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Best Sandbox

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Abstract

"Mathematics ought to be for everyone, not just for mathematicians, scientists, and engineers. Mathematics is not only about application; it is part of the created world."

Posting about learning about math through creative play from *In All Things* - an online hub committed to the claim that the life, death, and resurrection of Jesus Christ has implications for the entire world.

http://inallthings.org/the-best-sandbox/

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The Best Sandbox

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This past January, I was at a mathematics conference, sitting in a ballroom with several hundred mathematicians. The title of the next talk, “Mathematics for Human Flourishing,” had caught our attention. It was out of the ordinary and seemed to me to be, well, Reformed. Mathematicians typically do not weave Christian perspective into their talks, because frankly most mathematicians aren’t Christians. Yet, this talk began with the language of flourishing and ended with the word “Shalom.” The room erupted into a standing ovation. How did this happen?

The very highly respected Francis Su had given his outgoing address as the MAA president; it was deeply moving. Su’s talk came in five points (no, not those five points, but rather…): Play, Beauty, Truth, Justice, and Love. His points worked together to answer the question “Why do mathematics?”

This piece begins a series of five essays presenting specifically Reformed answers to Su’s question, by five different Christian mathematicians, building on each of Su’s five points. Why should we do mathematics? How can math lead to human flourishing? This series is not meant just for mathematicians, but for everyone. Because just as we can all enjoy and participate in music, so too with mathematics. So, let’s start at the beginning…with children.

For too many people, math is something they no longer do and no longer want to do. For them, math lives in the past tense. Math was about memorizing times tables, mad minutes, and the quadratic formula. They were told that math is the bad-tasting medicine that someday, far off in the future, they would need to solve real-world problems. Luckily for civilization, some people do persist in learning enough mathematics to use it, because mathematics powers important parts of the modern world. However, mathematics ought to be for everyone, not just for mathematicians, scientists, and engineers. Mathematics is not only about application; it is part of the created world. Too many are missing out on the fun, and that’s where *play* comes in.

Children’s play is quite interesting to observe; it is a rich mix of freedom and structure, imagination and rules. So it is with mathematics, except that the mind is the playground, and numbers are the toys. Mathematicians love building mathematical objects and playing with them. So can you! Perhaps if you have children, or grandchildren, you might consider playing mathematically with them.

Here’s a game for you to try. Instead of doing flash cards, do something open-ended like the four 4s game. You get four 4s and you need to arrange them using the standard mathematical operations of addition, subtraction, multiplication, and division (and parentheses). The goal is to make all the other numbers. I’ll do a couple for you. For example, $0 = 4 + 4 – 4 – 4$ and $1 = (44)/(44)$. This is playful mathematics. What integers can you find using only four 4s? How many different ways can you make, 0, 1, or 7 using just four 4s? There is freedom to imagine within a structure of rules. Just when you start feeling comfortable, you might change the rules: allow more operations, exponents, square roots, logarithms. In fact, Paul Dirac figured out a clever way of writing any number using just four 4’s!

Sometimes, mathematics shows up inside other games. One really interesting example is the children’s game Spot It!^{TM} Each person receives a card with 8 symbols on it. A community card is dealt, and the first person to match a symbol on that card with one on their card wins the card. What is interesting is that no matter what card is dealt, there is always exactly one symbol from that card which matches with the winning player’s card. I wonder how that works? Humans love to wonder. We wonder at the works of God and we wonder at the beauty of the creation. We also wonder about how things work, with a curiosity that has pushed us to build space telescopes reaching worlds far away in space and electron microscopes to see into the tiniest worlds in the smallest spaces. In the same way, we can wonder about this game, which works because of the wonderful world of projective geometry (whatever that

is). You might try to make your own homemade game of Spot It! ™ with 3, 4, or 5 symbols per card. Take pictures of family members and friends and print them out small enough to put on index cards. Can you find a way to make it work? It's a cool problem, and harder than you might think. (Definitely don't try to put 7 symbols on every card, because that's impossible…wait—what, why?!?) And that's where it can be so fun and playful to do mathematics… it's the ultimate sandbox, but in your mind.

Of course, the more mathematics you know, the more toys you get to use in your sandbox. This is a great reason to learn new mathematics. It's why teaching math in schools is important, but it is also critical that this teaching is done well. Even very small children are naturally curious about numbers and begin to play with them from a young age. I have the pleasure of encouraging this kind of play in my children. But, even I, a math professor, fear that they may lose their curiosity and desire to play with math if they have teachers in school who present math as being hard, out of reach, not for them, or incoherent. The same fear applies to them receiving this message from our culture. Teaching well is hard work that requires serious preparation and continued focus. We need to encourage teachers to lead students through mathematical tasks that help them view math positively. We need to tell our children that math is for them, because it is a beautiful part of God's created world, and no one should miss out on all the fun.

So, get out into the sandbox and play!