? ESSENTIAL QUESTION

How can you use a box plot and measures of spread to describe a data set?

EXPLORE ACTIVITY Real World COMMON CORE 6.SP.4

Using a Box Plot

A **box plot** is a display that shows how the values in a data set are distributed, or spread out.

To make a box plot, first find five values for the data set:

- the least value
- the **lower quartile** — the median of the lower half of the data
- the median
- the **upper quartile** — the median of the upper half of the data
- the greatest value

EXAMPLE 1 The heights of several students are shown. Make a box plot for the data.

Students' Heights (in.)					
60	58	54	56	63	61
65	61	62	59	56	58

STEP 1 Order the data and find the needed values.

Least value

Median = _____

Greatest value

Lower quartile = _____
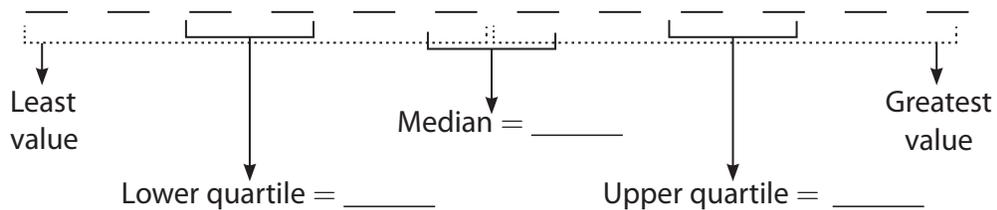
Upper quartile = _____

STEP 2 Draw the box plot.

Draw a number line that includes all the data values.

On the number line, draw dots above the least value, the lower quartile, the median, the upper quartile, and the greatest value.

Draw a segment connecting the least value to the lower quartile.
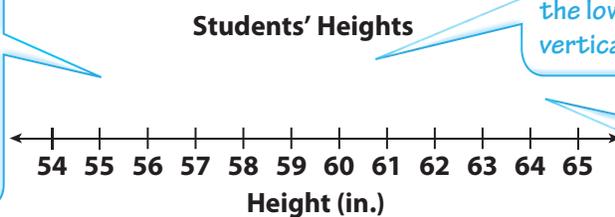
Draw a box whose ends pass through the lower and upper quartiles. Draw a vertical segment through the median.

Draw a segment connecting the upper quartile to the greatest value.

Students' Heights

54 55 56 57 58 59 60 61 62 63 64 65
Height (in.)

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Reflect

1. In the example, what percent of the data values are included in the box portion? What percent are included in each of the "whiskers" on the

ends of the box? _____

YOUR TURN

2. The daily high temperatures for some days last month are shown. Make a box plot of the data.

Daily High Temperatures (°F)					
85	78	92	88	78	84
80	94	89	75	79	83
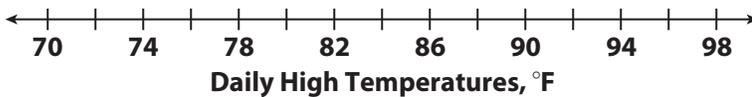
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←——+——+——+——+——+——+——+——+——+——+——+——→
   70    74    78    82    86    90    94    98
```
Daily High Temperatures, °F

Math On the Spot

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Finding the Interquartile Range

A **measure of spread** is a single number that describes the spread of a data set. One measure of spread is the *interquartile range*. The **interquartile range (IQR)** is the difference of the upper quartile and the lower quartile.

EXAMPLE 2 Real World

COMMON CORE 6.SP.5c

The box plots compare the ages of dancers in two different dance troupes.

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                    ┌────┬────────┐
  ●━━━━━━━━━●━━━━━━━┤    │        ├━━━━━●  Group A
                    └────┴────────┘
              ┌──────┬──────────┐
  ●━━━━━━━━━━━┤      │          ├━━━━━━━━━━●  Group B
              └──────┴──────────┘
←——+——+——+——+——+——+——+——+——+——+——+——+——+——+——→
  16   18   20   22   24   26   28   30
```
Dancers' Ages
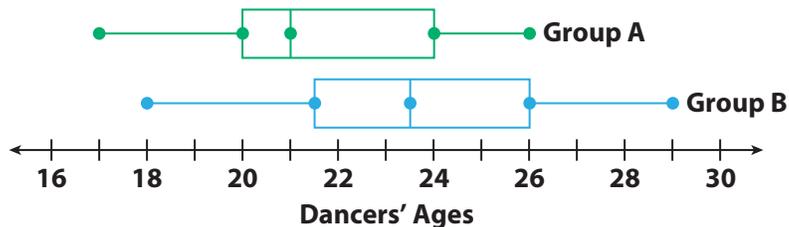
A Find the IQR for each set of data.

Group A: IQR = Upper quartile − Lower quartile

= 24 − 20 = 4

Group B: IQR = Upper quartile − Lower quartile

= 26 − 21.5 = 4.5

B Compare the IQRs. How do the IQRs describe the distribution of the ages in each group?

The IQR of group B is slightly greater than the IQR of group A. The ages in the middle half of group B are slightly more spread out than in group A.

YOUR TURN

3. The box plots compare the weekly earnings of two groups of salespeople from different clothing stores. Find and compare the IQRs of the box plots.

Group A

Group B

1000   1500   2000

Weekly Earnings ($)

_____

_____

_____
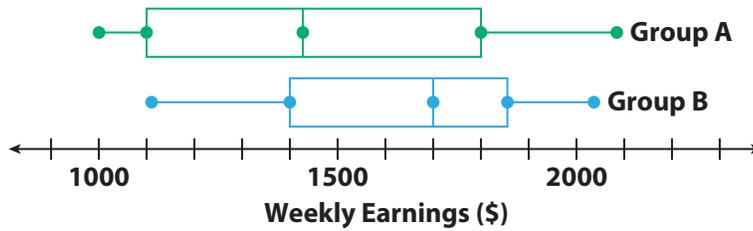
Finding the Range

Another measure that describes the spread of a set of data is the *range*. The **range** is the difference of the greatest value and the least value in a set of data.

EXAMPLE 3 Real World   COMMON CORE 6.SP.5c

The data sets show the ages of the players on two professional baseball teams. Find the range of each set of data.

Team A	36, 27, 28, 31, 39, 39, 28, 29, 24, 29, 30, 31, 29, 29, 28, 29, 31, 29, 32, 25, 37, 21, 26, 33, 29
Team B	25, 25, 26, 30, 27, 24, 29, 21, 27, 28, 26, 27, 25, 31, 22, 23, 29, 28, 25, 26, 28, 30, 23, 28, 29

STEP 1 Arrange the data sets in order from least to greatest.

Team A: 21, 24, 25, 26, 27, 28, 28, 28, 29, 29, 29, 29, 29, 29, 29, 30, 31, 31, 31, 32, 33, 36, 37, 39, 39

Team B: 21, 22, 23, 23, 24, 25, 25, 25, 25, 26, 26, 26, 27, 27, 27, 28, 28, 28, 28, 29, 29, 29, 30, 30, 31

STEP 2 Find the range of the data. Subtract the least value from the greatest value in each data set.

Team A: $39 - 21 = 18$

Team B: $31 - 21 = 10$

The range of ages for team A is 18 years, while the range of ages for team B is 10 years.
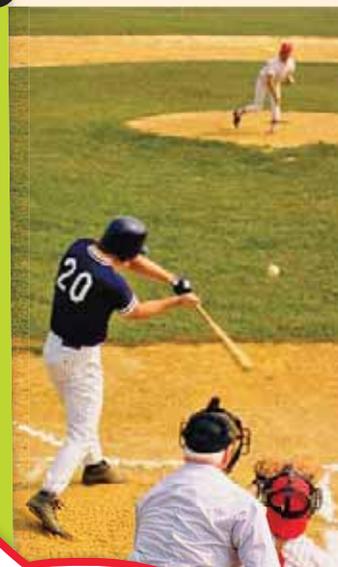
Math Talk
Mathematical Practices

How can you find the range of a set of data represented by a box plot?
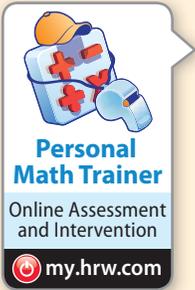
YOUR TURN

4. Find the range of each set of data. Which city's data has a greater range?

Average Monthly High Temperature (°F)	
Miami, FL	76, 78, 80, 83, 87, 90, 91, 91, 89, 86, 82, 78, 84
Chicago, IL	31, 35, 47, 59, 70, 80, 84, 82, 75, 62, 48, 35, 59

_____

Guided Practice

The RBIs (runs batted in) for 15 players from the 2010 Seattle Mariners are shown. Use this data set for 1–7.

Mariners' RBIs
15 51 35 25 58 33 64
43 33 29 14 13 11 4 10

1. Order the data from least to greatest. (Explore Activity Example 1)

   _____

2. Find the median. (Explore Activity Example 1) _____

3. Find the lower quartile. (Explore Activity Example 1) _____

4. Find the upper quartile. (Explore Activity Example 1) _____

5. Make a box plot for the data. (Explore Activity Example 1)


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   0  5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80
```

6. Find the IQR. (Example 2) _____

7. Find the range. (Example 3) _____

❓ ESSENTIAL QUESTION CHECK-IN

8. How is the range of a set of data different from the IQR?

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   _____

   _____

   _____

16.3 Independent Practice

COMMON CORE 6.SP.4, 6.SP.5c
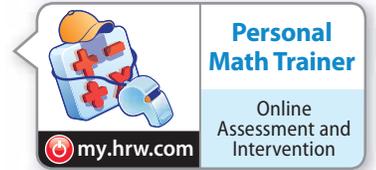
For 9–12, use the data set of the heights of several different students.

Students' Heights (in.)
46   47   48   48   56   48
46   52   57   52   45

9. Draw a box plot of the data.

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←——+——+——+——+——+——+——+——+——+——+——+——+——+——→
   45  46  47  48  49  50  51  52  53  54  55  56  57
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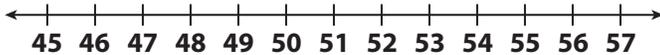
10. How many students are included in the data set? _____

11. What method could have been used to collect the data?

_____

12. **Represent Real-World Problems** What other data could you collect from the students to create a box plot? Provide several examples with units of measurement, if applicable.

_____

For 13–15, use the box plots of the total precipitation for the same group of cities for the months of January and June.
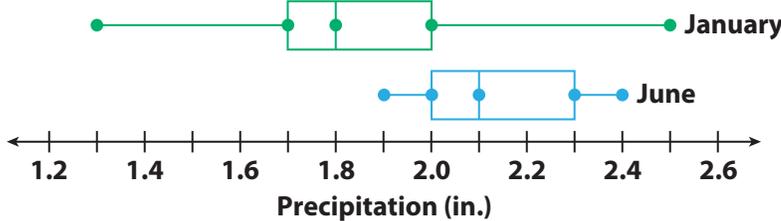
13. Calculate the IQR for each month.

January = _____ inches   June = _____ inches

14. Calculate the range for each month.

January = _____ inches   June = _____ inches

15. Compare the IQRs. What can you conclude about the two data sets?

_____

_____

16. Compare the ranges. What can you conclude about the two data sets?

_____

17. Analyze Relationships Can two box plots have the same range and IQR and yet represent completely different data? Explain.

_____

_____

_____

_____

18. Multiple Representations Matthew collected data about the ages of the actors in two different community theater groups. He drew a box plot for one of the sets of data.

Ages of Actors in the Southside Players
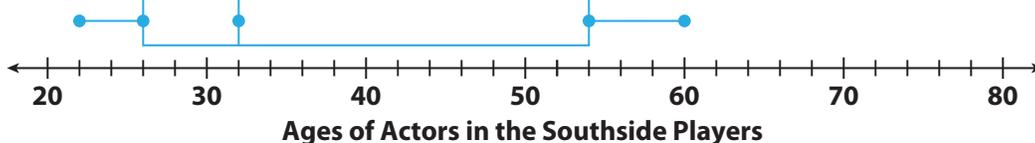
Ages of Actors in the Northside Players	71, 62, 63, 21, 63, 39, 25, 26, 30

a. Find the median, range, and IQR for each set of data.

Theater Group	Median	Range	IQR
Northside Players			
Southside Players			

b. Suppose you were to draw a second box plot for the Northside Players using the same number line as for the Southside Players. Which box plot would be longer overall? Which would have the longest box portion?

_____

_____

_____

c. Critique Reasoning Mandy assumes that because nine data values are shown for the Northside Players, nine data values were used to make the box plot for the Southside Players. Explain why this is not necessarily true.

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_____

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