

emcsquared: Talk or Text

Title: <i>Talk or Text?</i>	Grade: 8th Grade	BIG Idea:
Source: http://illuminations.nctm.org	Author(s): Kelley Taylor Amy Latta-Won Hope Phillips	System of Linear Equations

Prior Knowledge Needed:

- Define variables, write equations, solve equations, and interpret solutions (M7A2)
- Develop an equation in standard form to represent a situation in context

GPS Standards:

M8A4. Students will graph and analyze graphs of linear equations.

g. Solve problems involving linear relationships

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

a. Given a problem context, write an appropriate system of linear equations or inequalities.

b. Solve systems of equations graphically and algebraically, using technology as appropriate.

d. Interpret solutions in problem contexts.

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:

Students will*:

1. Compare two cell phone plans based on examples of different usage.
2. Write equations to model cost of cell phone usage.
3. Graph and solve a system of linear equations.
4. Analyze the solution to a system of linear equations and interpret the meaning of the graph.

*from

<http://illuminations.nctm.org/LessonDetail.aspx?id=L780>

Materials:

Computers with Internet access for students and/or computer with Internet access for teacher with projector
Information about real-world cell phone plans (i.e. Verizon, Sprint, etc.) (optional)

Talk or Text? Activity Sheet <http://illuminations.nctm.org/Lessons/TalkOrText/TalkOrText-AS.pdf>

Talk or Text? Answer Key <http://illuminations.nctm.org/Lessons/TalkOrText/TalkOrText-AK.pdf>

Task:

Good news! Your parents just said they would buy you your first cell phone and prepay \$25 each month for the plan of your choice. To make the best decision, you've found the two plans below. Compare the cell phone plans and choose the one that's right for you.

PLANS	TEXT MESSAGES	VOICE MINUTES
A	\$0.15 minute	\$0.05 minute
B	\$0.05 minute	\$0.10 minute

Which plan would you choose? Why? Use mathematical reasoning in explaining your choice.

*NOTE: For full details of this problem, follow this link from NCTM's *Illuminations* <http://illuminations.nctm.org/LessonDetail.aspx?id=L780>

Description and Teacher Directions:

The teacher support materials provided on the Illuminations website are excellent. They include the following: instructional plan; questions for students; assessment options; extensions; and teacher reflection. Ideally, all materials should be read by the teacher prior to presenting the lesson. The following is the link to the site: <http://illuminations.nctm.org/LessonDetail.aspx?id=L780>

This task has been adapted to include technology. As it is written, it is a paper-and-pencil task. Though the task is worthy of completion in its current form, incorporating technology can greatly enhance the mathematics. Students benefit from the extra information provided by online graphing utilities.

Because most classroom computers have the **Excel program**, the directions and commentary that follow are based on the use of Excel. The explanations below are detailed but assume the teacher has a working knowledge of how to use Excel to enter data, compose equations, and insert a graph.

1. Open an Excel spreadsheet.
2. Enter data for **Plan A** in the first two columns, labeling them -- *text messages* (x) and *voice minutes* (y), respectively
3. Begin the x -values with 0 to encourage students to consider the contextual definition of the y -intercept, the point (0, 500) where there are no text messages and all voice minutes.
4. Continue with 1, 2, 3, 4, and 5 text messages (x -values) and the resulting y -values. (See table below to view example of what the format should look like).
5. Ask students if they see a pattern developing in the y -values. (Answer: They are decreasing by 3, after starting with a total of 500.)
6. Enter an equation for the x - and y -values. For the x -values, the equation is $1 + \text{previous cell}$. For the y -values, the equation is $500 - 3*(x\text{-value})$. In Excel the asterisk is used for

multiplication.

7. Plan A's equation is the slope-intercept form of the problem's original, standard form equation. Lead students in a discussion about when one form is more appropriate to use than the other.

- Below are the steps to transform the equation from standard to slope-intercept form.

$$25 = 0.15x + 0.05y$$

$$-0.15x + 25 = 0.05y$$

$$\frac{-0.15x + 25 = 0.05y}{0.05}$$

$$-3x + 500 = y$$

- Use the *fill* tool to add more x-values; fill until, at least, $x = 250$
- Use the *fill* tool to add more y-values; fill to match the number of x-values

PLAN B:

- Repeat steps 1-5 for Plan B.
- Enter an equation for the x- and y-values. For the x-values, the equation is **1 + previous cell**. For the y-values, the equation is **250 - 0.5*(x-value)**.
- Plan B's equation is the slope-intercept form of the problem's original, standard form equation.
- Below are the steps to transform the equation from standard to slope-intercept form.

$$25 = 0.05x + 0.1y$$

$$25 - 0.05x = 0.1y$$

$$\frac{25 - 0.05x = 0.1y}{0.1}$$

$$250 - 0.5x = y$$

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Plan A		Plan B	
Text	Voice	Text	Voice
0	500	0	500

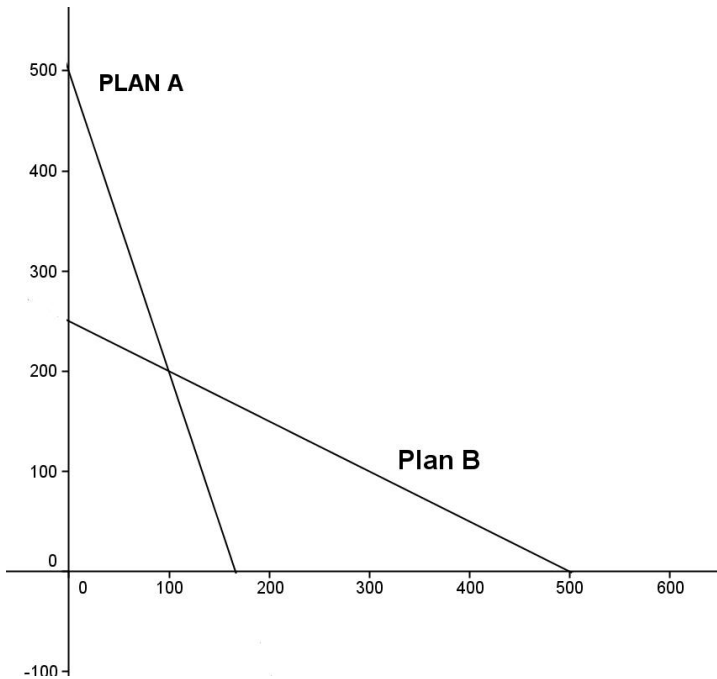
1	497	1	249.50
2	494	2	249
3	491	3	248.50
4	488	4	248
5	485	5	247.50

Graphing Plans A and B:

IMPORTANT NOTE: The answer to and graph of the problem found on the Illuminations website are incorrect. Both the ordered pair and graph have been reversed. The site states that the ordered pair (200, 100) is the correct answer. The correct answer is (100, 200). The graph is reversed but would be correct if it were reflected over the $y=x$ line. See a correct version of the graph below.

Plan A: $y = -3x + 500$

Plan B: $y = -.5x + 250$



- Using the icons at the top of the page, click on *Chart Wizard* (icon looks like a bar graph).
- Select *XY(Scatter)* in the left-hand column
- On the right-hand side, click the picture on the second row, left side; hovering over this picture should yield the description "Scatter with data points connected by smoothed lines"
- When prompted, click "Next" to continue the process.
- In the box entitled *Data Range*, clear the contents if data has

been pre-selected. Here you are "telling" Excel what data to graph. Using the "Ctrl" key, select the data in the following columns: the x- and y-values of Plan A and only the y-values of Plan B (the x-values of both plans are the same).

- Click "Next"
- Discuss with students an appropriate title for the graph and label the x- and y- axes as prompted (Text Messages, Voice Minutes).
- Click "Next" to place the graph on the spreadsheet
- By right-clicking on every **feature** of the graph (i.e. title, axes, scale, etc.), they can be altered. Let students explore these features in order to make their graphs as meaningful as possible. Changing the scale of the axes is particularly helpful for interpreting the intersection point and the data points, in general. As there is no need for negative y-values, try adjusting the axes so that the data is displayed in only one quadrant.
- Re-size the graph according to your needs by clicking on the graph and dragging it in a corner

Interpreting the Graph

- Refer to the teacher commentary provided on the Illuminations site
- **IMPORTANT NOTE: Question #7 on the Illuminations answer page is incorrect. The ordered pair should be (100, 200) indicating where the graphs intersect.**

Resources:

Note: If you prefer a paper copy of the graph for your preparation, click on the link that follows. The file is a Word document. This graph was not made in Excel. A sample of the **Excel** graph follows below.

 [Talk or Text \[graph\]-1.doc](#)

[Graph made in Excel Talk or Text \[graph\].doc](#)

If you do not have access to the EXCEL program, select one of the following online graphing applications to use to graph information:

www.geogebra.org

http://my.hrw.com/math06_07/nsmedia/tools/Graph_Calculator/graphCalc.html

<http://shodor.org/interactivate/activities/Graphit/> - investigation required to do two graphs at once

A convenient way to find a graphing applet -- Google "Graphing Calculator Applet"