

iPads and the Bamboo Tablet: Meeting the Needs of Today's Students

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Introduction

It is no secret that the students we encounter today are immersed in technology. The average college student owns 7 devices and spends over 125 hours per week on their devices. (www.edudemic.com/college-students-really-obsessed-with-technology) More than 90% of college students use email to communicate with professors. A vast majority of students own e-readers and purchase digital textbooks, if possible. Approximately 73% of students say they cannot study without technology and 70% take notes using keyboards instead of paper. All of this technology has created a dependency. It is no surprise to hear that 38% of students can't go more than 10 minutes without checking their smartphone. (www.mashable.com/2012/05/06/tech-college-infographic)

The challenge for educators is how to connect with these technologically savvy students. How can we reach these students and engage them in our lectures? How can we differentiate instruction to meet the various learning styles that are in our classroom? In this age of instant gratification, we need to be able to get, and keep, their attention.

The Bamboo Tablet

<http://www.wacom.com/en-us/products/navigation/bamboo-pad-wireless>

I have learned that Wacom has changed the Bamboo tablet to the Intuos tablet, but they have added a Bamboo Pad. Either should work fine for the purposes I will discuss here.

I am fortunate that my institution embraces technology. We have a SmartBoard site license which enabled me to download the SmartBoard software onto my laptop so that I can use it no matter where I am assigned to teach. All of our classrooms have projectors that can be connected to laptops as well as the computer on the podium in the room.

Over the past few semesters, I have been using the Wacom Bamboo tablet in all of my classes when I lecture. I write the notes on the tablet, using the SmartBoard technology and tools. However, it is not necessary to have SmartBoard technology to use the tablet. The Bamboo tablet can also be used to write on word documents.

Using the Bamboo tablet enables me to meet the various learning styles in my classroom. Because I am able to lecture facing the class, both my auditory and visual learners are getting the benefit of clear speech and facial cues. I also use a variety of colors to reach my visual learners (see Figures 1 and 2). Students, especially those in my developmental classes, benefit from seeing the different steps taken in different colors. I am then able to save my notes as a PDF and upload them on Blackboard. That way if a student misses a class, they know they will still be able to get the notes.

1.7 Number Properties

Commutative

$$5+3 = 3+5 \quad x+y = y+x$$

$$5 \cdot 3 = 3 \cdot 5 \quad xy = yx$$

Associative

$$5+(3+2) = (5+3)+2$$

$$5 \cdot (3 \cdot 2) = (5 \cdot 3) \cdot 2$$

Distributive

$$5(8-3) = 5(8) - 5(3)$$

$$5(8+3) = 5(8) + 5(3)$$

$$6(x-4) = 6(x) - 6(4)$$

$$6x - 24$$

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identity

$$x+0 = 0+x = x$$

$$x(1) = (1)(x) = x$$

So identity
element for
addition is 0
and it is
1 for mult.

inverse

$$5 + -5 = 0 \quad x + -x = 0$$

$$5 \left(\frac{1}{5}\right) = 1 \quad x \left(\frac{1}{x}\right) = 1$$

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1.8 Simplifying Expressions

$$\begin{array}{r} 2k - 7 - 5k + 7k - 3 - k \\ \hline \end{array}$$

$$3k - 10$$

$$\begin{array}{r} 6 - 3x - 2x - 5 + x - 3x \\ \hline \end{array}$$

$$1 - 7x \text{ or } -7x + 1$$

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$$4(6y-9) + 7$$

$$24y - 36 + 7$$

$$24y - 29$$

$$-4 - 5(y-13)$$

$$-4 - 5y + 65$$

$$-5y + 61$$

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$$-2(3r-4) - (6-r) + 2r - 5$$

$$-6r + 8 - 6 + r + 2r - 5$$

$$-3r - 3$$

$$-\frac{7}{8}(y-\frac{3}{8}) - \frac{1}{2}y$$

$$-\frac{7y}{8} + 21 - \frac{1}{2}y$$

$$-\frac{11}{10}y + 21 - \frac{5}{10}y$$

$$-\frac{16}{10}y + 21$$

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2.1 The addition property of Equality

$$x - 12 = 21$$

$$+12 \quad +12$$

$$x = 33$$

check

$$33 - 12 = 21$$

$$21 = 21 \checkmark$$

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Figure 1: Bamboo Tablet Example – Notes

Describe each system
without graphing + state & solving

$$\begin{aligned} 2x - 3y &= 5 \\ 3y &= 2x - 7 \end{aligned}$$

Rewrite
 $y = mx + b$

$$\begin{aligned} 2x - 3y &= 5 & 3y &= 2x - 7 \\ -2x & -2x & \frac{3}{3} & \frac{3}{3} \end{aligned}$$

$$\frac{-3y}{-3} = \frac{-2x+5}{-3} \quad y = \frac{2}{3}x - \frac{7}{3}$$

$$y = \frac{2}{3}x - \frac{5}{3}$$

Slopes same
y-int different

Some have parallel lines
which means no solutions
so inconsistent & independent
no solution
the 2 lines

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4.2 Solving by Substitution

$$\begin{aligned} 2x + 7y &= -12 \\ x &= 3 - 2y \end{aligned}$$

$$\begin{aligned} 2(3-2y) + 7y &= -12 \\ 6 - 4y + 7y &= -12 \\ -6 + 3y &= -12 \\ \frac{-6}{3} + \frac{3y}{3} &= \frac{-12}{3} \\ \frac{3y}{3} &= \frac{-12+6}{3} \end{aligned}$$

$$\begin{aligned} x &= 3 - 2y \\ x &= 3 - 2(-6) \end{aligned}$$

$$\begin{aligned} x &= 3 + 12 \\ x &= 15 \end{aligned} \quad (15, -6)$$

check
 $2(15) + 7(-6) = -12$
 $30 - 42 = -12$

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$$\begin{aligned} 2x + 3y &= 6 \\ x &= 3y + 5 \end{aligned}$$

$$\begin{aligned} 2(3y+5) + 3y &= 6 \\ 6y + 10 + 3y &= 6 \end{aligned}$$

$$\begin{aligned} 9y + 10 &= 6 \\ -10 & -10 \\ 9y &= -4 \\ y &= -\frac{4}{9} \end{aligned}$$

$$\begin{aligned} x &= 3y + 5 \\ x &= 3(-\frac{4}{9}) + 5 \end{aligned}$$

$$\begin{aligned} x &= -\frac{4}{3} + 5 \\ x &= -\frac{4}{3} + \frac{15}{3} \end{aligned}$$

$$\begin{aligned} x &= \frac{11}{3} \end{aligned}$$

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$$y = 8x + 4$$

$$16x - 2y = 8$$

$$16x - 2(8x+4) = 8$$

$$16x - 16x - 8 = 8$$

~~-8 = 8~~ No Solution
so there would
be parallel lines

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$$\begin{aligned} 3x - 2y &= 19 \\ x + y &= 8 \end{aligned}$$

Solve by
substitution

$$\begin{aligned} x + y &= 8 \\ -x & -x \\ y &= -x + 8 \end{aligned}$$

$$\begin{aligned} 3x - 2(-x+8) &= 19 \\ 3x + 2x - 16 &= 19 \\ 5x - 16 &= 19 \\ +16 & +16 \\ 5x &= 35 \\ x &= 7 \end{aligned}$$

$$\begin{aligned} 3x - 2y &= 19 \\ 3(7) - 2y &= 19 \\ 21 - 2y &= 19 \\ -21 & -21 \\ -2y &= -2 \\ y &= 1 \end{aligned}$$

$$\begin{aligned} (7, 1) \end{aligned}$$

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$$\begin{aligned} \frac{1}{3}x + \frac{1}{3}y &= -\frac{1}{3} \\ 2(\frac{1}{3}x + \frac{1}{3}y) &= -2 \\ x + 4y &= -4 \end{aligned}$$

$$\begin{aligned} 6(\frac{1}{3}x) + 6(\frac{1}{3}y) &= 6(-\frac{1}{3}) \\ 2x + 2y &= -2 \end{aligned}$$

$$\begin{aligned} 2x + 2y &= -2 \\ -4y &= -4y \\ x &= -4y - 2 \end{aligned}$$

$$\begin{aligned} x + 4y &= -4 \\ x - 4y &= -4 \\ +4y & +4y \\ x &= 0 \end{aligned}$$

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Figure 2: Bamboo Tablet Example – Notes 2

Another nice feature of using this tablet is the ability to create graphs using grid paper. Drawing graphs free hand on the white board has always been somewhat problematic. My developmental students need to see how graphs are done in a more accurate manner. Using the tablet, I can create graphs on grid paper (see Figure 3) so they can see an accurate representation of how to graph a line or find the point of intersection of two lines, etc.

The tablet also enables me to write on documents (see Figure 4). When I have a packet of problems, for example word problems, I am able to work on them with the class and save them as a PDF to put on Blackboard for students to access later.

The feedback I receive from my students with respect to my use of the tablet for lectures and notes is overwhelmingly positive. They appreciate that I am never “in the way” of the notes I have written. Also, if I move too fast for someone, I can page back easily for them to finish the note. Unlike when something is written on the board and then erased, my notes are always available.

Untitled.notebook

February 11, 2015

4.1 Solving Systems of Equations
By graphing

2 lines can intersect in 1 point, no points
or infinite points

is $(4, -1)$ a solution of the system?

$$\begin{array}{l} \checkmark 5x + 6y = 14 \quad 5(4) + 6(-1) = 14 \quad 20 - 6 = 14 \\ \checkmark 2x + 5y = 3 \quad 2(4) + 5(-1) = 3 \quad 8 - 5 = 3 \end{array}$$

Yes it is a solution

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is $(-3, -6)$ a solution of the system?

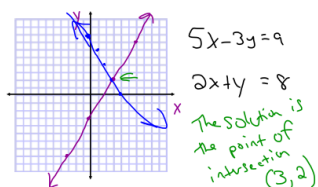
$$\checkmark x + y = -9 \quad -3 + -6 = -9$$

$$\times 2x + y = 4 \quad 2(-3) + -6 = 4$$

so it is not
a solution

$$\begin{array}{l} -6 + -6 = 4 \\ -12 \neq 4 \end{array}$$

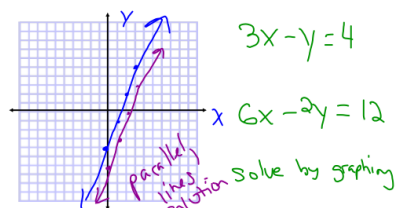
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Solve by graphing

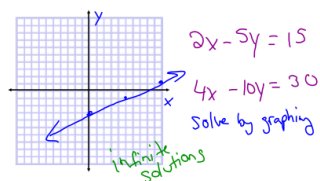
$$\begin{array}{r} 5x - 3y = 9 \\ -5x \quad -5x \\ \hline -3y = -5x + 9 \\ \frac{-3}{-3} \quad \frac{-5}{-3} \quad \frac{9}{-3} \\ y = \frac{5}{3}x - 3 \end{array}$$

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$$\begin{array}{r} 3x - y = 4 \\ -3x \quad -3x \\ \hline -y = -3x + 4 \\ \frac{-1}{-1} \quad \frac{-1}{-1} \quad \frac{4}{-1} \\ y = 3x - 4 \end{array}$$

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$$\begin{array}{r} 2x - 5y = 15 \\ -2x \quad -2x \\ \hline -5y = -2x + 15 \\ \frac{-5}{-5} \quad \frac{-2}{-5} \quad \frac{15}{-5} \\ y = \frac{2}{5}x - 3 \end{array}$$

$$\{x, y\} | 2x - 5y = 15 \text{ same line!}$$

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3 cases for solutions of systems

① Graphs intersect at exactly 1 point.
System is consistent b/c it has a solution
equations are independent

② Graphs don't intersect, lines parallel
System is inconsistent b/c no solution
equations are independent

③ Graphs are the same line
System is consistent b/c there are solutions
equations are dependent b/c lines are the same

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Figure 3: Bamboo Tablet Example – Graph

MAT 016 Section 4.4

For a production of Wicked at the Pantages Theatre in LA, main floor tickets cost \$96 and mid priced mezzanine tickets cost \$58. If a group of 18 people attended the show and spent a total of \$1234 for their tickets, how many of each kind of ticket did they buy?

$$5 = x = \text{main floor}$$

$$13 = y = \text{mezzanine}$$

$$5 + y = 18$$

$$y = 13$$

$$-58(x + y = 18)$$

$$96x + 58y = 1234$$

$$-58x - 58y = -1044$$

$$\begin{array}{r} 38x \\ \hline 38 \end{array} = \begin{array}{r} 190 \\ \hline 38 \end{array}$$

$$x = 5$$

How many liters of a 25% alcohol solution must be mixed with a 12% solution to get 13L of a 15% solution?

$$3 = x = \text{liters of 25\% solution}$$

$$10 = y = \text{liters of 12\% solution}$$

$$x + y = 13$$

$$.25x + .12y = .15(13)$$

$$-.25(x + y = 13)$$

$$.25x + .12y = .15(13)$$

$$195$$

$$x + 0 = 13$$

$$x = 3$$

$$-.25x - .25y = -.325$$

$$.25x + .12y = .195$$

$$-.13y = -.130$$

$$y = 10$$

Figure 4: Bamboo Tablet Example – Writing on Documents

iPads

In fall 2014, I received a mini-grant from our Center for Teaching Excellence. This grant enabled me to sign out classroom sets of iPads and report back on my results. I used the iPads specifically with my developmental algebra classes. The students were very excited to use them, they were happy to try something new and different in a math course. I found that using the iPads in class encouraged differentiated instruction and cooperative learning, as well as active participation and increased engagement.

Interestingly enough, the app that I used most with those classes was not a mathematical app. I used Jot! Free. It is a whiteboard app, and it is free. The way I used this app was to have students work together to solve problems. One student would solve the problem and the other would be the recorder. The problem solver needed to make sure the recorder understood the steps that were taken. Then they would switch roles. They would hold up their answers on the iPad so that I could quickly see which students understood the problems and which still needed remediation. Sometimes I had the students work independently on the iPads, still holding them up when finished so I could assess who needed assistance and who could try more challenging problems. This exercise enabled me to differentiate instruction and meet the various needs of my students.

The Jot! Free app is flexible and offers both plain whiteboard and grid paper backgrounds. Again, this flexibility proved to be very helpful for my students when it came to graphing. Students never seem to have graph paper with them, even if you tell them they will need to bring it to class. Using the grid paper portion of the app allowed them to better understand how to plot points, graph lines, find intercepts, and points of intersection.

Another app I used for graphing is FreeGraCalc (I love that there are so many wonderful, free apps available!).

You can see from my example below (Figure 5), that you can graph 4 equations on one grid. The equations are graphed in different colors, making them easy to identify. The students can then examine the corresponding table and make connections to the graph. I found that this table really helped my students understand how changing the slope and y-intercept affects the graph of a line.

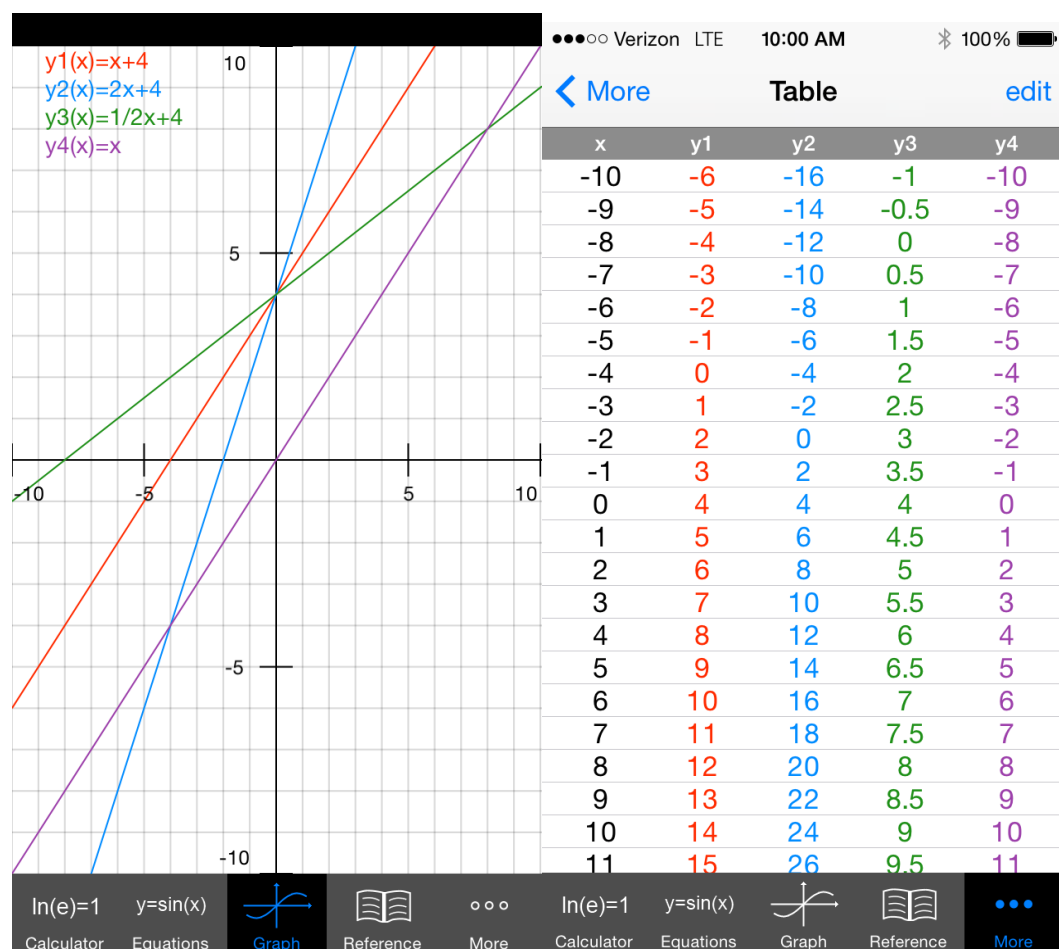


Figure 5: FreeGraCalc Example

Of course this app is also beneficial to use when examining graphs of different levels of difficulty, as illustrated in the following examples (Figures 6 - 10).

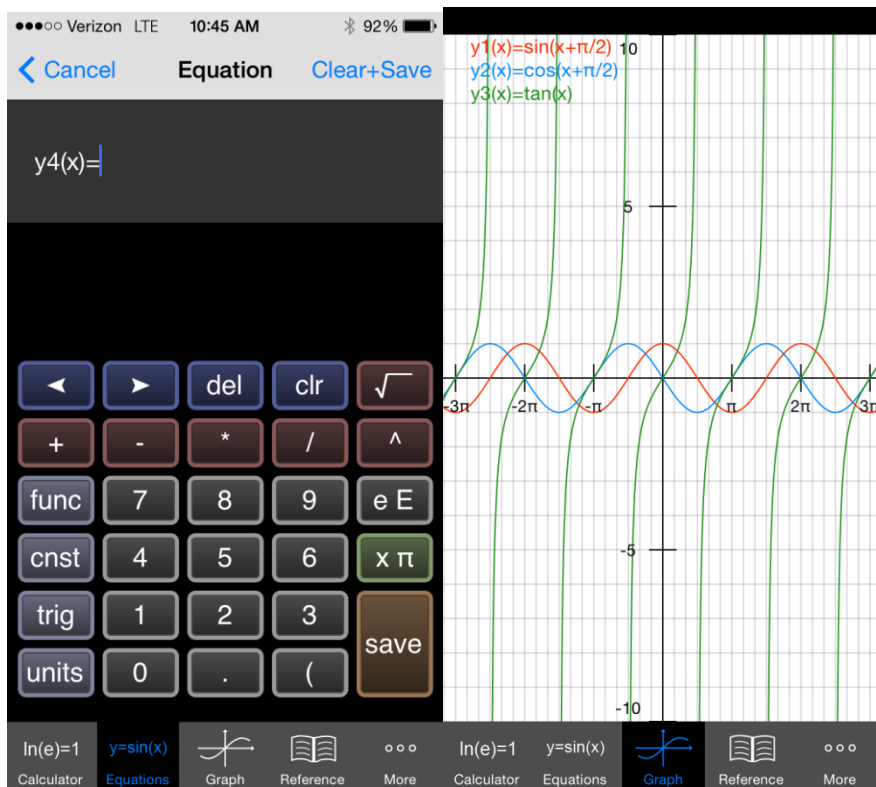


Figure 6: FreeGraCalc Example –Trigonometric graphs

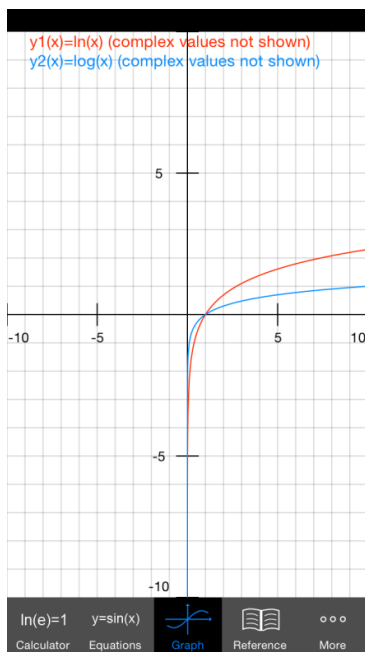


Figure 7: FreeGraCalc Example - Logarithmic

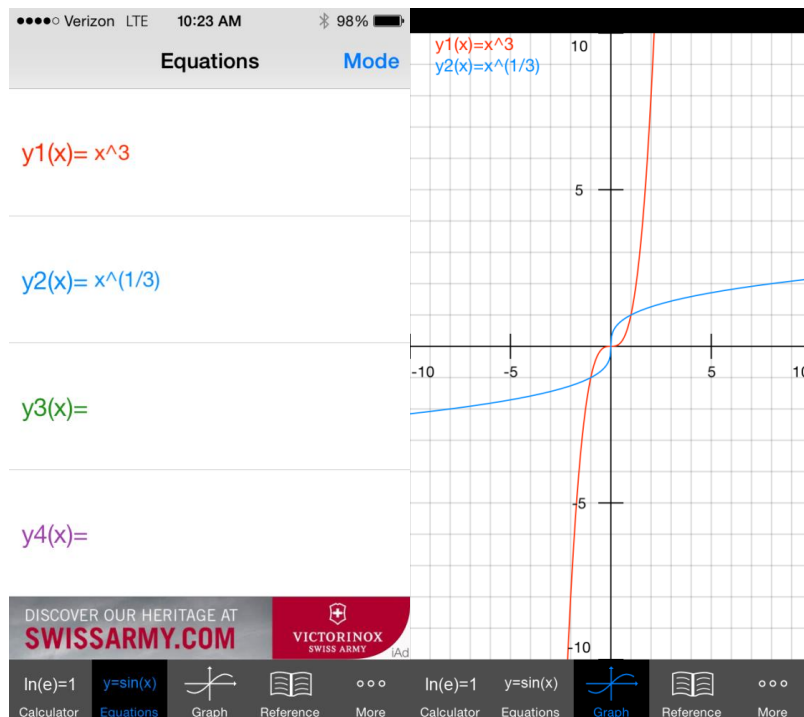


Figure 8: FreeGraCalc Example

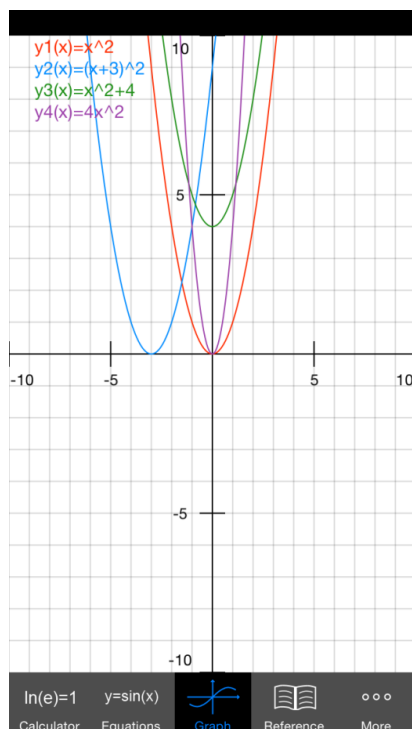


Figure 9: FreeGraCalc Example - Quadratic

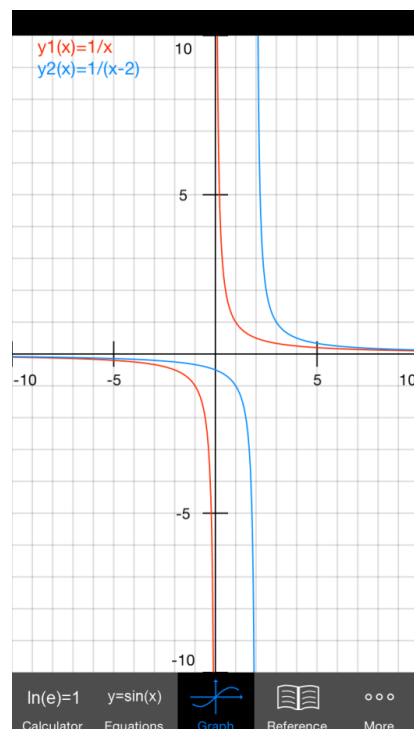


Figure 10: FreeGraCalc Example - Rational

FreeGraCalc has different modes and can create graphs of polar and parametric functions as well as statistical graphs. However, there are a couple of limitations to this app. One is that the most you can graph is 4 equations. The other is that you can only graph functions.

Fortunately, there is another (free) app available that can handle these problems. The app is Desmos and you can also access it via the web at www.desmos.com. Therefore, you can demonstrate using a computer and your students can work using iPads or smartphones (see Figure 11).

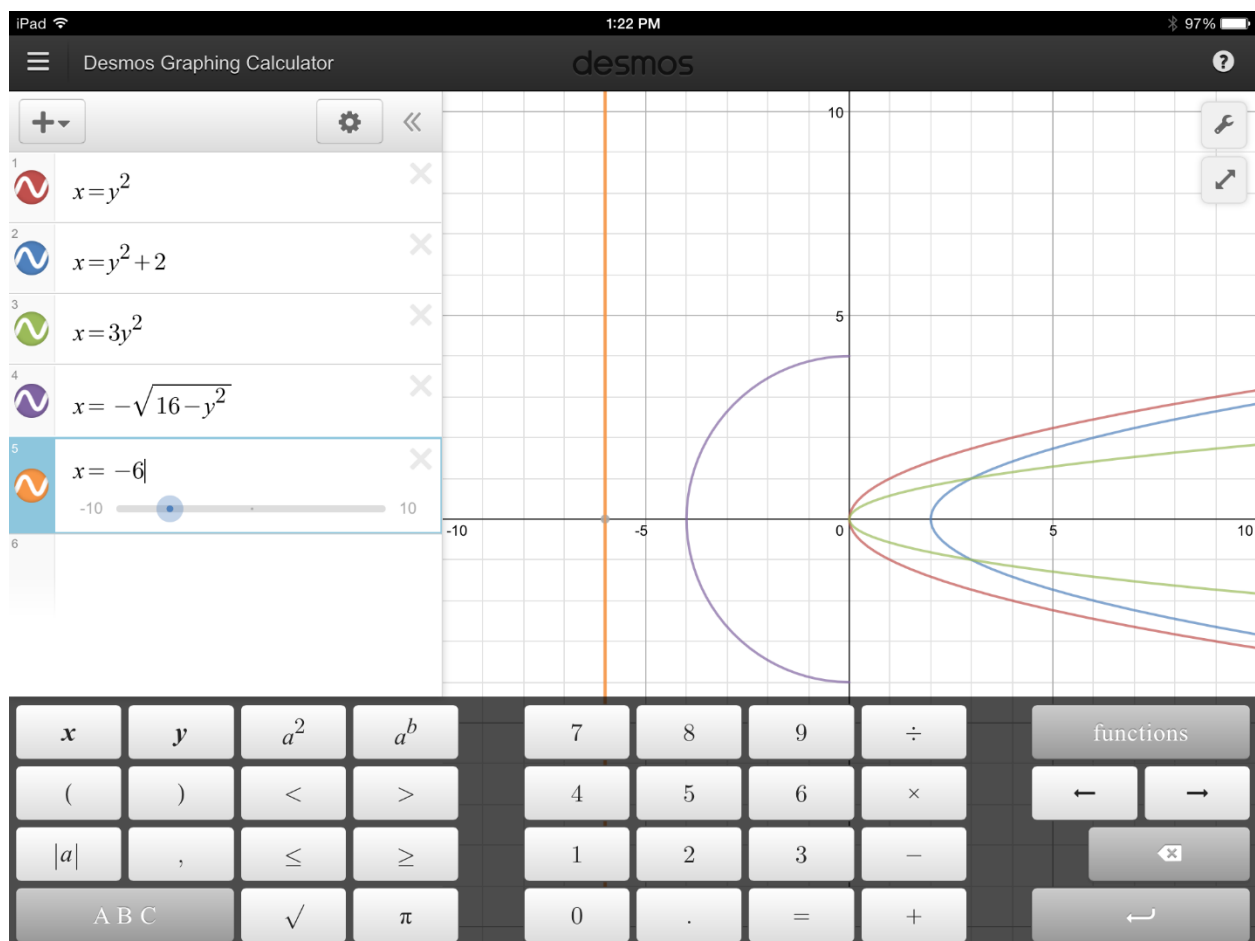


Figure 11: Desmos Example

The limitation to this app is that there is no way to see the table that corresponds to the graph. However, it has so many benefits and is so simple to use that it has become my “go to” site for graphing.

Finally, an app that I find useful when it comes to providing help via email is Bamboo Paper (see Figure 12). We all know how difficult it can be to answer a student’s question about a problem in an email. This app enables you to solve the problem by writing on the app’s notepaper, save it and email your written response to your student. This is much easier and more efficient than the cumbersome emails I have tried to compose where I explain how to do each step of a problem. This app is only available for the iPad.

$$4|2x+6|-9=15$$

$$4|2x+6|=24$$

$$2x+6=6 \quad 2x+6=-6$$

$$2x=0 \quad 2x=-12$$

$$x=0$$

$$x=-6$$

$$\{-6, 0\}$$

Figure 12: Bamboo Paper

Conclusion

Using different modes of technology is beneficial for both students and teachers alike. Technology enables us to address the three new “E’s of Education”-enable, engage and empower. (“The New 3 E’s of Education: Enabled, Engaged, Empowered-How Today’s Students are Leveraging Emerging Technologies for Learning” Speak Up 2010 National Findings, Project Tomorrow, 2011, p 18) We enable our students to reach their potential through increased access to educational resources. The use of technology engages students in rich, compelling learning experiences and fosters a deeper understanding and increased skill development, especially in problem solving. Using technology empowers students to take responsibility for their own education, and to use their curiosity to explore and become life-long learners.