

GRAPHS

Tables, charts, and graphs may be used to show relationships between two variables. Some software programs, such as Microsoft Excel and Microsoft Works, have built-in graphs or chart wizards that will help in constructing graphs. We will look at steps that demonstrate how to create a graph using Excel's chart wizard so that we can analyze change of data over time and events. Every software program works a little differently, but generally follows the same principle for creating graphs.

Graphs are used to display a graphic representation of data. We will look at line and bar graphs displaying the relationship between two variables. Line graphs are used to show growth or decline over a specified length of time. Bar graphs are used to compare amounts for each category. We will apply the use of Excel's graph wizard to create a double bar graph where we compare two sets of data.

A circle graph is a graphical representation of a whole group of data divided up into parts. We will look at the details for constructing a circle graph where we start with a tally chart and then find the fractional part of the whole each category represents along with angle for each section of the graph.

Measures of central tendency: mean, mode, median and range, are often used with collecting data and then displaying it in a graphic representation such as a histogram. A histogram is a special bar graph that is created from a tally chart of data that is organized into intervals. The tally is compiled into a frequency and then the graph is drawn using bars to represent the intervals.

Stem and leaf plots are used to organize data so that all pieces of the data can be seen quickly and in an organized format. The stems and leaves are based on place value of the data.

Graphs of Relationships between Two Variables

Admission to an amusement park costs \$2.00. Amusement park rides cost \$0.75 per ride. Write an equation to show how much it is going to cost to go to the amusement park.

Notice that we are now working with **two** variables, the total cost of going to the amusement park and the number of rides. Let's have **R** represent the number of rides and **C** represent the total cost.

We know it costs \$2.00 for admission to the park **plus** the amount of money spent on rides. To find the costs for rides, take the number of rides, **R** and multiply it by the cost of the rides.

$$0.75 \times R$$

Now we need to add in the cost of admission.

$$0.75 \times R + 2$$

This equation will equal the total cost of the amusement park.

$$0.75 \times R + 2 = C$$

The **R** in this equation is your **independent variable**. This means that the number is fixed and does not change or depend on other variables.

The **C** is the **dependent variable** because the cost depends on how many rides the person goes on.

Think of the equation like a machine. The independent variable is the number put into the equation. This is considered the **input**. The dependent variable is what comes out of the machine. This is called the **output**. To learn more about these terms, click the video link below.

Input and Output (2:01)

$$0.75 \times R + 2 = C$$

Let's input a 1 for **R** and see what we get for **C** as an output.

$$0.75 \times 1 + 2 = 2.75$$

Now input the numbers to 2 – 6.

$$0.75 \times 2 + 2 = 3.50$$

$$0.75 \times 3 + 2 = 4.25$$

$$0.75 \times 4 + 2 = 5.00$$

$$0.75 \times 5 + 2 = 5.75$$

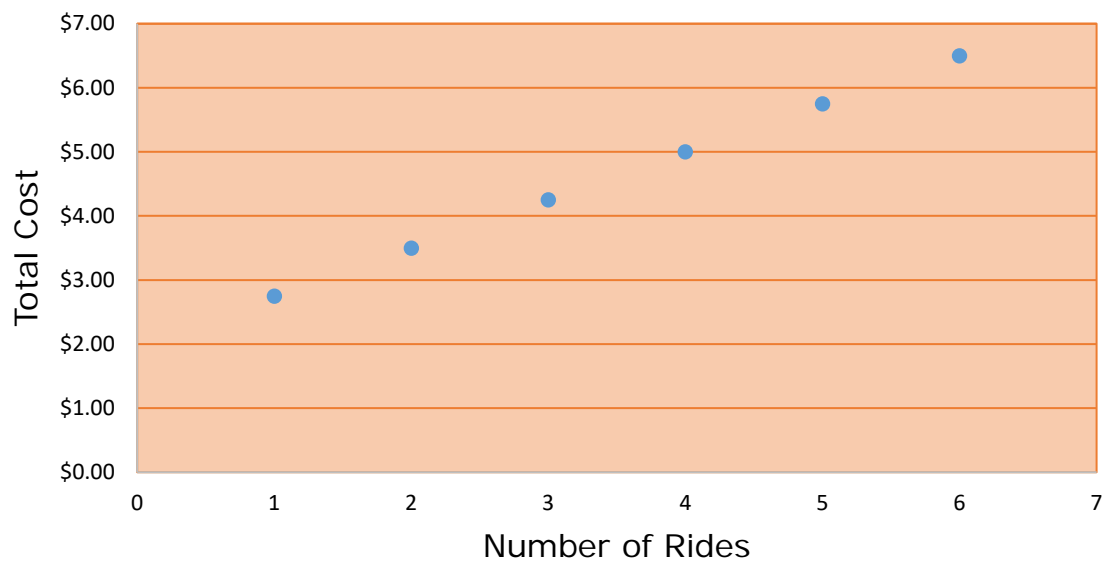
$$0.75 \times 6 + 2 = 6.50$$

This information can be represented in a table. One column for the input and one for the output.

Number of Rides (R)	Total Cost (C) C = \$0.75 × R + \$2.00
1	2.75
2	3.50
3	4.25
4	5.00
5	5.75
6	6.50

A graph can be made to show the **relationship** between the number of rides and the total cost. The equation, table, and graph all show the same information, just in different ways.

Amusement Park Charges



The relationship is that as the number of rides increases, the total cost increases.

Using Technology to Graph Data

With Excel, a spreadsheet program, you can create some very nice graphs easily. Other software programs also include spreadsheet programs like Microsoft Works.

Here are the steps to use Excel to create a graph. Most spreadsheet programs work in a similar way.

Step One: Type in the data and select the data that is to be graphed, then select the graph icon on the menu bar. The chart wizard will pop up. Select the type of graph. Pressing the bar “Press and Hold to View the Sample” will give you a preview of what your graph is going to look like.

The screenshot shows the Microsoft Excel interface. The spreadsheet has the following data in cells B1 through B4:

	A	B	C	D	E	F	G	H	I	J
1		70								
2		140								
3		210								
4		280								

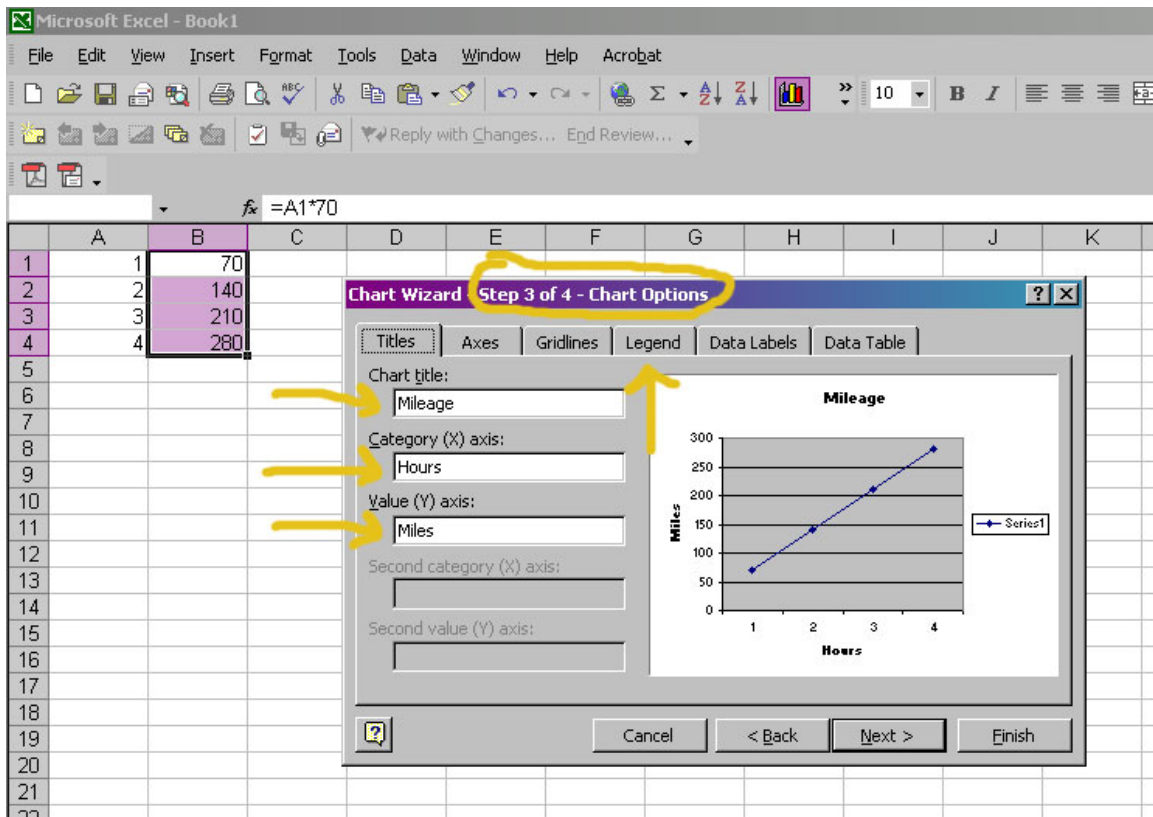
The Chart Wizard dialog box is open, showing the 'Step 1 of 4 - Chart Type' screen. The 'Line' chart type is selected. The 'Sample' preview shows a line graph with markers for the data points. The 'Press and Hold to View Sample' button is highlighted with a yellow circle, and a yellow arrow points to the 'Next >' button.

Step Two: For a simple graph, just press “next” in the chart wizard.

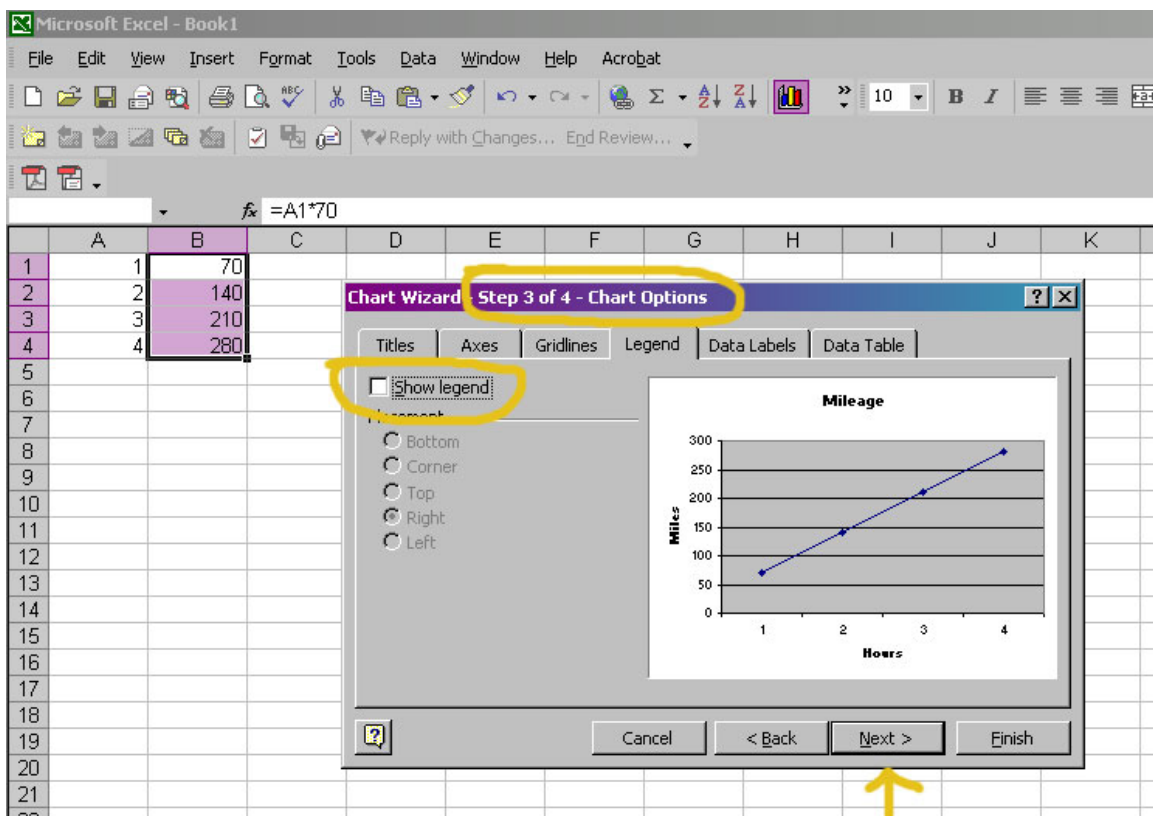
The screenshot shows the Microsoft Excel interface with the Chart Wizard dialog box open. The dialog box is titled "Chart Wizard - Step 2 of 4 - Chart Source Data". It has two tabs: "Data Range" and "Series". The "Data Range" tab is active, showing a line chart with four data points. The data range is set to "=Sheet1!\$B\$1:\$B\$4". The "Series in:" section has "Columns" selected. A yellow arrow points to the "Next >" button.

Row	Column	Value
1	B	70
2	B	140
3	B	210
4	B	280

Step Three: In this step, enter the chart title, the horizontal axis label (x) axis, and the vertical axis label (y) axis, then press on the “Legend” tab.



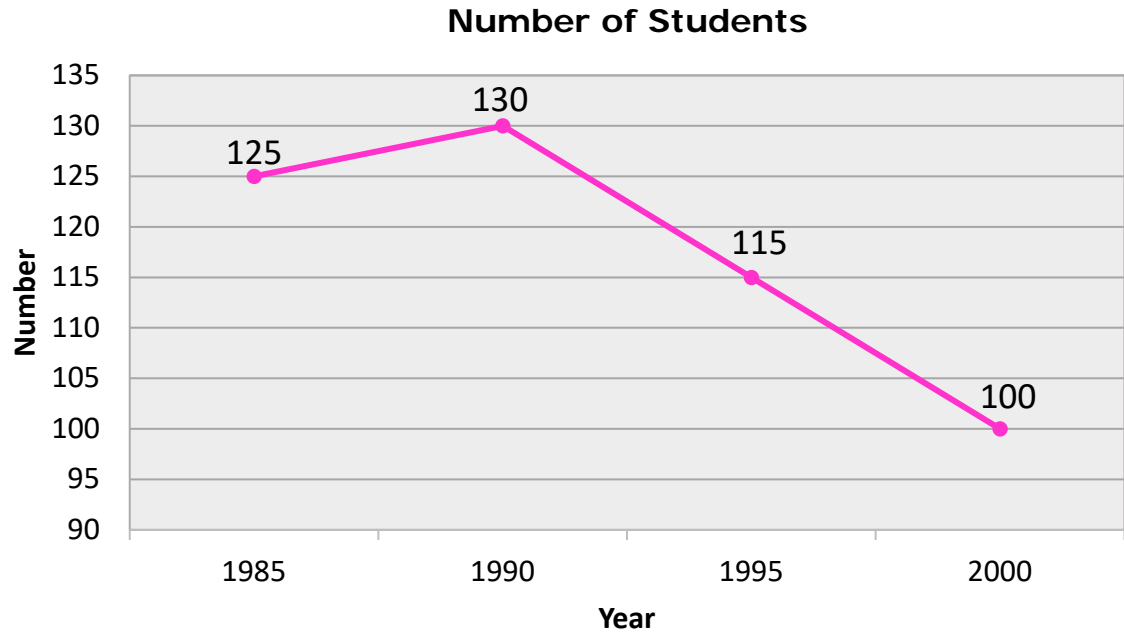
Step Four: Deselect the “Show Legend” checkbox, then select the “Next” button.



Line and Bar Graphs

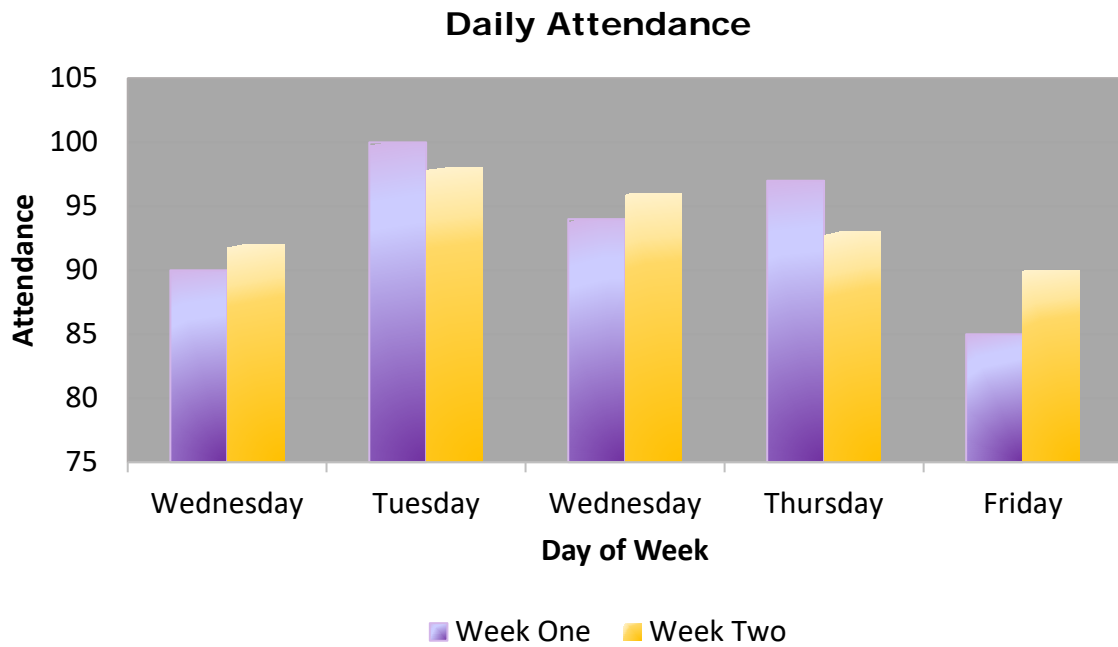
Beth is examining the student enrollment in her school's 6th grade class. She started with the year 1985 and made a line graph to look for a trend for the enrollment at her school. The line graph displayed that there is an overall gradual decline in enrollment.

Number of Students in 6 th Grade Class	
Year	Number
1985	125
1990	130
1995	115
2000	100



Beth is examining the daily attendance of her 6th grade class. She wanted to see which day of school students attend best. She selected a bar graph to compare the data for two weeks. She found that the daily attendance was best on Tuesday.

Daily Attendance of 6 th Grade Class		
	Week One	Week Two
Monday	90	92
Tuesday	100	98
Wednesday	94	96
Thursday	97	93
Friday	85	90



Comparing Change in Growth of Plants By Creating a Double Bar Chart with Excel

Alicia plotted the growth of three plants over one month. Each of the plants was placed in different windows and received different amounts of sunlight. Graph the results.

Step One: Type in all the data in cells that are touching each other. Do not skip any columns or rows. Select “column” if you want a vertical bar chart or “bar” if you want a horizontal bar chart and then select “next”.

The screenshot shows the Microsoft Excel interface with the Chart Wizard dialog box open. The data table is highlighted in yellow, and the 'Next >' button in the Chart Wizard is also highlighted in yellow. An arrow points from the data table to the 'Next >' button.

	A	B	C
1		First	Second
2	Plant A	3	7
3	Plant B	2	4
4	Plant C	5	10

Chart Wizard - Step 1 of 4 - Chart Type

Standard Types | Custom Types

Chart type: Column

Chart sub-type: Clustered Column, Compares values across categories.

Press and Hold to View Sample

Cancel < Back Next > Finish

Step Two: Check to see if the chart created is reflecting the data as you think it should and then select “next”.

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C
1		First	Second
2	Plant A	3	7
3	Plant B	2	4
4	Plant C	5	10

The Chart Wizard dialog box is titled "Chart Wizard - Step 2 of 4 - Chart Source Data". It shows a preview of a grouped bar chart with the following data:

Plant	First	Second
Plant A	3	7
Plant B	2	4
Plant C	5	10

The dialog box also shows the following options:

- Data range: `=Sheet1!A1:C4`
- Series in: Rows, Columns

The "Next >" button is highlighted in yellow.

Step Three: Enter chart titles and subtitles and also explore the other tabs to vary the appearance of the chart.

	A	B	C	D	E	F	G	H	I	J	K
1		First	Second								
2	Plant A	3	7								
3	Plant B	2	4								
4	Plant C	5	10								

Chart Wizard - Step 3 of 4 - Chart Options

Titles | Axes | Gridlines | Legend | Data Labels | Data Table

Chart title: Plant Growth in One Month

Category (X) axis: Plants

Value (Y) axis: Height in Inches

Second category (X) axis:

Second value (Y) axis:

Plant Growth in One Month

Height in Inches

Plant A Plant B Plant C

Plants

First Second

Cancel < Back Next > Finish

Step Four: Select “As a new sheet:” to create the chart in a sheet of its own and then select “Finish”.

	A	B	C	D	E	F	G	H	I	J	K
1		First	Second								
2	Plant A	3	7								
3	Plant B	2	4								
4	Plant C	5	10								

Chart Wizard - Step 4 of 4 - Chart Location

Place chart:

As new sheet: Chart1

As object in: Sheet1

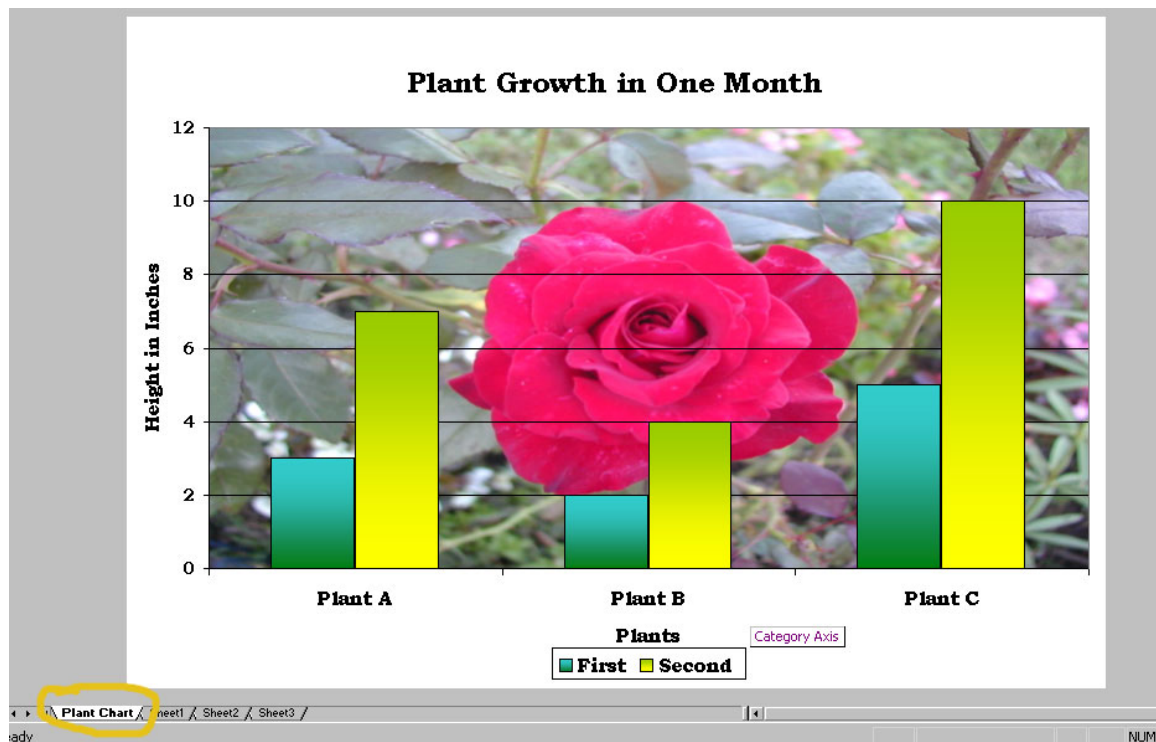
Cancel < Back Next > Finish

Step Five: Rename Chart 1 to a name that pertains to the chart by right-clicking on the Chart 1 tab. The appearance of the chart can be improved by right-click on different parts of the chart and exploring the submenus.

In this chart, the font of all of the labels, titles, and subtitles were changed and resized by right-clicking and selecting “format”.

The bars were changed from a basic color to a two gradient fill by right-clicking on the bars, selecting “format data series”, selecting “fill effects”.

A picture was imported into the background by right-clicking the background area of the chart, and selecting “format plot area”, selecting “fill effects”, selecting the “picture tab”, selecting “select picture button”, and then browsing to find a picture on your computer.

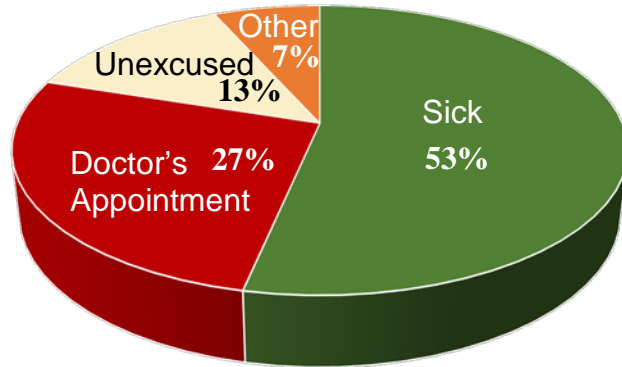


Circle Graphs

Beth is examining the reasons for student absences on Friday. She decided to display the information in a circle graph to show percentages of the whole group.

Reasons for Absences

Reasons for Absences	
Sick	8
Doctor's Appointment	4
Unexcused	2
Other	1



Constructing a Circle Graph

Madison recently surveyed her classmates to find out what color was their favorite color? She gave them four choices: blue, green, yellow, red.

First, she made a **tally** chart to keep track of their responses. Then she decided that a **circle graph** would display the data most effectively.

She then made another chart to organize her calculations for drawing the graph. Madison made fractions based on 20 (total responses), then reduced them. She multiplied the fractional part of the whole group by 360 since there are 360° in a circle.

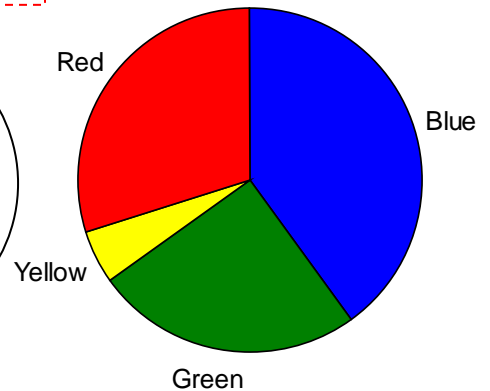
Tally of Favorite Color		
Blue		8
Green		5
Yellow		1
Red		6

Favorite Color		
Blue	$\frac{8}{20} = \frac{2}{5}$	$\frac{2}{5} \times 360 = 144^\circ$
Green	$\frac{5}{20} = \frac{1}{4}$	$\frac{1}{4} \times 360 = 90^\circ$
Yellow	$\frac{1}{20}$	$\frac{1}{20} \times 360 = 18^\circ$
Red	$\frac{6}{20} = \frac{3}{10}$	$\frac{3}{10} \times 360 = 108^\circ$
Check	$\frac{20}{20}$	360°

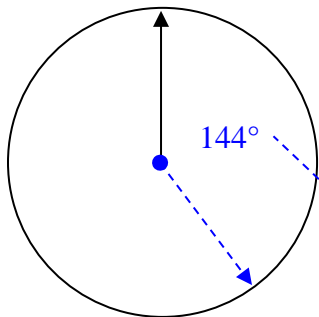
To check the calculations, Madison adds the results to check. The fractions **total 20/20**, which makes **1 whole** circle and the degrees total **360 (whole)**

Madison will not have to draw the last angle, but will measure it. It should measure 108° (red).

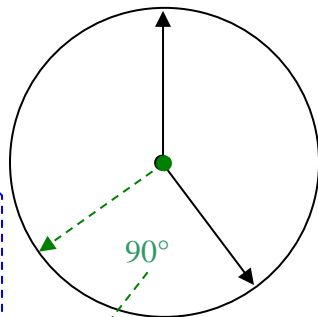
Favorite Color



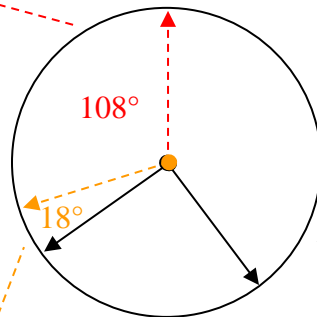
Madison completes the graph by adding category labels, a title, and color to correspond to the survey topic.



Madison draws a circle with one radius. She places a protractor on the radius, using the center of the circle as the vertex, and draws the first angle (blue).



She then moves the protractor to rest on the ray she just drew and proceeds to make the second angle (green).



Madison then moves the protractor to rest on the ray she drew and proceeds to make the third angle (yellow).

Measures of Central Tendency

To analyze sets of data, researchers often try to find a number that can represent the whole set. These numbers or pieces of data are called **measures of central tendency**. The three common measures we are going to study are: **mean, mode, and median**.

Mean: The mean of a set of data is the sum of all the data divided by the number of pieces of data (average).

Mode: The mode of a set of data is the number that occurs most often.

Median: The median of a set of data is the number in the middle when the data are arranged in order. When there are two middle numbers, the median is the average (mean) of the two numbers.

Let's take a look at Amanda's data from her class contest and determine the mean, mode, and median.

6	4	4	10	6
5	2	4	1	5
3	3	7	4	2
0	9	5	7	10

Mean: Add all the numbers, and then divide the sum by the number of numbers in the set.

$$6 + 4 + 4 + 10 + 6 + 5 + 2 + 4 + 1 + 5 + 3 + 3 + 7 + 4 + 2 + 0 + 9 + 5 + 7 + 10 = 97$$

$$97 \div 20 = 4.85$$

4.85 is the mean of the set of data.

Mode: Arrange the numbers in order from the smallest to the largest and determine which number occurs most often.

0, 1, 2, 2, 3, 3, 4, 4, 4, 4, 5, 5, 5, 6, 6, 7, 7, 9, 10, 10

4 is the mode of the set of data because it occurs most often.

Median: Use the arranged numbers from the mode and determine what the middle number is.

0, 1, 2, 2, 3, 3, 4, 4, 4, 4, 5, 5, 5, 6, 6, 7, 7, 9, 10, 10

Since there are two middle numbers, we must add them together and find the mean.

$$4 + 5 = 9$$

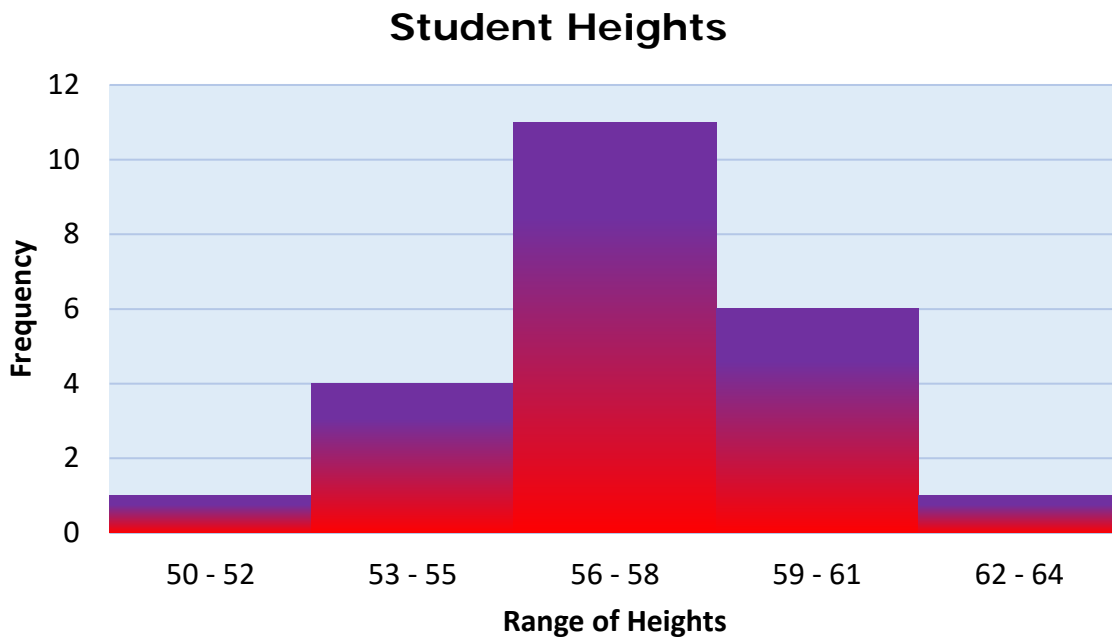
$$9 \div 2 = 4.5$$

The median of the set of data is **4.5**.

A frequency table may be arranged into a table that displays **intervals of data** along with the frequency of the intervals. The height of the sixth graders has been organized into intervals of 3, starting with 50 and ending with 64.

Height (inches) (intervals of 3)	Tally	Frequency
50 – 52		1
53 – 55		4
56 – 58	++++ +++++	11
59 – 61	++++	6
62 – 64		1

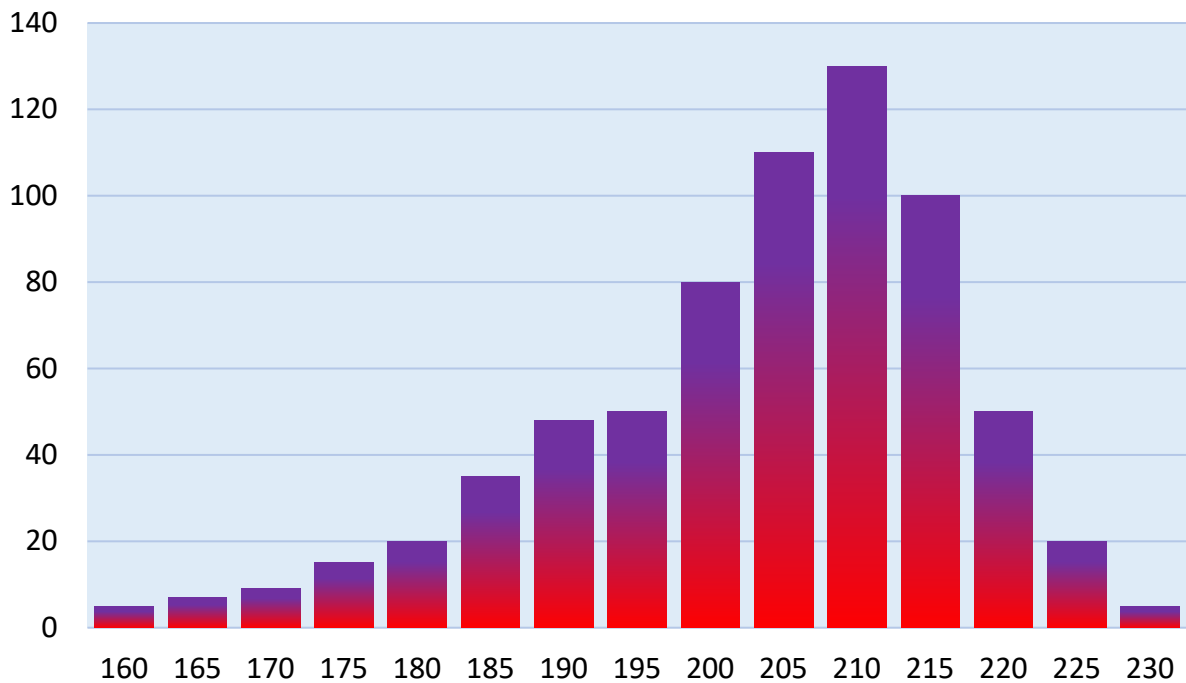
A **histogram** is a graphical representation of the data in the table graphing the intervals of data by the frequency of the heights within the intervals.



The graph shows that most 6th graders' heights fall within a range of 53 inches through 61 inches.

Outliers are data that occur infrequently for the group of data being analyzed. In this case the data falling in the interval of 50 – 52 is considered outlying data, along with data falling in the interval of 62 – 64, where there is only one height each falling in those intervals, a height of 52 inches and a height of 63 inches.

Shape is the term used to describe how the data is distributed. This data is somewhat **symmetrical** with small amounts of data occurring in the outer intervals and a high concentration of the data near the center. Data is symmetrical if it is balanced from left to right. It is considered **skewed** if all of the data occurs near one end or the other.



Stem-and-Leaf Plot

Make a stem-and-leaf plot for the ages of past presidents. In the table, are the ages of the last 22 presidents on the day of their inauguration.

Ages of Last 22 Presidents			
46	64	69	52
61	56	55	43
62	60	51	54
51	55	56	51
42	54	55	55
47	54		

To create a stem-and-leaf plot

1. Find the least value and the highest value in the data.
2. Determine the least place value which will be the leaves.
3. Determine the stems needed which will be the next place values.
4. List the stems in order from smallest to largest.
5. List the leaves to the right of the corresponding stems.
6. Put the leaves in order.
7. Make a title and legend for the graph.

Step 1 The lowest data value is 42 and the highest is 69.

Steps 2 - 5

Stem (Tens)	Leaves (Ones)
4	6 3 2 7
5	2 6 5 1 4 1 5 6 1 4 5 5 4
6	4 9 1 2 0

Steps 6 & 7

