

Title: Basic Algebra and Computers: Spreadsheets, Charts, and Simple Line Graphs

Grade Ranges:

 K-4

 X 5-8

 X 9-12

Subject Tag:

Math: Algebra

Computers: General

Synopsis:

This lesson shows students in one period how to use Microsoft Excel as a “graphing calculator.” The lesson is intended primarily to show students visual representations of line graphs in a Cartesian plane but also provides students with basic skills for using Excel. Excel can be used as a graphing calculator for Algebraic equations ranging from simple line ($f(x) = mx + b$) to advanced parabolic ($f(x) = x^2 + 3x - 4$) equations.

Keywords:

algebraic equations, line graphs, slope-intercept, spreadsheets, Microsoft Excel, parabolic equations

Body:

After introducing the concept of the slope-intercept equation for a line, tell students that the class will have a visual representation of lines and equations. One of the more common methods of teaching beginning Algebra students how to draw a line graph in a two-dimensional Cartesian plane is to show them how to make an “XY” chart. Students should create diagrams resembling a lower case t, similar to the diagram below. On the left side of the t, students should write down various values they will use to represent x in the slope-intercept equation. On the right hand side of the t, students should calculate the value of y or $f(x)$ based on the specified x value. Here is an example:

x	$f(x) = 3x - 6$
-5	-21
-3	-15
-1	-9
1	-3
3	3
5	9

To do this operation by hand, students will need to determine the $f(x)$ value on their own. Prior to the use of graphing calculators and now computers, students would plot the preceding point pairs (x, y) on a sheet of graphing paper and literally connect the dots to make their line graphs. Tell students that you want to provide them with a new and fun way to visually represent their line graphs other than this method (by hand) and that they

can learn a new skill in the process. Take them to the computer lab to introduce the basics of creating graphs in Excel.

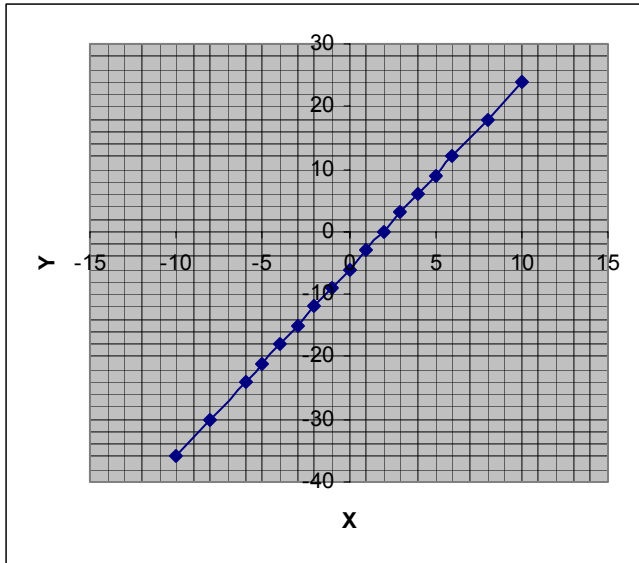
Note: If you are unsure of how to use Excel, meet with your school's technology specialist to learn about the following features: cell formatting, calculation formulas, filling formulas or values across rows or down columns, and creating charts and the accompanying topics of chart manipulation, including chart types, axis labeling, legend display.

In the computer lab:

Have students set up two columns in a spreadsheet to mimic the chart shown above, explaining to them how to use formulas and substitute cell names into slope-intercept equation. Here is a sample spreadsheet using the same equation as in the chart above:

x	$f(x) = 3x - 6$
-10	-36
-8	-30
-6	-24
-5	-21
-4	-18
-3	-15
-2	-12
-1	-9
0	-6
1	-3
2	0
3	3
4	6
5	9
6	12
8	18
10	24

Next, have the students create a chart. Select the chart type of XY scatter with data points connected with smooth lines. (Or you can explore to find another representation that works.) Walk students through the various processes for labeling axes and legend display to suit your requirements for the assignment. The handout included with this lesson plan uses the data from the table in the last example to show students what an XY scatter chart looks like.



Ask students to describe the relationship formed by the different values of the slope, or m in the equation $y = mx + b$. Ask students to point out on their graphs how changing the value of the slope of a line from a whole number to a fraction and from a positive number to a negative number changes the shape and angle of the lines drawn in their Excel charts.

For the remainder of the class period, give students five to 10 additional slope-intercept equations and have them create number tables and graphs using Excel. Have students print their work before the end of the period and hand it in to you for assessment.

After finishing the computer-based assignment, have students answer five to 10 additional questions related to estimation of the appearance of slope-intercept line equations. Create the problems in advance and then either write them on the board or hand out a problem sheet to students. Have them use their printed graphs to estimate the appearance and slope of various equations based on the graphs they have created. Tell students they cannot use Excel to predict the appearance of a line but instead must use their printed graphs. Their answers should involve a basic description of which direction the line slopes (to the left or right), the angle of the slope (steep to flat), and where the line crosses the y-axis.

Note about the related links listed below: Few Web sites specifically address the issue of using Excel as a graphing calculator. However, you can use some of the tutorials listed below to learn about creating charts in Excel — the graphing aspect of the program.

Related Links:

Microsoft Excel Tutorial

<http://www.bcschools.net/staff/ExcelHelp.htm>

Good quality online MS Excel tutorial

Introduction to Microsoft Excel 97

<http://www.unt.edu/training/Excel97/>

Another nice and easy-to-understand MS Excel 97 tutorial published by the University of North Texas

Microsoft Excel Help

<http://www.computerhope.com/excel.htm>

Of most interest is the “Excel formulas” section of this site – also provides good information about Excel 2002 and 2000, ideas should be intuitively translatable to Macintosh or PC and to older versions of Excel

Ask Mr. Excel – Tips and Solutions for Excel

<http://www.mrexcel.com/>

FAQ and message board pages for help with Excel

Microsoft Office – Excel Home Page

<http://www.microsoft.com/office/excel/default.asp>

home page for Microsoft Excel

Slope-Intercept Activity

http://www.exploremath.com/activities/Activity_page.cfm?ActivityID=16

The activity allows users to experiment online with the slope and intercept of a line. Registration at ExploreMath.com is free, but necessary for accessing a lesson plan that accompanies the activity. Installation of the Macromedia Shockwave player also is required.

Determining Line Equations

http://www.gomath.com/htdocs/lesson/linearequation_lesson1.htm

According to the author of this text-based lesson, students who successfully complete the activities “will be able to determine an equation of a line through two given points, or one given point and the slope.” The GoMath site also features a geometry calculator, online math games, and “Formula-To-Go,” which is an algebra, geometry, trigonometry, and calculus resource.

Features:

- ___ Contains special education tips
- ___ Quick Activity (less than 30 minutes; story starter)
- ___ Requires Internet access for students to complete

Objectives:

1. Provide students with visual representations of slope-intercept equations
2. Further familiarize students with the concept of line graphs in a two-dimensional Cartesian plane
3. Integrate computer skills into standard curriculum objectives

Standards:

NY: 3: Students use mathematical operations and relationships among them to understand mathematics. **4:** Students use mathematical modeling/multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships. **6:** Students use ideas of uncertainty to illustrate that mathematics involves more than exactness when dealing with everyday situations. **7:** Students use patterns and functions to develop mathematical power, appreciate the true beauty of mathematics, and construct generalizations that describe patterns simply and efficiently.

NYC: Middle School: M3a. Discovers, describes, and generalizes patterns, including linear, exponential, and simple quadratic relationships, i.e., those of the form $f(n)=n^2$ or $f(n)=cn^2$, for constant c , including $A=s^2$, and represents them with variables and expressions. **M3b.** Represents relationships with tables, graphs in the coordinate plane, and verbal or symbolic rules. **M3c.** Analyzes tables, graphs, and rules to determine functional relationships. **M5a.** Formulation: The student participates in the formulation of problems. **M5b.** Implementation: The student makes the basic choices involved in planning and carrying out a solution. **M5d.** Mathematical reasoning: The student demonstrates mathematical reasoning by generalizing patterns, making conjectures and explaining why they seem true, and by making sensible, justifiable statements. **M6f.** Uses equations, formulas, and simple algebraic notation appropriately. **M7a.** Uses mathematical language and representations with appropriate accuracy, including numerical tables and equations, simple algebraic equations and formulas, charts, graphs, and diagrams. **High School: M6c.** Evaluates and analyzes formulas and functions of many kinds, using both pencil and paper and more advanced technology.

CT: Learning Resource and Information Technology 5. Application. Students will use appropriate technologies to create written, visual, oral and multimedia products to communicate ideas, information or conclusions to others. **Mathematics 3.** Estimation and Approximation. Students will make estimates and approximations, and judge the reasonableness of results. **4.** Ratios, Proportions and Percents. Students will use ratios, proportions and percents to represent relationships between quantities and measures and solve problems involving ratios, proportions and percents. **9.** Algebra and Functions. Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change. **Technology Education 4.** Problem Solving/Research and Development. Students will recognize technology as the result of a creative act, and will be able to apply disciplined problem-solving strategies to enhance invention and innovation.

NJ: Mathematics 4.2: All Students Will Communicate Mathematically Through Written, Oral, Symbolic, And Visual Forms Of Expression. **4.5:** All Students Will Regularly And Routinely Use Calculators, Computers, Manipulatives, And Other Mathematical Tools To Enhance Mathematical Thinking, Understanding, And Power. **4.10:** All Students Will Use A Variety Of Estimation Strategies And Recognize Situations In Which Estimation Is Appropriate. **4.13:** All Students Will Develop An Understanding Of Algebraic Concepts And Processes And Will Use Them To Represent

And Analyze Relationships Among Variable Quantities And To Solve Problems. **Cross-Content Workplace Readiness: 2:** All students will use technology, information and other tools. **3:** All students will use critical thinking, decision-making, and problem-solving skills.

Prerequisite Skills:

1. Students should have familiarity with ordered point pairs (x, y) prior to this lesson.
2. Students should have some familiarity with slope-intercept line equations or the lesson will need to be split into two sessions.
3. Students should have some familiarity with the basics of how to operate a computer and print to a networked printer in your school's computer lab (if applicable).

Time Required:

45 minutes

Technology and Materials Needed:

1. Computers, preferred ratio of 1:1 computers to students, but 1:2 is possible

Assessment Criteria:

1. Grading of spreadsheets and charts – you can design your own rubric.
2. Follow-up quiz or test with questions related to computer experience

Recommended Lesson Plan Review Date:

Review Comments:

Check Web sites.

