result $(4ab = (a + b)^2)$ that might be taken to hold if one experiments with only a few small numbers ($a = b = 2$ and $a = b = 3$ in this case).

The book also has a lot to say on the work of the most famous of the Indian mathematicians, people like Bhaskhara or Arhyabhata, whose names are well-known by all with even a passing interest in the history of mathematics. Their work and those of their contemporaries is covered in great detail in chapters 5 and 6. Chapter 7 is concerned with the school of *Madhava* in Kerala that flourished in the 12th and 13th centuries CE. The school is named after the mathematician who discovered the $\pi/4$ series, and is probably the most famous school in the history of Indian mathematics. Other highlights of this school include the series for the arctangent, later rediscovered by Gregory, a computation of the length of the circumference of a circle with the help of successively smaller polygons, and Taylor series approximations for the sine and cosine.

The last two chapters of the book deal with relations with Islamic mathematics, early contacts with Europeans, and the beginning of modern times. This fascinating and well-written book is beautifully produced by Princeton University Press in a hardcover edition that is almost free of misprints, and deserves to be read by anyone with a serious interest in the history of mathematics.

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Mathematics and music, by David Wright. Pp. 161. £29.50. 2009. ISBN 978-0-8218-4873-9 (American Mathematical Society).

Over the past two years I have reviewed a number of books on the mathematics behind music, but nothing quite like this. The author is both a research mathematician (in algebraic geometry) and an arranger, composer and conductor of choral music, so he is well qualified to explain the links between the disciplines. He teaches a freshman level college course aimed at students who are both mathematically and musically inclined, and this is really the favoured textbook for that curriculum.

Little expertise in either discipline is assumed and what you need to know is explained carefully, with the maths and the music side by side. Thus we have sections on modular arithmetic, exponents and logarithms, groups and rings, trigonometry and Fourier analysis, which run parallel with a description of note values, intervals, chord notations, timbre and tuning. At the end of each short chapter there is a set of exercises, requiring ability in both mathematics and musical analysis; these are, I think, quite demanding and, if they are to be of any real use, there should be hints to the solutions, if not full answers. The lack of these is a serious omission, since without them there is no way of knowing if you are understanding the material or not.

However, I was also rather surprised that over half of the book is devoted to the relationship between ratios and musical intervals. Octave identification is explained in terms of arithmetic modulo 12 and there is a lot of work on translating ratios into

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pitch intervals in the standard chromatic scale. Thus the ratio of 3:1 is approximated very well by 19 semitones, but that of 5:1 fares much worse since it becomes appreciably sharp. But really the significant point the author is making is that only powers of 2 will result in perfect tuning. The fact that the circle of fifths depends on the fact that 3^{12} is approximately 2^{19} does not seem to me to be particularly difficult to grasp, but in this text a remarkable amount of time and effort is spent on the fact that powers of two are not multiples of any other primes. I could not help thinking that the quite considerable mathematical framework which is developed for this is actually overkill.

There are some nice touches. The fact that the diatonic scale has eight notes, and therefore seven intervals of either tones or semitones, means that all the modes have a unique key signature. This is because it is impossible for any such sequence to contain a non-trivial cyclic permutation of itself. However, if we were working with nine notes, and hence eight intervals (which must sum to 12 semitones) the sequence of intervals $1, 1, \frac{1}{2}, \frac{1}{2}, 1, 1, \frac{1}{2}, \frac{1}{2}$ would be ambiguous as to its key signature. And there is a guide to writing serial music by constructing a row chart of note classes, which includes a composition using seven-tone equal temperament. The final chapter looks at alternatives to well-tempered tuning, such as the Pythagorean scale, just intonation and the mean-tone scale, but argues that the disadvantages (and particularly the difficulties in transposition) outweigh any minor benefits of such systems.

So, if you want a textbook which goes into a lot of depth about the mathematics of intervals, this might well appeal to you. However, you won't find much on musical form or the mechanics behind sound production or avant garde compositional techniques favoured by modern British musicians. And you might also feel that you don't need reminding about algebraic structure or elementary number theory. If you are after a lighter touch and a broader sweep, perhaps you would do better to look elsewhere.

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Riot at the calc. exam and other Mathematically Bent stories, by Colin Adams. Pp. 271. $32. 2009. ISBN 978-0-8218-4817-3 (American Mathematical Society).

This unusual book contains 33 of the author's short, humorous, mathematically-themed stories, together with background notes on 15 of them. Most of the stories first appeared in the column 'Mathematically Bent' in the *Mathematical Intelligencer*; some have been performed as skits at mathematics conferences.

The stories are whimsically amusing rather than laugh-aloud funny. They range from parodies of familiar tales (such as Rumpled Stiltsken 'turning coffee into theorems' and The Three Little Pigs trying to prove three of the Millennium problems), through extended metaphors (for example, where proving a big theorem is likened to a sea voyage or climbing a mountain or giving birth to a baby), to more in-house (and in-joke) pieces on what being a mathematician is like, both individually and professionally (including the Jekyll and Hyde flip over between teaching and doing research). Several revolve around mathematical nightmares: the theorem with an unfixable lemma or embarrassing counterexample, the crank whose proof turns out to be correct, the exam room as battlefield, and the unsympathetic teacher who is the scourge of their classes (and the cause of the 'Riot at the calc. exam'). Other stories will receive a knowing nod from anyone involved in administration: the borderline exam mark challenged in a court of law, the risk assessment for a mathematics department, the telephone interview, the tensions in a hiring committee, and the moral dilemmas for the 'mathematical ethicist'. Some,