# Box Plots

Box plots: Models and calculations

**Name** _____ **Date** _____ **Score** _____ / 6

**QUICK REVIEW**

A box plot uses minimum, $Q_1$, median, $Q_3$, maximum. Sort data, find the median, then find medians of the lower and upper halves; omit the overall median for an odd count. For $2, 4, 6, 8, 10, 12$, the summary is $2, 4, 7, 10, 12$. IQR $= 10 - 4 = 6$; the box covers the middle half, not the full range.

**Worked example**

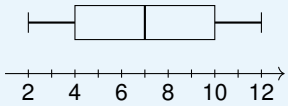
Construct a box plot. Data: $2, 4, 6, 8, 10, 12$. Draw the box plot and state the five-number summary, IQR, and range.

**1.** Sort: $2, 4, 6, 8, 10, 12$. Average positions $3$ and $4$: $(6 + 8)/2 = 7$.

**2.** Lower half $2, 4, 6$ gives $Q_1 = 4$; upper half $8, 10, 12$ gives $Q_3 = 10$.

**3.** The whiskers end at $2, 12$; box width $= 10 - 4 = 6$ and full range $= 12 - 2 = 10$.

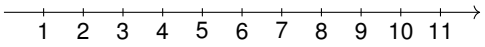
**Answer:** Min $2$, $Q_1 = 4$, median $7$, $Q_3 = 10$, max $12$; IQR $6$; range $10$.



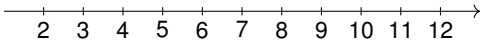

## Practice Problems

Show your thinking.

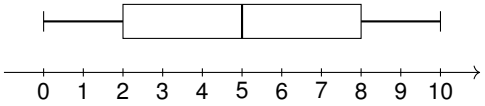
**1.** Construct a six-value plot. Data: $1, 3, 5, 7, 9, 11$. Draw the box plot and state the five-number summary, IQR, and range.



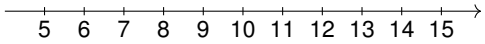

**2.** Use the odd-count quartile convention. Data: $2, 4, 4, 6, 8, 10, 12$. Draw the box plot and state the five-number summary, IQR, and range.



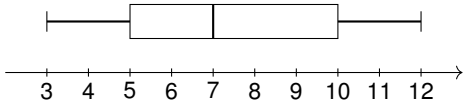

**3.** Read the three central markers and endpoints. Read the five-number summary, IQR, and range from the box plot.



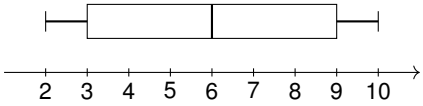

**4.** Summarize practice times in minutes. Data: $5, 7, 9, 11, 13, 15$. Draw the box plot and state the five-number summary, IQR, and range.




**5.** Recover the numerical five-number summary. Read the five-number summary, IQR, and range from the box plot.




**6.** A student calls the box width the full range. Correct both measures. Read the five-number summary, IQR, and range from the box plot.



# Answer Key

1. Min $1$, $Q_1 = 3$, median $6$, $Q_3 = 9$, max $11$; IQR $6$; range $10$.
2. Min $2$, $Q_1 = 4$, median $6$, $Q_3 = 10$, max $12$; IQR $6$; range $10$.
3. Min $0$, $Q_1 = 2$, median $5$, $Q_3 = 8$, max $10$; IQR $6$; range $10$.
4. Min $5$, $Q_1 = 7$, median $10$, $Q_3 = 13$, max $15$; IQR $6$; range $10$.
5. Min $3$, $Q_1 = 5$, median $7$, $Q_3 = 10$, max $12$; IQR $5$; range $9$.
6. Min $2$, $Q_1 = 3$, median $6$, $Q_3 = 9$, max $10$; IQR $6$; range $8$.

## Step-by-Step Solutions

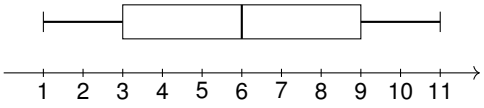
Follow each calculation, then check your own work.

### Problem 1

**1.** Sort: $1, 3, 5, 7, 9, 11$. Average positions $3$ and $4$: $(5 + 7)/2 = 6$.

**2.** Lower half $1, 3, 5$ gives $Q_1 = 3$; upper half $7, 9, 11$ gives $Q_3 = 9$.

**3.** The whiskers end at $1, 11$; box width $= 9 - 3 = 6$ and full range $= 11 - 1 = 10$.

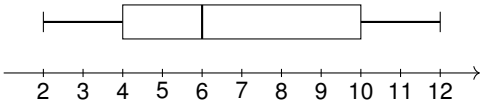



### Problem 2

**1.** Sort: $2, 4, 4, 6, 8, 10, 12$. The middle position $4$ gives median $6$. Leave it out of the halves.

**2.** Lower half $2, 4, 4$ gives $Q_1 = 4$; upper half $8, 10, 12$ gives $Q_3 = 10$.

**3.** The whiskers end at $2, 12$; box width $= 10 - 4 = 6$ and full range $= 12 - 2 = 10$.




### Problem 3

**1.** The whisker tips mark minimum $0$ and maximum $10$. Read the median line at $5$.

**2.** The left box edge is $Q_1 = 2$; the right edge is $Q_3 = 8$.

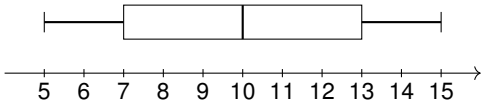
**3.** IQR $= 8 - 2 = 6$. Full range $= 10 - 0 = 10$.

### Problem 4

**1.** Sort: $5, 7, 9, 11, 13, 15$. Average positions $3$ and $4$: $(9 + 11)/2 = 10$.

**2.** Lower half $5, 7, 9$ gives $Q_1 = 7$; upper half $11, 13, 15$ gives $Q_3 = 13$.

**3.** The whiskers end at $5, 15$; box width $= 13 - 7 = 6$ and full range $= 15 - 5 = 10$.




### Problem 5

**1.** The whisker tips mark minimum $3$ and maximum $12$. Read the median line at $7$.

**2.** The left box edge is $Q_1 = 5$; the right edge is $Q_3 = 10$.

**3.** IQR $= 10 - 5 = 5$. Full range $= 12 - 3 = 9$.

### Problem 6

**1.** The whisker tips mark minimum $2$ and maximum $10$. Read the median line at $6$.

**2.** The left box edge is $Q_1 = 3$; the right edge is $Q_3 = 9$.

**3.** IQR $= 9 - 3 = 6$. Full range $= 10 - 2 = 8$.

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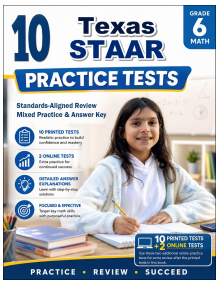


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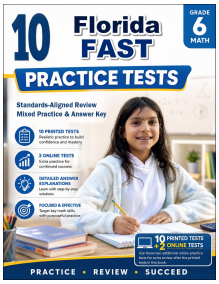


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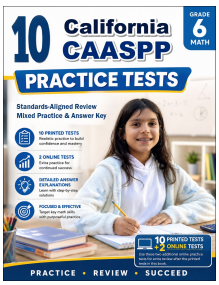


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