

Using StudyWorks Middle School Math and Excel to create a graph

Purpose and/or Objectives:

The student will be introduced to Computer Science and the type of research being performed today.

The student will correlate geographical distances to universities around the world and RTT (round trip time) on the Internet.

The student will use StudyWorks and Excel to create a graph based on the RTT data collected using the Ping program.

Background and Major Concepts to be mastered during the activity:

- Students will already know how to create a line graph by hand.
- Students will be able to use the Microsoft Windows command screen to perform ping.
- Students will be able to use StudyWorks and Excel to graph the ping data.

Skills/Techniques developed in activity:

- Students will be able to get to the Microsoft Windows command screen.
- Students will be able to ping websites from the command screen.
- Students will be able to locate the average RTT and know what this means.
- Students will be able to enter data on Excel and create a line graph.
- Students will be able to enter data on StudyWorks and create a line graph.
- Students will make observations based on their graphs.
- Students will determine what other experiments could be performed in order to analyze the problem of packet loss and delay.

Materials needed:

- Computers with Excel and/or StudyWorks.
(If a computer is not available for every student, then this lesson can be modified by allowing students to work in groups on the computers available.)

Requirements from the students:

- What other real life data can be graphed using StudyWorks or Excel?
- What professions do you think use software such as this?
- What benefit do you see in using one program over the other?
- Which do you find easier to use?
- Which do you think presents the data more effectively?
- What observations do you see in the distance/time relationship for ping based on your graph?
- What other data would be useful when trying to determine network round trip time?
- Why would using the command screen be a better method of operating the computer?

Teaching Suggestions:

Review with students that a line graph is the best graph to use when showing data involving time. Also review the placement of the x and y axis, and the parts of a graph (title, scale, and other labels).

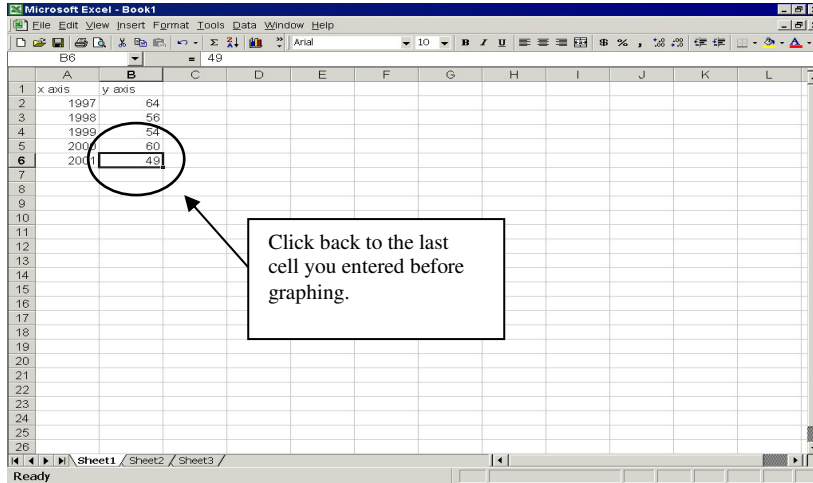
1. Explain that there are other ways to manage and manipulate files. The command screen allow users to type commands rather than just using the mouse and clicking. One program that is used on the command screen is the ping tool. Ping will be explained momentarily. Show students how to get to the command screen. Go to START, then RUN, then click OK. The "C:" means that you are typing to the "C" drive, or the hard drive of the computer. Many of you have probably saved files onto the "A:" drive which is the floppy disk drive.
2. The ping tool allows people to verify connections to remote computers and to determine how long it took and whether or not there was any loss in the information on the way. For example, I can type "ping www.ncsu.edu" which is North Carolina State University to see how long it takes to get there and back. Notice that at the bottom, the average time is given in milliseconds. This is the data we are going to use today to create a graph. Ask: "Why would this information be important to know?" Allow students time to respond. Explain that in order to make the internet, which is just a network of connected computers more efficient, it is important to be able to "see" where these packets of information go and how long it takes to get there. Think of a mail carrier who physically has to deliver a package. If some roads have too much traffic, the shortest distance may not be the quickest and during different times of the day, the carrier may choose a different route because of traffic delays in congested areas. If researchers can determine patterns in packet delay and loss, then they can work on making the system better. This is a real life problem being worked on today in many universities across the nation, including USF.
3. Once you have collected data using ping, you can graph this information and make observations. Do you think the farther the packet has to travel in distance, the more or less delay there will be? Well, that is what we will try to determine today after graphing our data.
4. Ping the following universities or have students ping five different universities of their choice as long as they are spread out geographically: (For American Universities, go to www.clas.ufl.edu/CLAS/american-universities.html . For International Universities, go to www.findaschool.org/ .)
 - (University of South Florida) www.usf.edu
 - (Georgia Tech) www.gatech.edu
 - (University of California at Riverside) www.ucr.edu
 - (Lund University, Sweden) www.lu.se
 - (University of Canterbury, New Zealand) www.canterbury.ac.nz
5. Record the average time. Give students the approximate distance to each location in the world from your location if all the students are pinging the same locations. If they are pinging locations of their choice, then have them find this information out on their own either using an atlas or an internet distance calculator. This could be an entirely different lesson to present if they are not familiar with this skill.)

PART I: Using Excel to graph

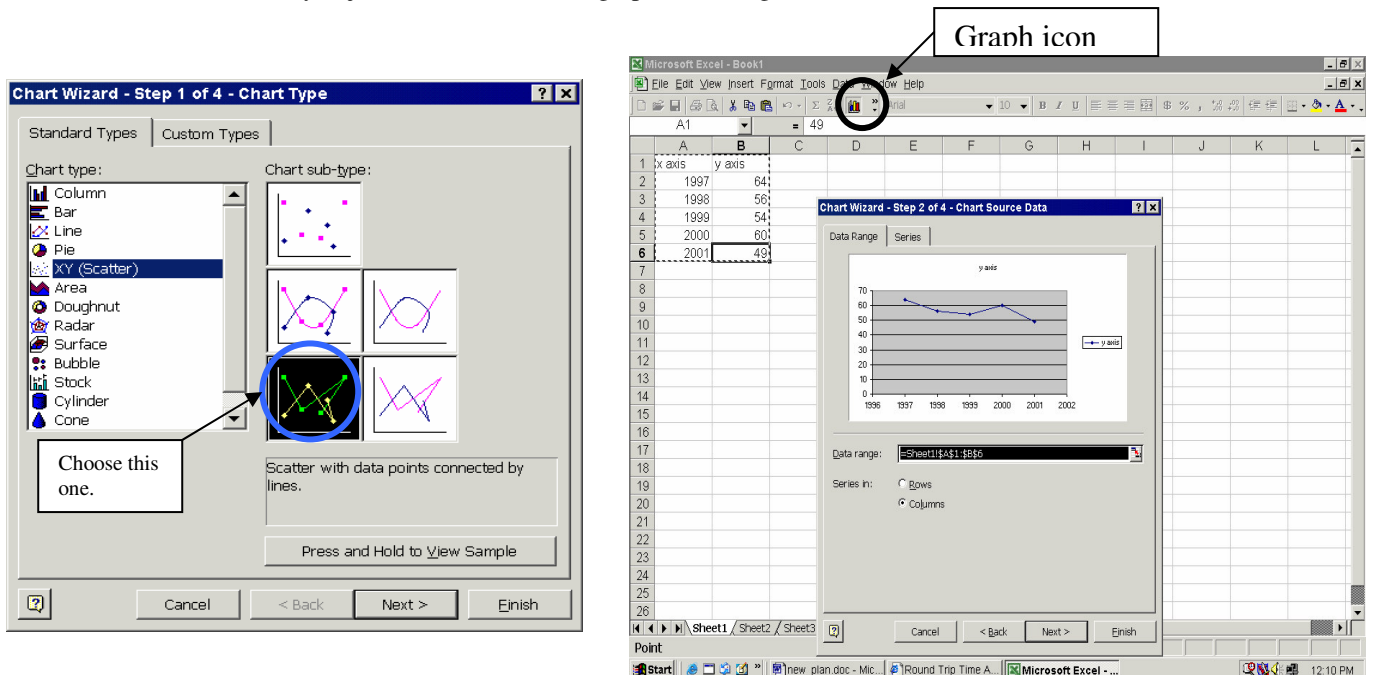
6. We can enter this information into a program like Excel which will enable us to display the data as a graph. Open Excel from your desktop. Notice the page is made up of cells or blocks that can hold information. Each cell is labeled by columns and rows. The columns have letters and the rows have numbers. Excel is a program that can take the information in each one these cells and organize or display them in many ways.

For example:

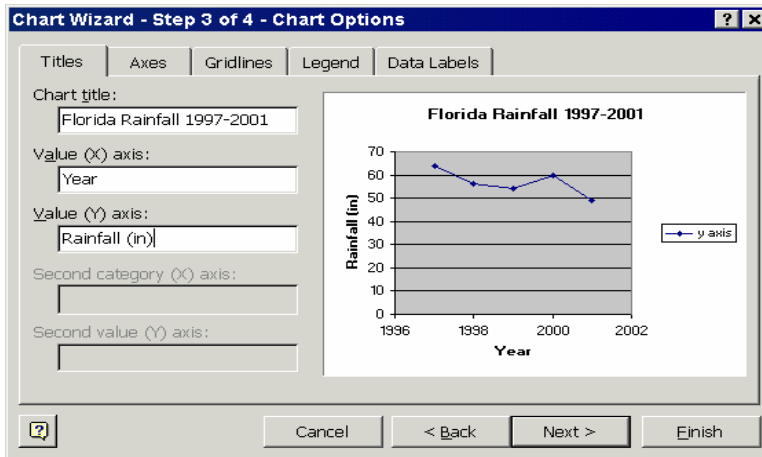
- A) I will type "x axis" in this cell (A1), and underneath it different numbers in a few cells of that column. Then I'll type "y-axis" in the next top column cell (B1) along with different numbers in the same number of cells as the other column. Click on a blank cell and then click back onto the last cell you just entered. (see figure below)



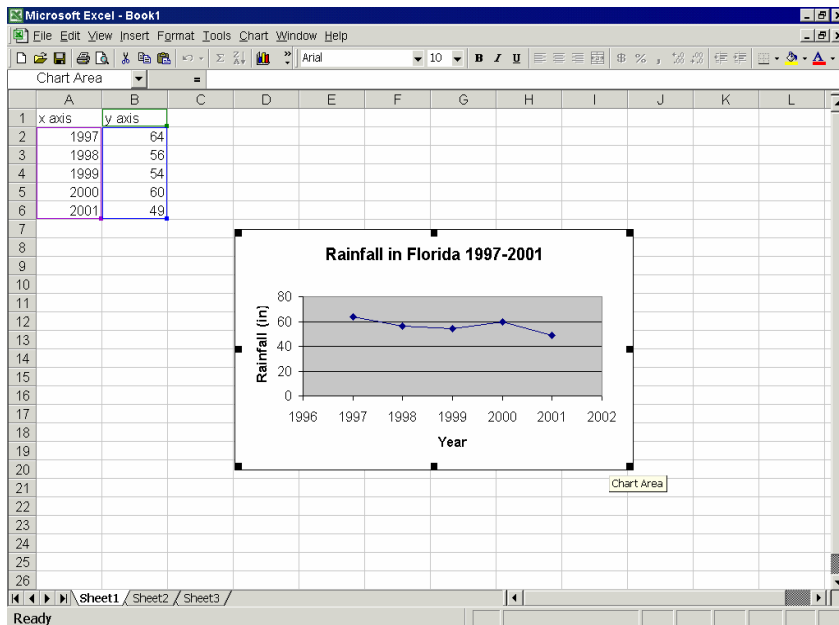
- B) From there I can click on the graph icon from the top and choose "x y scatter" from the "Standard types window." From the "Chart sub-type" area of that same window, choose the one in the lower left hand corner. This will allow a scatter with data points connected by lines. But, as you can see, Excel allows me to choose from many types of graphs. Click on "Next" to go to the next window. You will see that a moving border has surrounded the data you just entered in order to graph it. (see figures below)



- C) "Columns" should be chosen in the "Data Range" window so click "Next."
- D) I can name the graph by typing it in on the "Chart title" line. (I will name this Florida Rainfall over the past five years.)
- E) Also complete the values for your x and y axis. (I will say x is the Year and y is the amount of rainfall in inches.) (see figure below)



- F) Choose the Legend tab at the top and click on "Show Legend" to get rid of this. The box should now be blank. Click "Next" at the bottom.
- G) Choose "Finish." Our graph looks great! We can do some other things: change the background color, the plotted point shape, etc. (see figure below)



7. Now, you will type your data into Excel just like I did for my example. Then, graph your data and print it. (Some students will need help during this time, so allow for questions and help.)

8. What other professions might use a program like Excel? What kind of data could Excel be used to manipulate? Do you think you will use this in the future whenever you have to graph data?

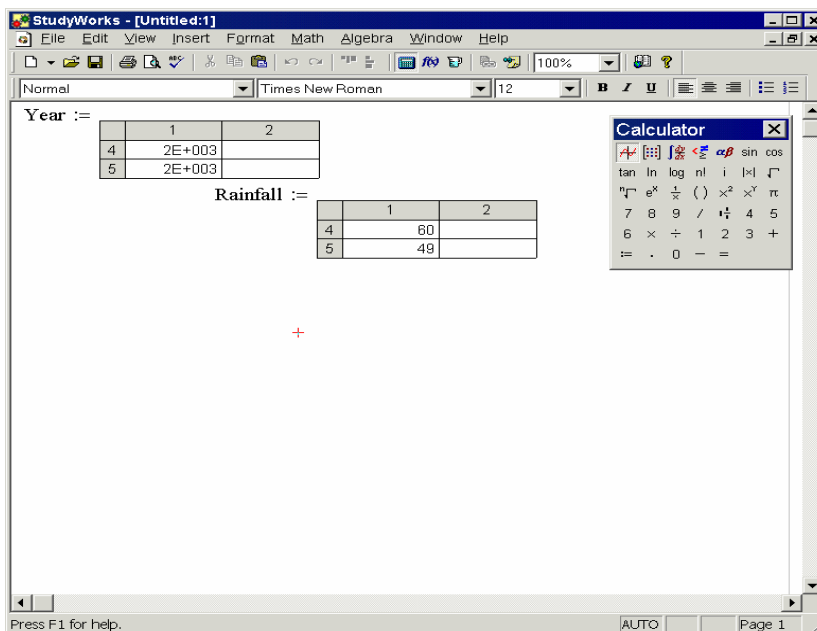
PART II: Using StudyWorks to graph data

6. We can also enter this information into a program like StudyWorks which is a Math learning resource. You will find that this program is very useful as a tutorial and practice guide. Notice the page is like a worksheet with a calculator menu.

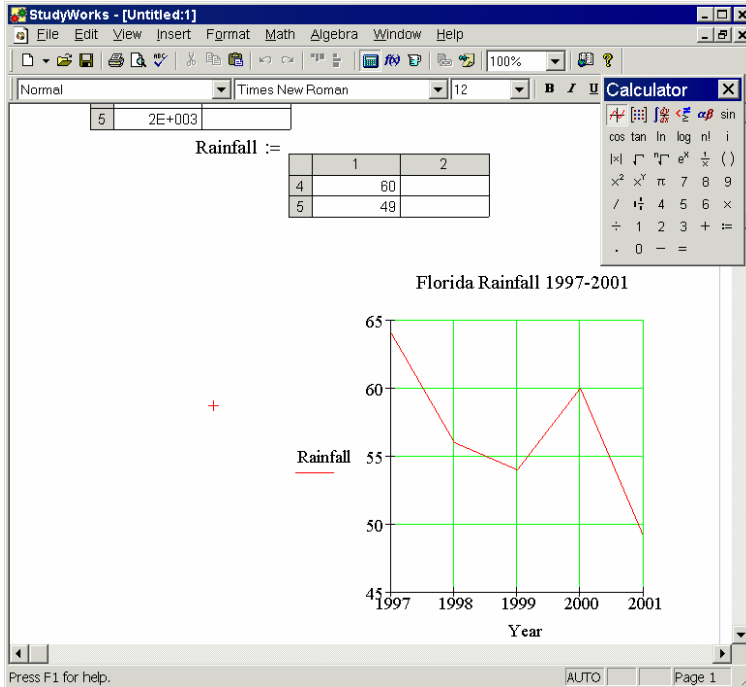
7. Watch the example I will do for you.

Example:

- A) Choose “Insert” from the top and highlight and choose “Component.”
- B) Then click on “Input Table” and “Finish.”
- C) You will see the cursor here on your worksheet. You must name this information. (I will name this Year.)
- D) Now you can enter your data into this table with a number in each column cell. Click outside of the table when you have finished.
- E) To enter the next set of data, go to “Insert” again, choose “Component,” click on “Input Table,” click on “Finish,” and name and enter the next set of data. (I will name this Rainfall.) Again, click outside of the table after entering all the data. (see figure below)



- F) To create a graph based on the information I just entered into my tables, I click on the Line Graph icon.
- G) You will see a blank outline of the graph with the cursor at the bottom for you to name the x-axis. (I will name mine Year.) Click on the y-axis name label line and name it. (I will name it Rainfall.)
- H) Click outside of the graph and voila, your graph has been made!
- I) Place the cursor above the graph and click to type the title of the graph. (see the next figure)



8. Now you will type your data into the StudyWorks worksheet just like I did in my example. Print your graph when you are finished. (Circulate among students and help them as needed.)

9. If students pinged locations of their choice, have them compare data to see the correlation between distance and time. If time didn't always increase when distance did, what percentage did? What can we conclude?

Post-Activity Discussion:

Ask questions of students as listed in the "Requirements from students."

Also explain that time and distance correlations do not always result in findings like what we found in this lesson. Explain the difference between Internet 1 and Internet 2. Use this analogy: Computers can operate on these two different systems. Internet 2 is like a highway with many lanes that allow for more traffic and quicker arrival time. Internet 1 is like a city or county road with only a few lanes that doesn't allow for a lot of traffic. So even though a packet of information is sent from here to some place in North Carolina, it depends on which Internet it's sent on. So even though the computers you are sending information to may be a block away from each other, the time that it gets there will be different because of these different pathways. Therefore, as distance increases, time doesn't always increase. (But, as we saw with our data, it does most of the time.)

Correlating Sunshine State Standards:

- MA.B.4.3
- MA.D.1.3
- MA.D.2.3
- MA.E.1.3
- MA.E.3.3
- SC.H.1.3
- SC.H.3.3

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Thanks to Dr. Ken Christensen for teaching me about Computer Science and for helping me take it back to the classroom.