

Sinclair Mathnet

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reVision of Elementary Algebra

The faculty learning community investigating a reVision of Elementary Algebra has been continuing to meet with representatives of software companies for demonstrations and discussions. They, Dave Hare, Karl Hess, Richard Uchida and Jim Willis, have also been contacting institutions currently using some of these mathematics learning systems to discuss strategies and results. In the near future, as the choices are narrowed down, some of these institutions will be visited to gain further insight into their teaching strategies.

Continuing discussions have also been taking place regarding the proposal for the pilot here at Sinclair. The community is focused on

engaging students using flexible individualized study plans and flexible hours, perhaps in a lab setting, hoping to help **all** students stay on task throughout the quarter.

As an essential part of the original Ohio Learning Network grant proposal, students are being interviewed in all MAT 101 classes this quarter using the mid-quarter interview process. Facilitators using questions and topics developed by the community are leading students in discussions about their past experiences in mathematics, their thoughts on proposed teaching strategies, and on any suggestions they may have.

The community plans to present a proposal for the pilot by the end of the Winter Quarter.

Jim Willis ■

Rep. Setzer's Math Lab Visit



Lab Coordinator Willow Cliffswallow, Rep. Setzer, and student Richard Burke (*above*)



(*above*) Dept. Chair Tony Ponder, Willow Cliffswallow, and Rep. Setzer

(*left*) Rep. Setzer and Tony Ponder

State Representative **Arlene Setzer** (R. Vandalia and Chair of the Education Committee) visited the Math Lab on January 16 during the Board Advance. Rep. Setzer retired from teaching in 2000 after 33 years at Vandalia-Butler High School. She was very favorably impressed with the lab facilities.



FACTORING BINOMIALS $x^a \pm y^b$ by Harvey

Let a , b , a_0 , b_0 , g , g_1 , and g_2 all be positive integers.

Claim 1: The binomial difference $x^a - y^b$ is divisible by $x^{a_0} - y^{b_0}$ if and only if there exists an integer g such that $a_0g = a$ and $b_0g = b$.

Proof: Let $a = a_0g_1$ and $b = b_0g_2$ and consider the quotient

$$\frac{x^a - y^b}{x^{a_0} - y^{b_0}} = x^{a-a_0} + x^{a-2a_0}y^{b_0} + x^{a-3a_0}y^{2b_0} + \dots + x^{a-(g_1-1)a_0}y^{(g_1-2)b_0} + y^{(g_1-1)b_0}.$$

For this division to “come out even,” we must have that $y^{(g_1-1)b_0}y^{b_0} = y^{g_2b_0} = y^b$, implying that $g_1 = g_2$. Letting $g = g_1 = g_2$, $x^a - y^b$ is divisible by $x^{a_0} - y^{b_0}$ if and only if $a = a_0g$ and $b = b_0g$. The quotient will have g terms. ■

Examples

a. $\frac{x^{12} - y^{27}}{x^4 - y^9}$ is a trinomial ($g = 3$)

b. $\frac{x^5 - y^{15}}{x - y^3}$ is a 5-nomial ($g = 5$)

c. $\frac{x^{12} - y^{18}}{x^4 - y^9}$ is not a polynomial since

$g_1 = 3$, but $g_2 = 2$. (Try the long division.)

Claim 2: The binomial sum $x^a + y^b$ is divisible by $x^{a_0} + y^{b_0}$ if and only if there exists an odd integer g such that $a_0g = a$ and $b_0g = b$.

Proof: Consider the quotient

$$\frac{x^a + y^b}{x^{a_0} + y^{b_0}} = \frac{x^{a_0g} + y^{b_0g}}{x^{a_0} + y^{b_0}} = \frac{x^{a_0}{}^g + y^{b_0}{}^g}{x^{a_0} + y^{b_0}} = \frac{u^g + v^g}{u + v} \text{ where } u = x^{a_0} \text{ and } v =$$

y^{b_0} .

Since the odd numbered terms of the quotient are positive,

$$u^{g-1} - u^{g-2}v + u^{g-3}v^2 + \dots + (-1)^{g-1}v^{g-1}$$

terminates if and only if the last term, $(-1)^{g-1}v^{g-1}$ is positive, implying an odd integer value for g .

If $a = a_0g_1$ and $b = b_0g_2$, we can use an argument similar to the first proof of this article to show that $g_1 = g_2$. ■

Examples

a. $x^{30} + y^{15}$ is divisible by $x^2 + y$ ($g = 15$),
 $x^6 + y^3$ ($g = 5$) and $x^{10} + y^5$ ($g = 3$).

b. $x^{40} + y^{80}$ is divisible by $x^8 + y^{16}$ ($g = 5$)

c. $x^a + y^b$ is algebraically prime if and only if a and b share no common odd factor g with $g > 1$.



The frond of a fern -
Is it real or a
computer-generated
fractal image?

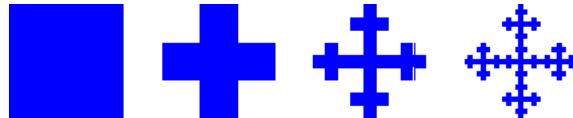
WINTER QUARTER COLLOQUIUM

This quarter's Colloquium featured talks by part-time faculty member **Frank Bely** and **Dr. Kevin Roper**, Associate Professor of Mathematics at Cedarville University.

In his talk, "Riemann Finds Lost Leibnitz on a Sunny Afternoon," Frank described how he uses summation formulas and limits in his high school calculus classes to motivate the development of the Fundamental Theorem of Calculus.



Frank Bely



Dr. Roper spoke on "Fractals: What are They and Why Do They Seem to Mirror Nature so Well?" He explained how fractals are generated via recursive definitions, and gave a number of examples - including the beautiful and mystifying Mandelbrot set. He also gave a plethora of examples of fractals from nature – some of which are virtually indistinguishable from their mathematical counterparts.



Dr. Kevin Roper

The Mandelbrot Set



Dr. Mandelbrot coined the word "**fractal**" to describe objects that, like the Mandelbrot Set, repeat the same shape over and over in larger and smaller sizes. The Mandelbrot Set has been called the most complex mathematical object known. In the images above, zooming in on the edge of the Mandelbrot set reveals intricate details that eventually lead... back to the Mandelbrot set!



High School Algebra

At the Math Department meeting in January, **Maryann Barta**, chair of the Xenia High School Mathematics Department, spoke about the similarities and differences between the Algebra 1 curriculum at Xenia High School and Sinclair's MAT 101 and MAT 102. We might be surprised to find, she said, that students finishing Xenia's program would have seen virtually all of the topics covered in MAT 101 and 102 - and then some! They cover some probability and statistics, graphing systems of linear inequalities, and exponential growth and decay in addition to all of the topics that our students see.



Maryann also talked to us about the Ohio Graduation Test for Mathematics and its impact on students. She explained how difficult it is to prepare students for a March exam when the course material isn't finished until June!

REMINDERS

- Records of test scores and grades should be retained for two years. Student work not returned to students should be retained for two quarters. Students should be allowed to review their final exams, but instructors should keep them and retain them on file for two quarters.
- Students should be required to know and be able to use the course formulas on the course syllabi. They should be tested over them without being allowed to use copies of the formulas, including copies stored in their graphing calculators.
- When giving outside-of-class graded assignments, be sure students understand what resources they are allowed to use and what they aren't, and take steps to ensure that the credit you give is for work that *they* have done. When working in the Math Help Room, please be sure you are not helping students with graded assignments.

The following is an example of a question from the extended answer portion of the OGT.

Mr. Richards needs to price items that must be sold within 90 days, and he has two options.

In option A, Mr. Richards prices items at \$225 and gives \$1.00 off the price for every day that the item does not sell.

For Option B, he prices items at \$250 and gives \$2.00 off for every day the item does not sell.

Write an equation for each option that relates the price of the item to the number of days that the item has not sold.

Use the equations to find the day on which the two options yield the same price.

Harvey's Joke Corner

REDUCING SALON

$$\dots \frac{4}{8}, \frac{3}{6}, \frac{2}{4}$$

SORRY - WE'RE CLOSED

$$\frac{1}{2}$$

A very small college team lost an AMATYC Math Competition to our SCC all-stars. They said they were "outnumbered."

