



FOCUS ON MATHEMATICS MATH EXPO!

WWW.FOCUSONMATH.ORG

The *Focus on Mathematics* partnership is sponsoring expositions of student research projects on topics in mathematics. The Mathematics Exposition, to be held on June 11, 2005 at the Boston Museum of Science, will encourage and support student research in each of the *Focus on Mathematics* school districts. This is a yearly event in which students develop projects and are mentored by teachers and mathematicians from Boston University, UMass Lowell, Worcester Polytechnic Institute, and EDC, Inc. Students then present their results to peers, educators, and panels of mathematicians at poster sessions in the districts.

REMEMBER THESE DATES!

- **FEBRUARY/MARCH** – Students begin work on projects.
- **APRIL/MAY** – Poster Sessions are held in schools.
- **JUNE 11, 2005** – Selected projects will be presented at the Math Expo.

This effort is being coordinated by mathematicians

Art Heinricher (Worcester Polytechnic Institute) and Glen R. Hall (Boston University).

Students are encouraged to come up with their own ideas, but other project ideas are available.

A preliminary list is available now at www.focusonmath.org/projects

All project ideas are welcome!

For more information you may contact Glen Hall at HardMathCafe@focusonmath.org

SOME PROJECT SUGGESTIONS:

THE NUMBER THEORY OF CICADA INVASIONS

In the east and Midwest United States there is a noisy summer insect called a "periodical cicada." These insects are noted for three things: They are annoyingly loud during their 4-6 week mating season; the larvae spend either 13 or 17 years maturing underground; and on years in which they emerge, there are literally millions of them per acre of woodland. There are 30 "broods" of periodical cicada located in different areas of the country. Broods I-XIV have a 17-year cycle and broods XV-XXX have a 13-year cycle. Last year (2004), brood X (one of the largest 17-year broods) emerged from Washington D.C. to Michigan. In 2002 brood XXIII, a 13-year brood emerged in some of the same region. (More details are available.)

Getting Started

1. How often over the next 100, 200, 500, 1000 and 10,000 years will the 17-year brood X and the 13-year brood XXIII emerge in the same year?
2. It is curious that the two periods commonly observed are 13 and 17 years — both prime numbers. How often would broods with periods of 12 and 16 years emerge in the same year?
3. Suppose the next time the 13-year brood and the 17-year brood emerge together a new hybrid subspecies with a 15-year period develops. How often over the next 10,000 years will all three of these broods appear at the same time?

Going Deeper

Can you develop a general rule to predict how often, on average, broods with periods N and M will emerge together? Try the same question for three broods with period L , M , and N . What about four broods...?

Communicated by G. Hall

THE TRUE COST OF A SPEEDING TICKET

The total cost of a speeding ticket is much more than the fine you pay to the state. In Massachusetts, your insurance rates will go up and you will be paying additional insurance for several years after the ticket. Massachusetts uses a point system, where different types of tickets "earn" different numbers of points and your insurance premium will increase 7% per point.

Getting Started

1. Develop a formula, or program, or table, or something that would allow any driver to compute easily the real cost of a ticket.
2. How much does a second speeding ticket cost? More or less than the first?

Going Deeper

Find out more about how automobile insurance works in Massachusetts. How much should you expect to pay for insurance when you first get your license? How much is the fine for a typical speeding ticket? How does the Massachusetts point system (it is called the Safe Driver Insurance Plan, SDIP) work?

Communicated by A. Heinricher.

SQUARE CHIPS FROM ROUND WAFERS

The silicon wafers used in manufacturing computer chips are round. The chips that go into your computer are rectangular. If a chip manufacturer can increase the radius of the wafer, how many more chips can they produce?

Your Job: Develop the formula that would help the company decide if the cost of increasing the size of the wafer is justified.

Getting Started:

Find out more about computer chip manufacturing. How large are the wafers? How large are real computer chips?

Communicated by A. Heinricher

