emcsquared: Textbook Dilemma

Title:	**Grade: 8th**	**BIG Idea:**
Textbook Dilemma Activity based on NCTM's *Navigating Through Algebra in Grades 6-8,* p. 56	**Author(s)**: Kelley Taylor Amy Latta-Won Hope Phillips	Systems of Equations

Prior Knowledge Needed:

* graph data points on a coordinate plane
* define variables, write equations, solve equations, and interpret solutions (M7A2)

GPS Standards:

M8A5. Students will understand systems of linear equations...and use them to solve problems.

a. Given a problem context, write an appropriate system of linear equations.
b. Solve systems of equations graphically and algebraically, using technology as appropriate.
d. Interpret solutions in problem contexts.

Process Standards:

M8P1. Students will solve problems (using appropriate technology).
M8P3. Students will communicate mathematically.
M8P4. Students will make connections among mathematical ideas to other disciplines.
M8P5. Students will represent mathematics in multiple ways.

Objectives:

1. Students will develop linear equations in slope-intercept form to describe a given context.
2. Students will graph lines using a graphing applet.
3. Students will interpret the solutions to a system of equations.

Materials:

Online graphing utility (see *Resources* section below)
Copies of the task *Textbook Dilemma* (see *Resources* section below)

Task:

The superintendent of your school system needs help! She must decide which company to use for purchasing textbooks for the next school year. She is asking math classes to help decide which company would be most economical in this time of financial hardship. Since your class is one of the best, you have been selected!

Companies

***BRAINS R US* – Initial cost of $4000 plus $63.00 for each book**

***NERDS RULE* – Initial cost of $3000 plus $65.00 for each book**

***GEEKS HAVE IT* – $80.00 per book**

1. Which company is offering the best deal? Show your work using words, a table, a graph, and an equation.

2. Which company has the worst deal? Show your work using words, a table, a graph, and an equation.

Write a recommendation to the Board of Education detailing your findings. Which company should the Board use? Why?

Description and Teacher Directions:

This activity is designed for students to use technology to represent a system of equations. Students will use an online graphing calculator applet to input equations and produce graphs. Directions provided below do not provide an explanation of every feature of the applet. By clicking on the available buttons and tabs, users will find the applet very intuitive. Encourage students to explore the applet's features.

Students will use the representations to answer the task questions and compose a written recommendation to the Board of Education. Ideally, individual students should have access to a computer lab or laptops. However, the teacher could project the graphing applet for the entire class and model the inputting of data.

Students should develop equations for the three plans in slope-intercept form, as this is the most appropriate form for the way the information is presented in the problem.

NOTE: The asterisks in the equations below indicate multiplication.

Brains R Us:

Total Cost = $4000 + $63.00 * Number of Books
y = 4000 + 63x

Nerds Rule:

Total Cost = $3000 + $65.00 * Number of Books
y = 3000 + 65x

Geeks Have It:

Total Cost = $80 * Number of Books
y = 80x

Use the free, online graphing calculator applet with this systems of equations problem. Click on the link that follows to view a step-by-step tutorial of some of the features of the calculator that apply to systems problems. Free Online Calculator Directions.doc

Enter the first equation in Y_1; the second equations in Y_2; and the third equation in Y_3.

One can typically click the "Graph" key and successfully view each graphed line. However, because of the large numbers involved in this problems, the "settings" tab must be used. Click the "Settings" tab and enter the following values:

x-axis: min. 0; max. 1200; ticks every 50

y-axis: min. 0; max. 70,000; ticks every 1000

Table Settings: start 0; step 1 (*Students will change these settings as they progress through the task.)

Remember, the table in the right-hand corner shows data values for the line that is *currently selected*. A line is *selected* by clicking on its equation. Students may enter a new "x" value in any position on the table, and the corresponding "y" value will appear in real time.

While students may estimate points of intersection, they will need to confirm their estimates by entering values in the table. By using the table, students will *confirm* their beliefs about which company is the most cost effective and at what point.

In analyzing the graphs, students should come to the following conclusions (no chronologically is suggested by the bullet points below):

- Each plan offers the best deal **at some point**. Depending on the number of books to be ordered, all three lines occupy the lowest position, **at some point**.

- At 200 books, the cost of the *Geeks Have it* plan is $16,000. At 200 books, the cost of the *Nerds Rule* plan is also $16,000.
- If purchasing less than 200 books, the *Geeks Have It* plan is the most cost effective.
- If purchasing more than 200 books but less than 500, the *Nerds Rule* plan is the most cost effective.
- If purchasing greater than 500 books, the *Brains R Us* plan is most cost effective.

The "Intersection" tab enables students to determine intersection points. Select any two of the lines. For this task a total of three selections of two lines is possible (*Brains* & *Nerds*; *Brains* & *Geeks*; and *Nerds* & *Geeks*).

Click on the boxes to the left of the two equations you are selecting. Click on the "Find Intersection Point(s)" button. The values are not integers because of the way the applet "pixelates". Students should ignore the decimal places and regard these as integer values only.

Resources:

Free online graphing calculator applet
http://my.hrw.com/math06_07/nsmedia/tools/Graph_Calculator/graphCalc.html

Textbook Dilemma Task Worksheet
Textbook task.doc