The Mystery of Prime Numbers:
A toy for curious people of all ages
to play with on their computers
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Your comments and suggestions are welcome!

Prime numbers are the darkest mystery in all of mathematics. The reason: Primes are the DNA of arithmetic—at least, that is the prevailing belief among mathematicians, and yet no one has ever discovered the magical equation that will predict one prime after another. Mathematicians believe that something *that fundamental* has to have a pattern, but none has been discovered. There has to be a hidden equation that will generate the prime numbers, the building blocks of arithmetic.

Wait, you say. I know how arithmetic works. In elementary school, I learned the procedures of addition, subtraction, multiplication and division. I know all about it!

So, what's the mystery?

In biology a hidden pattern called a double helix was discovered for the DNA molecule --a stunning revelation that explains how heredity functions and won a Nobel Prize in 1962 for James Watson, Francis Crick, and Maurice Wilkins. James Watson was a postdoctoral student still in his 20s when he was awarded the Nobel Prize.

Unfortunately, there is no Nobel Prize waiting for someone who discovers the hidden pattern explaining how arithmetic works. Mathematics was, for reasons still unknown, excluded from Nobel Prizes by Alfred Nobel, the man who made a fortune with the discovery of dynamite in 1866. But, it is exciting to search for an answer anyway.

Here is what we now know: The even numbers starting with 4 and most of the odd numbers can be created by multiplying two or more prime numbers. The primes consists of a small set of odd numbers and the even number of 2.

Here are some examples:

4 = 2 times 2   9 = 3 times 3

6 = 2 times 3   10 = 2 times 5

8 = 2 times 2 times 2   12 = 2 times 2 times 3

So, what's the problem?

For several thousand years we have been looking for a hidden pattern that will explain how the primes fit together to create the other numbers. The primes are the parents of the other numbers. But how do they procreate? Something as fundamental as the ability to create all other numbers has to have an underlying pattern, but as yet—no pattern has been discovered. It looks random, but this disturbs our mystical belief in science and mathematics. As Albert Einstein was so fond of saying, "If the universe (and everything in it) is a product of randomness, science would be impossible." There has to be cause-effect relationships. If not, we had best discontinue all scientific research. If not, we had best discontinue all medical research. It is a waste of time and money.

Randomness: What is it?

The nemesis for all scientists is randomness or chance. Trying to handle randomness is like attempting to wrestle to the mat a 400 pound gorilla. "Randomness" is just a word without much meaning to most people. But picture this: If you have ten books on your book shelf, how many different ways can you arrange those books? The answer is 10 factorial or 10 times 9 times 8 times etc, until you get to 1. That is about 4 million different arrangements by chance. Sound impressive?

Wait! What if we add one more book to make it eleven books on the shelf? The number of different combination leaps to 11 factorial or an incredible 40 million, and if we add another book or two, my computer does not have the power to calculate the number of different arrangements.

Isaac Asimov, the science writer, once expressed the problem of science something like this: *The biblical story of Adam and Eve may be interpreted this way…*

> God told the couple, "Eat the fruit of any tree except this one, an apple tree containing all knowledge." A snake, who could walk and talk, whispered to Eve, "If you take a bite of an apple from the forbidden tree, you will be like God. You will know everything." The temptation was overwhelming.
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> Eve took a bite and persuaded Adam to taste the apple, too. There was the deafening sound of thunder and lightning. God appeared and handed Adam a deck of cards. "Here in this deck of cards is all knowledge of the universe. I will shuffle it once and hand it to you. When you return the cards to their original order, you will have in your hands all knowledge."
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> The question is: How many times must Adam shuffle the deck to get the original order? The answer is 52 factorial. That is 52 times 51 times 50, etc., which is billions and billions of shuffles. In thousands of generations after Adam, people around the world have been shuffling that deck of cards, and once in great while, a card falls into the original order and we have an exciting discovery, like a cure for polio or cancer, or like the Wright Brothers, who deciphered the secret of how birds fly.

The Game of Discovery

In science, all the odds seem to be overwhelmingly against the players in the game of discovery. But, scientists would not continue playing the game unless they believed, like Einstein, that the universe operates on cause-effect relationships which means that randomness is something of an illusion.

Most scientists agree with Albert Einstein that, "If the universe is the product of pure chance, science would not be possible." Look at it this way: With one shuffle by God, Adam's deck of cards is in random order, but the original arrangement of the cards may be a universe of precise cause- effect relationships.

Let's have some examples

I can represent all even numbers with 2n. By all, I mean all even numbers through eternity. For example,

2(1) = 2

2(2) = 4

2(3) = 6

represent specific even numbers of 2,4 and 6, but 2n represents all possible even numbers.

Not only that, but I can represent all possible odd numbers with 2n + 1 as, for instance

2(1) + 1 = 3

2(2) + 1 = 5

2(3) + 1 = 7

You could argue that I have not proven that 2n represents all possible even numbers and 2n + 1 represents all odd numbers since no one knows how many even and odd numbers exist. If even and odd numbers continue on forever without ending, then we will never know all possible even and odd numbers. The answer is: We don't know whether 2n represents all even numbers and 2n + 1 represents all odd numbers. This is an assumption.

The problem, in my opinion, is how can I represent all possible prime numbers such as 2, 3, 5, 7, 11, 13, 17, 19, 23, 29...etc.? Without a way to represent all primes, we are baffled as to how to explore this small set of odd numbers and the lone even number of 2. If we discover a way to represent all possible primes, we may find that hidden equation that will predict prime numbers. And, if primes are fundamental to arithmetic, there must be an invisible equation that will generate all prime numbers. There has to be.

A rival explanation

I want to suggest a rival hypothesis: It may be that the prime numbers are not really prime at all. This may be an illusion. For example, consider the number 8. 8 = 2 time 2 time 2, and 2 is a prime number. You might conclude that 8 is the result of multiplying three primes, that is, 2 times 2 times 2.

But this is deceptive, since arithmetic can only be performed with a pair of numbers not three, not four—only a pair. Therefore, 8 cannot equal 2 times 2 times 2. It can equal 2 times 2 = 4, and then 4 times 2 = 8.

One more example: 12 = 2 times 2 times 3, all primes, but it is impossible to multiply three numbers. You can only multiply one pair of numbers at a time. So, 12 = 2 times 2 = 4, and then 4 times 3 = 12. Or, 12 = 2 times 3 = 6, and 6 times 2 = 12. No matter how you multiply, 12 is not the product exclusively of prime numbers.

What exactly are we looking for?

I suggest three patterns. The first I call the golden equation that will predict every prime and no false primes. The second is a silver equation that will predict some primes and no false primes. The third is a bronze equation that will predict only false primes and no primes. After you doodle with this intriguing puzzle, if you think you have a gold, silver or bronze equation, please e-mail me with your solution at tprworld@aol.com I will submit it to professional mathematicians for evaluation. If they find no flaws, I will put your answer up on our website and give you full credit. That's the next best thing to winning a Nobel Prize.

Let's get our kids doodling on their computers to discover the answers

Kids can't doodle if they are not aware that there are mysteries! So, here is what I recommend: Declassify those mysteries now stamped with, "Only for the eyes of advanced students" to "Here is an exciting toy that elementary students are fully capable of playing with and perhaps coming up with a breakthrough--especially since children now have access to the most powerful toy of the 21st century, the computer." Young people also have something that is a luxury for their parents—time to explore such mysteries.

Part of this article is excerpted from my new book,
The Weird and Wonderful World of Mathematical Mysteries:
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