Recap: Graphs should have titles and labels.

Bar graphs: Use for CATEGORY data.

- Can have either single unit scale or can be scaled (multi-unit scale).
- The scale on the frequency (number) axis should match the height of the bars.
- The frequency scale should increase evenly like a number line.

Picture graphs: Use for CATEGORY data.

- Can have either a single unit scale or can be scaled.
- Scaled picture graphs must have a key telling the scale.
- All of the pictures in the graph (that represent data) must be the same size.

Circle graphs: Use for CATEGORY data.

- USE WHEN you want to emphasize that the categories make up a whole.
- Use ratios to find the right size of a part of a circle graph.
- Use a protractor to measure the right size for a circle graph.

Dot plots/line plots: Use for NUMBER data.

- Graph each data value as a dot or x above a number line showing the possible number values.
- Line plots are usually not scaled—each dot represents a single collected piece of data.
- Line plots should always be on a number line—make sure your number line is evenly spaced out when you make your graph.

Median and quartiles:

- The median is the middle number when you order the data from smallest to largest.
- The quartiles are the half-way point of each half.
- If there are an even number of data numbers, then there isn't a single middle number and you choose the number half way in between the two middle numbers.
- The median is a measure of CENTER
- The interquartile range (the difference between the upper and lower quartiles) is a measure of SPREAD (how spread out the data is)

Box-and-whisker plot: Use for NUMBER data where finding an average reasonable.

- USE WHEN comparing data where you have the **same measured amount** for **two or more *populations***. A *population* is a group of something that you are collecting data about: it could be a group of people, a species of animal or plant, a group of animals or plants (for instance that are the same species but live in different places), or a type of company or brand of a product.
- When you are graphing box and whisker plots to compare data you should use the same number line scale for all of the graphs, and you should draw out your number line scale before you start making the box plots.
- The median line on a box and whisker plot shows the CENTER of the data set, and the box shows a typical middle range for the data within the data set (interquartile range, SPREAD).

Histogram: Use for NUMBER data where finding an average reasonable.

- Similar to a bar graph for number data.
- USE WHEN you want to show the shape of data collected for a single population.
- The key conceptual difference between a bar graph and a histogram is that the bars in a histogram show a range of values rather than a single value.
- Some important tips for drawing a histogram are to make the bars meet on their sides (no spaces between bars),
- make the number line axis evenly spaced and label it as you would a number line (at the tick marks, not between: note that usually it's best to put those tick marks where they can show where the bars begin and end), and
- choose a range of values for each bar so that there are a useful number of total bars (usually between 5 and 12).

Minor warning: if you get into the real nitty-gritty of statistical graphs, you'll find that there are fancy things you can do with histograms, like using different widths for different bars. This is not stuff

you'd be teaching to elementary/middle school students, though, so we haven't done any of that. Unless you know more statistics than I've taught you, keep the widths of all of your bars the same.

Mean and mean absolute deviation:

- The mean of a data set is what is usually called the average: add up all the values and divide by the number of data points. The mean is the most common measure of CENTER.
- To get the mean absolute deviation, find the difference (positive, absolute value difference) between each data point and the mean. Then find the mean of those difference values. This is a measure of SPREAD, and tells you about how much larger and smaller than the center (mean) you can expect the most typical data to be.

Stem and Leaf plot: Use with NUMBER data where you want to see each data value.

- A stem and leaf plot shows all of the data numbers and organizes them by place value.
- A stem and leaf plot can show just the numbers from one numerical data set or it can show two data sets side by side.
- A stem and leaf plot should always have a key.
- Stem and leaf plots are most useful if the number of data values in your set are not too larger and not too small (it wouldn't be a very good choice for less than 10 numbers or more than 100).

Scatter plot: Useful for PAIRED NUMBER data.

- USE WHEN you have **two values or measurements for each individual** in the data set. An individual could be a person, an animal or a plant that was measured in two different ways, or it could be a company, state or country about which you know two pieces of numerical information (often information like population or net worth).
- The two measurements are *correlated* if the dots in the scatter plot line up along an imaginary line. At the elementary/middle school level, we look visually for the dots to line up and sketch in a line through the middle of the dots. In a more sophisticated statistics application there are ways to get a best-fit line and to measure how well the data matches the line.
- A key concept for understanding the equation of a line is to notice how the *slope* of a line corresponds to the side length ratios of a right triangle with horizontal and vertical legs. All such triangles along a line will be *similar* triangles, and their side length ratios will be equal.

Line graph: Line graphs can be used for certain kinds of PAIRED NUMBER data.

- USE WHEN the data has measurements that **change over time**, paired with time values.
- The horizontal axis is the time axis, and the other axis shows the data collected at those times.
- The lines in a line graph are used to show *trends that occur over time.*

1. From our class data, choose something that it would work well to make a circle graph for.
   - Make a careful circle graph. Show your calculations to find the size of each wedge, and use a protractor to get the size correct (do by hand).
   - Write a sentence about something you can deduce about the data based on what you see in the circle graph.

2. From our class data, choose something that would work well to make a histogram for.
   - Explain why a histogram is a good choice for that data.
   - Make the histogram.
   - Write a sentence describing the data based on what you see in the shape of the histogram.

3. From our class data, choose something that would work well to make a scatter plot for.
   - Explain why a scatter plot is a good choice for that data.
   - Make the scatter plot.
   - Estimate and find the equation for a good-fit line for the scatter plot.

4. Describe data you could collect from 2 or more populations (perhaps with a class of 5^{th} grade students) where a box plot would be a good choice to show how two populations compared.
   - Explain how you could collect the data.
   - Explain why a box plot would be a good choice to show the data.

5. Describe data you could collect where a line graph would be a good choice to display the data.
   - Explain how you could collect the data.
   - Explain why a line graph would be a good choice to show the data.