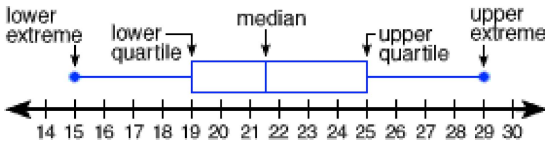
Richmond Public Schools

Curriculum Framework

Grade 7 Honors (7/8)

Strand: Measurement and Geometry	
8.12 The student will **a) represent numerical data in boxplots;** **b) make observations and inferences about data represented in boxplots; and** **c) compare and analyze two data sets using boxplots.** **7.9 The student, given data in a practical situation, will** **a) represent data in a histogram;** **b) make observations and inferences about data represented in a histogram; and** **c) compare histograms with the same data represented in stem-and-leaf plots, line plots, and circle graphs.**	
Suggested Pacing	
Related Standards	
Spiral Down: 5th Grade: ● SOL 5.16 ● SOL 5.17 6th Grade: ● SOL 6.10	Spiral Up:
Essential Questions	**Common Misconceptions**
● How are box plots and histograms useful with real-life data? ● What types of data are best displayed in a box plot and histogram?	● Box Plot: students have difficulty calculating the 5 Number Summary; specifically with an even number of data ● Histogram: students have difficulty seperating the data into equal intervals ● Questions: students have difficulty answering thoughtful questions about the Box Plot and the Histogram(ie. where does 50% of the data lie, how many had more than 50).
Understanding the Standard	**Essential Knowledge and Skills**
SOL 8.12:	SOL 8.12:

- A boxplot (box-and-whisker plot) is a convenient and informative way to represent single-variable (univariate) data.
- Boxplots are effective at giving an overall impression of the shape, center, and spread of the data. It does not show a distribution in as much detail as a stem and leaf plot or a histogram.
- A boxplot will allow you to quickly analyze a set of data by identifying key statistical measures (median and range) and major concentrations of data.
- A boxplot uses a rectangle to represent the middle half of a set of data and lines (whiskers) at both ends to represent the remainder of the data. The median is marked by a vertical line inside the rectangle.
- The five critical points in a boxplot, commonly referred to as the five-number summary, are lower extreme (minimum), lower quartile, median, upper quartile, and upper extreme (maximum).
  Each of these points represents the bounds for the four quartiles. In the example below, the lower extreme is 15, the lower quartile is 19, the median is 21.5, the upper quartile is 25, and the upper extreme is 29.



- The range is the difference between the upper extreme and the lower extreme. The interquartile range (IQR) is the difference between the upper quartile and the lower quartile. Using the example above, the range is 14 or 29–15. The interquartile range is 6 or 25–19.
- When there are an odd number of data values in a set of data, the median will not be considered when calculating the lower and upper quartiles.
  - Example: Calculate the median, lower quartile, and upper quartile for the following data values:

    3 5 6 7 8 9 11 13 13

Median: 8; Lower Quartile: 5.5; Upper Quartile: 12

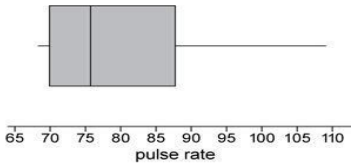
- In the pulse rate example, shown below, many students incorrectly interpret that longer sections contain more data and shorter ones contain less. It is important to remember that roughly **the same amount of data is in each**

- Collect and display a numeric data set of no more than 20 items, using boxplots. (a)
- Make observations and inferences about data represented in a boxplot. (b)
- Given a data set represented in a boxplot, identify and describe the lower extreme (minimum), upper extreme (maximum), median, upper quartile, lower quartile, range, and interquartile range. (b)
- Compare and analyze two data sets represented in boxplots. (c)

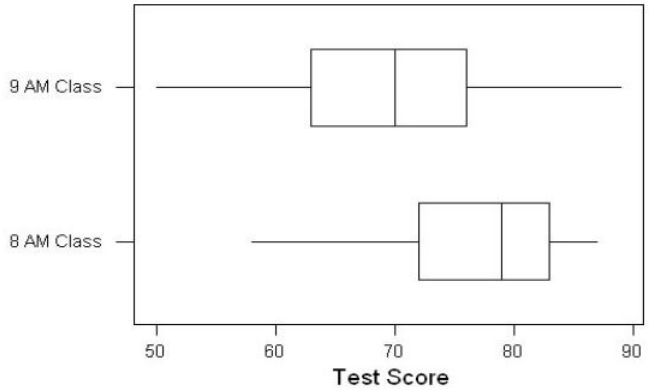
SOL 7.9:

- Collect, organize, and represent data in a histogram. (a)
- Make observations and inferences about data represented in a histogram. (b)
- Compare data represented in histograms with the same data represented in line plots, circle graphs, and stem-and-leaf plots. (c)

section. The numbers in the left whisker (lowest of the data) are spread less widely than those in the right whisker.



- Boxplots are useful when comparing information about two data sets. This example compares the test scores for a college class offered at two different times.



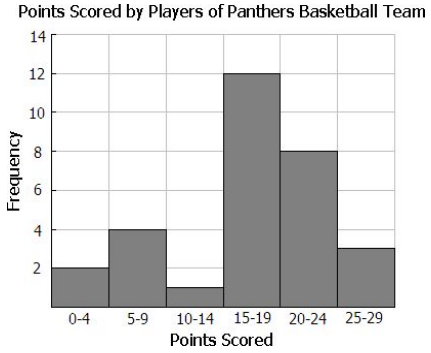
Using these boxplots, comparisons could be made about the two sets of data, such as comparing the median score of each class or the Interquartile Range (IQR) of each class.

SOL 7.9:

- A histogram is a graph that provides a visual interpretation of numerical data by indicating the number of data points that lie within a range of values, called a class or a bin. The frequency of the data that falls in each

class or bin is depicted by the use of a bar. Every element of the data set is not preserved when representing data in a histogram.

- All graphs must include a title and labels that describe the data.
- Numerical data that can be characterized using consecutive intervals are best displayed in a histogram.
- Teachers should be reasonable about the selection of data values. Students should have experiences constructing histograms, but a focus should be placed on the analysis of histograms.
- A histogram is a form of bar graph in which the categories are consecutive and equal intervals. The length or height of each bar is determined by the number of data elements (frequency) falling into a particular interval.



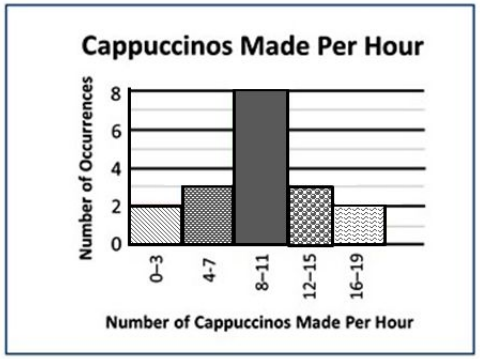
- A frequency distribution shows how often an item, a number, or range of numbers occurs. It can be used to construct a histogram.

Number of Cappuccinos Made per Hour at the Cafe

Number of Cups of Coffee	Tally	Frequency
0 - 3	||	2
4 – 7	|||	3
8 – 11	𝍸 |||	8

To construct a histogram:

- Organize collected data into a table. Create one column for data range categories (bins), divided into equal intervals that will include all of your data (for example, 0-10, 11-20, 21-30), and another column for frequency.
  - Bins should be all the same size.
  - Bins should include all of the data.
  - Boundaries for bins should reflect the data values being represented.
  - Determine the number of bins based upon the data.
  - If possible, the number of bins created should be a factor the number of data values (e.g., a histogram representing 20 data values might have 4 or 5 bins).
- Create a graph. Mark the data range intervals on the *x*-axis (horizontal axis) with no space between the categories. Mark frequency on the *y*-axis (vertical axis), also in equal intervals.
- Plot the data. For each data range category (bin), draw a horizontal line at the appropriate frequency or marker. Then, create a vertical bar for that category reaching up to the marked frequency. Do this for each data range category (bin).



– Note: histograms may be drawn so that the bars are horizontal. To do this, interchange the *x*- and *y*-axis. Mark the data range intervals (bins) on the *y*-axis and the frequency on the *x*-axis. Draw the bars horizontally. ● Comparisons, predictions and inferences are made by examining characteristics of a data set displayed in a variety of graphical representations to draw conclusions. Data analysis helps describe data, recognize patterns or trends, and make predictions. ● There are two types of data: categorical and numerical. Categorical data can be sorted into groups or categories while numerical data are values or observations that can be measured. For example, types of fish caught would be categorical data while weights of fish caught would be numerical data. While students need to be aware of the differences, they do not have to know the terms for each type of data. ● Different types of graphs can be used to display categorical data. The way data is displayed is often dependent on what someone is trying to communicate. ● A line plot provides an ordered display of all values in a data set and shows the frequency of data on a number line. Line plots are used to show the spread of the data, to include clusters(groups of data points) and gaps (large spaces between data points), and quickly identify the range, mode, and any extreme data values. ● A circle graph is used for categorical and discrete numerical data. Circle graphs are used to show a relationship of the parts to a whole. Every element of the data set is not preserved when representing data in a circle graph. ● A stem and leaf plot is used for discrete numerical data and is used to show frequency of data distribution. A stem and leaf plot displays the entire data set and provides a picture of the distribution of data. ● Different situations or contexts warrant different types of graphs, and it helps to have a good knowledge of what graphs are available. Students can	

determine which graph makes the most sense to use based on the type of data provided and which graph can help them answer questions most easily.

- Comparing different types of representations (charts and graphs) provide students an opportunity to learn how different graphs can show different things about the same data. Following construction of graphs, students benefit from discussions around what information each graph provides.
- The information displayed in different graphs may be examined to determine how data are or are not related, differences between characteristics (comparisons), trends that suggest what new data might be like (predictions), and/or "what could happen if" (inference).

Vocabulary

SOL 8.12:

Box Plot	Univariate Data	Lower Quartile (1st Quartile)
Lower Extreme (minimum)	Median (middle; 2nd Quartile)	Upper Quartile (3rd Quartile)
Upper Extreme (maximum)	Mean (average)	Range (max – min)
Interquartile Range (IQR)	Five-Number Summary	Univariate Data

SOL 7.9a, b, b:

Numerical Data	Histogram	Frequency Distribution
Circle Graph	Stem-and-Leaf Plot	Line Plot
Mean	Median	Mode
Range	Trend	

Instructional Activities Organized by Learning Objective

Textbook

Notes

Resources
- Print
- Technology-based

Station Activities

Richmond Public Schools

Curriculum Framework

Grade 7 Honors (7/8)

Assessment	
Cross-Curricular Connections	**Tiered Differentiations**