

## From the Editor

### Oooh, That Awful Yellow!

The yellow headers and titles in our December issue generated more complaining letters than any other feature of *MAA FOCUS* in the last several years! Let me assure everyone that Carol Baxter and I do retain our sanity. The yellow headers were not the result of some daring experimentation; rather, we both simply weren't paying attention to the interior color until it was too late. Our apologies to everyone, especially those who are colorblind or whose eyes, like mine, are no longer as given to heroic feats as they once were. We have learned our lesson!

## To the Editor

We are always happy to hear from our readers. If at all possible, send letters by email to [fggouvea@colby.edu](mailto:fggouvea@colby.edu). Letters will be edited for publication.

### How to Help Students Succeed

In the May/June *MAA FOCUS*, Carmen Latterell asked "How Do Students Study?" I would like to comment on how to help them succeed. Latterell outlines three main lessons that she has learned in years of teaching. I restate each along with techniques I have found useful.

*Students do not read the textbook, but they do attend lectures.* One interesting way to encourage students to read the textbook is through the use of reading questions. For each section, assign two to three definition-based or open-ended questions that students must turn in at the beginning of class. For instance, in a differential equations class teaching first-order linear DEs, you may ask: 1. What is the standard form of a first-order linear equation? 2. Are all Linear DEs separable? 3. What is the role of the integrating factor?

*Students do not work problems that are viewed as extra.* One way to get students to work more problems is to collect more than you grade. I reserve a small percentage of the points for completeness. This way, students feel they are rewarded for the problems that are collected, but not graded.

*Students think they are doing better than they are.* It is important for a student to realize where they stand in a course. If you keep an up-to-date grade book it is very easy to include a students' class total at the top of any assignment. A simple 248/300 at the top of the second test quickly lets the students know that they are currently at a low B.

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### More on Induction

In regard to the article "More on Teaching Induction" by David M. Bradley (October 2008) on the overuse of induction as a proof technique: We can certainly construct proofs of combinatorial identities, such as his example— $1 + 2 + 3 + \dots + n = n(n + 1)/2$ —that hide the induction from our students. As mathematicians, though, we should keep in mind that with identities of this type induction is always present, at least in the background. There is an implicit quantifier in front of the identity saying "for every positive integer  $n$ ..." And in almost every treatment of the foundations of mathematics, the definition of the positive integers is via the recursive Peano axioms or some equivalent recursive method. Induction is often the most natural proof technique when dealing with recursively defined structures.

I have always taught my students that an ellipsis is almost certainly a shorthand notation, a flag shouting "induction is the proper tool to make this concept formal." The left-hand side of the identity above is nonsense when  $n$  is 1, 2, or 3, and ambiguous for larger integers. A better, unambiguous expression, valid for every positive integer  $n$ , is  $\sum_{i=1}^n i$ , where the  $\sum$  notation is defined recursively:

$$\sum_{i=1}^1 a_i = a_1, \text{ and } \sum_{i=1}^{n+1} a_i = \sum_{i=1}^n a_i + a_{n+1}.$$

In fact this recursive definition, or something very similar to it, is pretty much forced upon us by the recursive definition of the positive integers and the fact that addition is defined as a binary operation. We should not be surprised, then, when induction turns out to be a natural proof technique for identities that sum over the positive integers.

I am a great fan of the book *Proofs that Really Count*, by Arthur Benjamin and Jennifer Quinn (MAA, 2003). The first chapter, on identities involving sums of Fibonacci numbers, is typical. Some 31 such identities are proved, in a charming and apparently non-

inductive manner, by showing that both sides of a Fibonacci identity count the same set of tiling patterns. But the proofs of all these identities are based on Combinatorial Theorem 1, initially linking Fibonacci numbers to tiling patterns. And the proof of Combinatorial Theorem 1 is inductive. How else can you lay the foundation for proofs involving an integer sequence defined recursively?

There may be times when it is pedagogically advantageous to encourage our students to accept and create non-inductive proofs of combinatorial identities. But let's be aware of the fact that there is something intrinsically recursive about these identities. In such cases, an inductive proof might well be the most natural.

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Weill Cornell Medical College in Qatar

# MATHEMATICS

## FACULTY POSITION

In a pioneering international initiative, the Weill Cornell Medical College (WCMC) established the Weill Cornell Medical College in Qatar (WCMC-Q) with the sponsorship of the Qatar Foundation for Education, Science and Community Development. WCMC-Q is located in Doha, Qatar, and in its seventh year of operation, its inaugural class having graduated with Cornell MD degrees in May 2008.

WCMC-Q seeks candidates for a full-time senior level faculty position to teach in Doha in the Pre-medical Program, with major responsibility for teaching mathematics to premedical students. The two-year Pre-medical Program is designed to prepare students for admission to the WCMC-Q Medical Program. Intensive and challenging, this two-year program has been specifically prepared for students in the Middle East. It provides them with instruction in subjects that comprise the pre-medical requirements of most medical colleges in the US.

The successful candidate will teach one course per semester at the level of college calculus and introductory statistics. In addition, he/she will participate in student academic advising, committee work, and the academic life of WCMC-Q. Research funding support is available and active participation in relevant research will be encouraged.

Qualifications include a Ph.D. in Mathematics, demonstrable teaching skills, and teaching experience at the college/university level. Candidates are expected to have experience in the American higher education system and must be willing to relocate to Doha, Qatar for the duration of the appointment. Academic rank and salary are commensurate with training and experience and are accompanied by an attractive foreign-service benefits package. Qualified applicants should submit a curriculum vitae and a letter of interest outlining their teaching and research experience to:

<http://job.qatar-med.cornell.edu> \*

\*Please select the appropriate position under the Academic options and indicate job # 08-wcmcq-MT

Cornell University is an equal opportunity, affirmative action educator and employer. Details regarding the WCMC-Q program and facilities can be accessed at: [www.qatar-med.cornell.edu](http://www.qatar-med.cornell.edu)

*The screening of applications will begin immediately and continue until suitable candidates are identified. Please note that due to the high volume of applications, only short-listed candidates will be contacted. Service is expected to begin in August 2009.*

*Short-listed candidates will be asked to provide names of three references.*