\_\_\_



## Answer Keys

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| <p>1. 2, 3, 6, 9, 10; IQR 6</p> <p>2. 1, 3, 7, 11, 13; IQR 8</p> <p>3. 10, 12, 15, 18, 20; IQR 6</p> <p>4. 5, 8, 12, 16, 19; IQR 8</p> <p>5. 3, 3, 5, 8, 9; IQR 5</p> <p>6. 2, 2, 6, 10, 12; IQR 8</p> <p>7. 4, 8, 14, 20, 24; IQR 12</p> <p>8. 11, 12, 15, 18, 19; IQR 6</p> <p>9. 6, 6, 8, 14, 18; IQR 8</p> <p>10. 1, 4, 10, 16, 19; IQR 12</p> <p>11. 2, 6.5, 12.5, 18.5, 23; IQR 12</p> <p>12. 9, 9, 9, 12, 15; IQR 3</p> | <p>13. 10, 20, 35, 50, 60; IQR 30</p> <p>14. 5, 5, 10, 15, 15; IQR 10</p> <p>15. 2, 4, 6, 10, 12; IQR 6</p> <p>16. 7, 8, 10, 12, 13; IQR 4</p> <p>17. 14</p> <p>18. 8</p> <p>19. 55</p> <p>20. 0</p> <p>21. min 60, <math>Q_1</math> 65, med 80, <math>Q_3</math> 95, max 100; IQR = 30</p> <p>22. IQR = 16 degrees</p> <p>23. Store A IQR = 6, Store B IQR = 3; Store A is more spread out</p> <p>24. <math>Q_1 = 11</math>, <math>Q_3 = 17</math>; IQR = 6</p> |
|--|--|

### Step-by-Step Explanations

1. Median = 6. Lower half 2, 4 gives  $Q_1 = 3$ ; upper half 8, 10 gives  $Q_3 = 9$ . IQR =  $9 - 3 = 6$ .
2. Median = 7. Lower half 1, 3, 5 gives  $Q_1 = 3$ ; upper half 9, 11, 13 gives  $Q_3 = 11$ . IQR = 8.
3. Median =  $\frac{14+16}{2} = 15$ . Lower half 10, 12, 14 gives  $Q_1 = 12$ ; upper half 16, 18, 20 gives  $Q_3 = 18$ . IQR = 6.
4. Median =  $\frac{11+13}{2} = 12$ . Lower half 5, 7, 9, 11 gives  $Q_1 = 8$ ; upper half 13, 15, 17, 19 gives  $Q_3 = 16$ . IQR = 8.
5. Median = 5. Lower half 3, 3 gives  $Q_1 = 3$ ; upper half 7, 9 gives  $Q_3 = 8$ . IQR =  $8 - 3 = 5$ .
6. Median = 6. Lower half 2, 2, 4 gives  $Q_1 = 2$ ; upper half 8, 10, 12 gives  $Q_3 = 10$ . IQR = 8.
7. Median =  $\frac{12+16}{2} = 14$ . Lower half 4, 8, 12 gives  $Q_1 = 8$ ; upper half 16, 20, 24 gives  $Q_3 = 20$ . IQR = 12.
8. Median = 15. Lower half 11, 13 gives  $Q_1 = 12$ ; upper half 17, 19 gives  $Q_3 = 18$ . IQR = 6.
9. Median =  $\frac{6+10}{2} = 8$ . Lower half 6, 6 gives  $Q_1 = 6$ ; upper half 10, 14, 18 gives  $Q_3 = 14$ . IQR = 8.
10. Median = 10. Lower half 1, 4, 7 gives  $Q_1 = 4$ ; upper half 13, 16, 19 gives  $Q_3 = 16$ . IQR = 12.
11. Median =  $\frac{11+14}{2} = 12.5$ . Lower half 2, 5, 8, 11 gives  $Q_1 = 6.5$ ; upper half 14, 17, 20, 23 gives  $Q_3 = 18.5$ . IQR = 12.
12. Median = 9. Lower half 9, 9 gives  $Q_1 = 9$ ; upper half 9, 15 gives  $Q_3 = 12$ . IQR =  $12 - 9 = 3$ .
13. Median =  $\frac{30+40}{2} = 35$ . Lower half 10, 20, 30 gives  $Q_1 = 20$ ; upper half 40, 50, 60 gives  $Q_3 = 50$ . IQR = 30.
14. Median =  $\frac{10+10}{2} = 10$ . Lower half 5, 5, 10 gives  $Q_1 = 5$ ; upper half 10, 15, 15 gives  $Q_3 = 15$ . IQR = 10.
15. Median = 6. Lower half 2, 4, 4 gives  $Q_1 = 4$ ; upper half 8, 10, 12 gives  $Q_3 = 10$ . IQR = 6.
16. Median = 10. Lower half 7, 8, 9 gives  $Q_1 = 8$ ; upper half 11, 12, 13 gives  $Q_3 = 12$ . IQR = 4.
17. Range = max - min =  $19 - 5 = 14$ .
18. IQR =  $Q_3 - Q_1 = 22 - 14 = 8$ .
19. Since IQR =  $Q_3 - Q_1$ , we get  $Q_3 = Q_1 + \text{IQR} = 30 + 25 = 55$ .
20. All values are equal, so  $Q_1 = Q_3 = 6$  and IQR = 0 — no spread at all.
21. Median = 80. Lower half 60, 70 gives  $Q_1 = 65$ ; upper half 90, 100 gives  $Q_3 = 95$ . So IQR =  $95 - 65 = 30$ .
22. Median = 70. Lower half 58, 62, 66 gives  $Q_1 = 62$ ; upper half 74, 78, 82 gives  $Q_3 = 78$ . IQR =  $78 - 62 = 16$  — the middle half of days spans 16 degrees.
23. Store A: median 6,  $Q_1 = 3$ ,  $Q_3 = 9$ , so IQR = 6. Store B: median 6,  $Q_1 = 4.5$ ,  $Q_3 = 7.5$ , so IQR = 3. Store A's middle half is more spread out.
24. Median =  $\frac{13+15}{2} = 14$ . Lower half 9, 11, 13 gives  $Q_1 = 11$ ; upper half 15, 17, 19 gives  $Q_3 = 17$ . IQR =  $17 - 11 = 6$ .



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