Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
Number 68, March 2006

Contents

***NOTICE*!!!**

Starting with the April issue, the *Vision-Potential* Newsletter will be distributed electronically. In order to continue receiving the Newsletter, send your e-mail address to Don Small, don-small@usma.edu.

---

[1] Problem Solving Communication Group Work

At the 2006 Joint Mathematics Meeting, a distinguished panel from the San Antonio community discussed the mathematical skills and attitudes that are important to their businesses. The members of the panel were: Anthony Edwards (Vice President of Community Programs - CPS Energy), Sandra Martinez (Director Human Resources & Community Affairs - Lockheed Martin), Steve Bryant (Manager of Human Resources Information Systems - Zachry Construction), and Frances Gonzalez (Assistant City Manager - City of San Antonio). Elizabeth Kreston (Mathematics Chair - University of the Incarnate Word) moderated the panel. Each panelist stressed the skills of problem solving, communication, and group work. With respect to attitudes, they spoke about willingness to take risks, ability and desire to learn on their own, and comfort in facing new situations.

The importance of group work was underscored a week later in a *NY Times* article, "Ford Eliminating Up To 30,000 Jobs and 14 Factories" written by Micheline Maynard. In noting that the size of the workforce in the automobile industry has remained relatively stable, she wrote

> "While foreign automakers have hired some former Detroit workers, most of their (new) workers have no automotive experience and were chosen through rigorous screening processes that stress physical endurance and a bent for working in teams."

After the panel session, Sandra Martinez commented that Lockheed Martin's interview process for potential hires includes posing a problem to the interviewee and evaluating how they solve the problem.

The strong consensus among the panelists on what employers look for in hiring new employees is even more impressive when one considers the types of workers. Energy companies are known for long term workers whereas

* Supported by the U.S. Military Academy.

many construction workers are only employed for the duration of a construction job. Aircraft companies provide high paying positions for highly skilled workers while city government positions usually provide median salaries.

The comments of the panelists lent credibility to the movement for refocusing college algebra to emphasize problem solving, communications, and group work.

[2] Don't Forget to Make Your Connections

Alex Heidenberg and Rodney Sturdivant
The United States Military Academy

Greater Expectations, a national panel report issued from the Association of American Colleges, warns of a "one-size-fits-all" approach to assessment and learning, stating:

> State-mandated assessments at various levels from kindergarten through grade twelve can be equally problematic. In many states, the standardized testing movement is reinforcing the interpretation of learning as mere acquisition of unconnected facts.... When tests carry high stakes– when they determine whether students advance or graduate– teachers find themselves pressed to produce good results and thus learn to "teach to the tests," even if classroom dynamics suggest a different pace or approach.

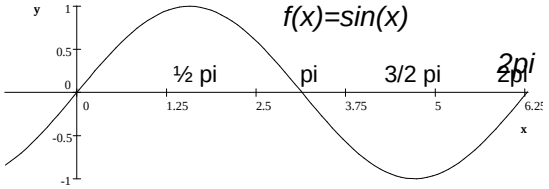
As teachers, most of us take pride in our ability to break down complicated mathematical processes into clear, concise algorithms. In an effort to help our students succeed, we often attempt to make the learning process as efficient as possible. However, learning is not an efficient process. Constructivist theory essentially states that learning occurs as the student processes new knowledge in the context of what they already know. It is our job as teachers to create experiences that help students connect new material to their existing base of knowledge. It is essential that we strive to help them make connections to material they have encountered in previous courses and in different contexts. It is equally important to recognize that our students have different learning styles. Whenever possible, it is advantageous to present concepts analytically, graphically, and numerically. Provided below are several examples of concepts that are easily connected to other concepts.

1. Distance Formula – A quick review of traditional college algebra texts (e.g. Barnett, Ziegler, & Byleen; Demana, Waits, & Clemons; Sullivan; Rockswold) identifies a common approach to teaching the distance formula. A colored box containing the formula immediately follows a graphical derivation of the formula using the Pythagorean formula.

The distance between the points (x_1, y_1) and (x_2, y_2) in the xy-plane is $d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

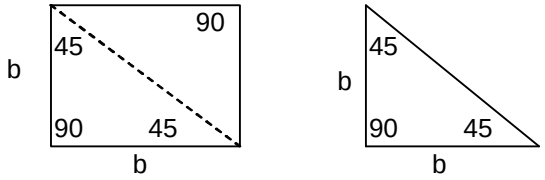
The mere placement of a formula in a colored box sends a message to the student that this formula is without question the most important concept on the page. Its coloring signifies importance and suggests this is a theorem warranting memorization. A mathematician sees compactness, simplicity, and beauty in this formula. However, a student sees a combination of subscripts, superscripts, and radical signs that render themselves meaningless, representing a language that is foreign to them. Our purpose is to stress that the formula is far less important than allowing the students the opportunity to connect the Pythagorean formula to a common application.

2. Trigonometric values for special angles – Many students have been shown "tricks" to memorize these values, while others are introduced to the unit circle as a means to recall them. There is very little involving trigonometry that requires memorization. An image of the graphical representation of the basic Sine and Cosine curves along with a fundamental understanding of geometry is generally sufficient for a student to progress mathematically.

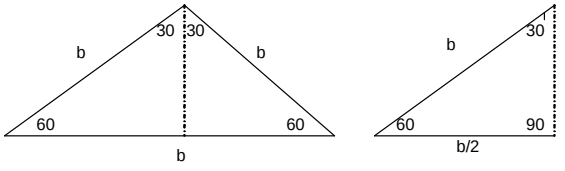


A student that can reproduce the Sine curve and understand that the normal period is equal to 2 pi (2π), can easily see where the sine function is equal to 0 or 1. Connections to functional notation, domain, and the amplitude of the sine curve are straightforward.

Students should easily be able to use a minimal amount of geometry (i.e., bisect a square along a diagonal) and the Pythagorean formula to reconstruct relationships that provide the trigonometric values for 45-45-90.



A similar exercise can be used to help students develop the trigonometric values for a 30-60-90 triangle. Start with an equilateral triangle of side b and ask the students to bisect one of the angles.



The base of the bisected triangle is now equal to $b/2$. Determine the final leg of the triangle using the Pythagorean formula.

The examples above provide two opportunities to help students make important connections between mathematical concepts. Once the connection is established, the student only needs to remember the original concept, recognizing the application of a previously learned concept and enjoy revisiting an "old friend". The purpose of this article is to remind the teacher that our students seek to simplify and streamline learning in an effort to achieve the best possible grade. It is the responsibility of the educator to help the student make connections in order to solidify learning and ultimately improve the experience of mathematics education.

[3] Fort Lewis Forensics

Freshman Mathematics Program
at Fort Lewis College

The original idea for this project came from Activities for Algebra with the TI-83 Plus by Rachel Newman-Turner and Robert Goodman. The project has since been completely reworked by the Freshman Mathematics Program at Fort Lewis College over the past two years to become a reform-oriented project for college algebra. The project is an excellent summative assessment that covers modeling/regression, transformations, and inverses.

Statement. A terrible crime has been committed. The well respected potato Russ Russet has been murdered. When found, the temperature of the body of Mr. Russet was 25 degrees Celsius. A healthy potato has a body temperature of 65 degrees Celsius. In this project, you are to create a model that accurately models the decrease in Russ Russet's temperature over time. This model can then be used to determine the time of death (25 degrees) of Russ Russet.

Data Collection. First, you need to record room/ambient temperature. Next take a

medium-sized sacrificial spud and either boil it for 15 minutes or microwave it on high power for five minutes. Then, using a sharp pencil or pen, puncture the potato. The hole in the potato should reach to its center. Insert the end of a thermometer into the center of the potato. (A glass alcohol thermometer that can be obtained from a science laboratory is recommended.) The temperature will rise and peak after a few minutes. At this point, the temperature will start to decrease. When the temperature decreases to 65 degrees Celsius, record this temperature as time equals zero. Then, record the temperature every five minutes for the next hour.

Model Creation. Using the data collected, create linear, quadratic, and exponential models for the temperature of your cooling potato. Superimpose graphs of your models on a scatterplot of the data.

Project Report. Your report for this project should include, at a minimum, the following components:

A. For each model:

* A discussion of the appropriateness of the model including, but not limited to, how well the model fits the data, domain and range limits, and factors that affect the data.
* The limitations of the model.
* The length of time it takes for the potato to cool from 65 degrees to 25 degrees Celsius. Discuss the underlying assumptions that could affect the validity of the model.
* A realistic (real world) interpretation for the presence or absence of asymptotes.

B. A statement of which model you think is best and your reasons for selecting that model.

C. A discussion of how your selected model would be affected if the potato were placed in a refrigerator (2 degrees Celsius) after being punctured.

* Your models have yet to take into consideration room/ambient temperature. Discuss how your best model might be modified to account for room/ambient temperature. One might consider modifying the original data. Perform this modification and summarize the benefits and limitations of this transformed model.
* The case of Russ Russet now needs to be solved. Using your transformed model, find its inverse. Discuss why it is beneficial to have the inverse of your model. Using the inverse, determine the time of death of Russ Russet and present it within a description of the crime scene and the events leading up to the crime.

[4] Correction

My sincere apology to Diana Perdue of Virginia State University for misspelling her name in connection with the *Handshake Problem* printed in the February issue of the *Vision-Potential* Newsletter.

[5] Notices

1. MAA PREP Workshop on *Refocusing College Algebra*, May 22-25, 2006 at Florida Gulf Coast Univ. For information, contact Norma Agras at Miami-Dade College at nagras@mdc.edu.

2. Deadline for contributions to the April Newsletter is April 1, 2006. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

3. To subscribe to this Newsletter, send your e-mail address to Don Small at don-small@usma.edu.