Jim Tanton's Teaching Philosophy statement (downloaded from the St Mark's Math Institute website http://www.stmarksschool.org, January 2009). Jim Tanton is the founder of the St. Mark's Math Institute, and has taught at Milton Academy as well as at Harvard, and has also taught courses in the past in the Math for Teaching program. Jim is now a fellow at the Math Association of America, and leads workshops around the world on teaching math.

Mathematics is often presented as a large collection of disparate facts to be absorbed (memorized!) and used only with very specific applications in mind. Yet the development of mathematics has been a journey that has engaged the human mind and spirit for thousands of years, offering joy, play, and creative invention. The Pythagorean theorem, for instance, although likely first developed for practical needs provided great intellectual interest to Babylonian scholars of 2000 B.C.E. who hunted for extraordinarily large multi-digit numbers satisfying the famous relation $a^2 + b^2 = c^2$. Ancient Chinese scholars took joy in arranging numbers in square grids to create the first "magic squares," and Renaissance scholars in Europe sought to find a formula for the prime numbers, even though no practical application was in mind. Each of these ideas spurred further questions and further developments in mathematics — the general study of Diophantine equations, semi-magic squares and Latin squares, and public-key cryptography, for instance — again, both with and without practical application in mind. Most every concept presented to students today has a historical place and conceptual context that is rich and meaningful.

Sadly, however, mathematics suffers from the ingrained perception that primary and secondary education in the subject should consist almost exclusively of an acquisition of a set of skills that will prove to be useful to students in their later careers. With the push for standardized testing in the public school system, this mind-set is only reinforced, and I personally fear that the joy of deep understanding of the subject and the sense of play with the ideas it contains is diminishing. For example, it may seem exciting that we can produce students who can compute 376×859 in a flash, but I am saddened with the idea that such a student is not encouraged to consider why we are sure that 859×376 will produce the same answer. For those students who may be naturally inclined to consider this, I also worry about the response an educator would give upon receiving such a query. Is every teacher able to provide for a student an example of a system of arithmetic for which it is no longer possible to assume that $a \times b$ and $b \times a$ are the same and then lead a student through a path of creative discovery in the study of such a system? (As physicists and mathematicians have discovered, such systems do exist.) By exploring fundamental questions that challenge basic assumptions, *one discovers deeper understanding of concepts and finds a level of creative play that is far more satisfying than the performance of rote computation. Students encouraged to think this way have learnt to be adaptable, to not only understand and apply the principles of a concept to the topic at hand, but to also apply those foundations and habits of mind to new situations that may arise. After all, with the current advances of technology in our society today, we cannot be sure that the rote skill-sets we deem of value today will be relevant to the situations and environments students will face in their future careers. We need to teach our students to be reflective, to be flexible, and to have the confidence to adapt to new contexts and new situations.*

There is a creative aspect to mathematical thinking. Even fundamental, "elementary" questions provide the fodder for deep inquiry and insight: Why is the product of two negative numbers positive? What is pi and why is the value of this number the same for all circles? What is value of pi for a shape different than a circle? Is every number a fraction? Why does the long division algorithm work? Why is dividing by a fraction the same as multiplying by its reciprocal? What is the value of i^i? Why should a number to the zeroth power equal one? Why is "zero factorial" equal to one? (Is there such a thing as "one half factorial"?) What is the fourth dimension? Is there anything wrong with leaving a radical in the denominator of a rational expression? Questions like these often trouble student and teacher alike (if they are ever asked). Yet these are wonderfully rich questions, worthy of exploration, consideration, and deep thinking — and there is no need to accept the rote answers to them typically provided!

As a researcher, author, and educator in mathematics I have always striven to share with my students the sense of joy and enthusiasm I experience in thinking about and doing mathematics. Intellectual playfulness, adaptability, flexibility, creative enquiry, and the "throwing away of boundaries" are the tools that allow mathematicians working at the research level to succeed. They are also the tools that allow mankind to make new discoveries, develop innovations, and to thrive, and are the skills I hope educators ultimately teach our students.