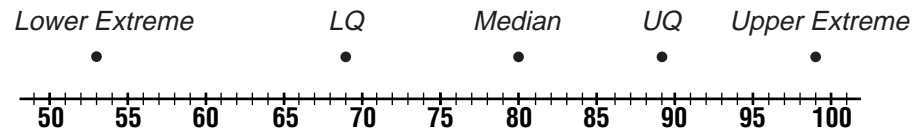


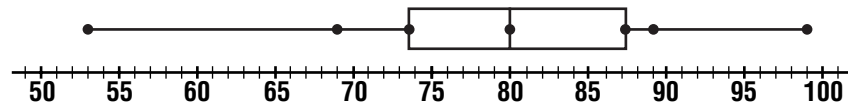
Step 3

Draw a number line for the range of the values. Above the number line, mark points for the extreme, median, and quartile values. The highest and lowest values in a set of data are called the **extreme values**.



Step 4

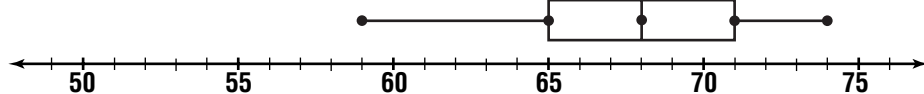
Draw a box that contains the quartile values. Draw a vertical line through the median value. Then extend the *whiskers* from each quartile to the extreme data points.



Refer to the drawing above. The middle half of the values and the median lie within the box. The length of the box represents the interquartile range and the length of the entire diagram from one end of the whisker to the other represents the range of values. From this diagram, we can determine if there are any outliers. An **outlier** is a value of data that is more than 1.5 times the interquartile range from the quartiles.

Now is a good time to give students a problem in which they need to find these values given a box-and-whisker plot.

Example 2 The box-and-whisker plot below shows the heights in inches of the eleven girls on the Parkview High girls' softball team.



Find the range, the median, the upper and lower quartiles, and the interquartile range. Are there any outliers?

Solution The greatest value in this data set is 74. The least value is 59. So, the range of values is $74 - 59$ or 15. The median is 68. The upper quartile, which is displayed at the right-hand edge of the box, is 71. The lower quartile, which is displayed at the left-hand edge of the box, is 65. The interquartile range is $71 - 65$ or 6.

To determine if there are any outliers, first multiply the interquartile range by 1.5.

$$6 \times 1.5 = 9$$

Since the result is 9, an outlier would be a value that is greater than 9 plus the upper quartile, or less than 9 subtracted from the lower quartile. The upper quartile is 71, and the lower quartile is 65. Since $71 + 9 = 80$ and $65 - 9 = 56$, the limits for the outliers are 56 and 80. There are no outliers in the data.

Note to the Teacher *You may wish to discuss with students the other graphs that are often used to present data. These include line graphs, pictographs, circle graphs, and comparative graphs.*

