

Meet M77232917, the largest known prime number

By Smithsonian.com, adapted by Newsela staff on 01.25.18

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A prime number is any number that can only be divided by 1 and itself. Photo by: Robert Brook/Getty Images

There is a new prime number in town. It starts with a 4, continues on for 23 million numbers, then ends with a 1. A prime number is a number that can only be evenly divided by 1 and itself.

Prime numbers are very important. They are used in security for protecting banking information. They are also used for protecting messages and pictures sent on phones. Finding larger prime numbers doesn't make the security stronger. Still, humans are curious about what other big prime numbers are out there.

The 50th Mersenne Prime

The newest prime number is found by multiplying 2 by 2, 77,232,917 times, then subtracting 1. This form of calculation means the new prime is considered a Mersenne prime. These primes are named after the French mathematician Marin Mersenne. A Mersenne prime is always found by multiplying 2 times 2 over and over, then subtracting 1.

The new number is called M77232917 for short. It is nearly 1 million numbers longer than the last big prime discovered in 2016. It's the 50th Mersenne prime discovered. There could still be other prime numbers that have not been found that are smaller than the 50th one.

Finding A New Prime Is Harder Than It Seems

Discovering the new prime was a group effort. Jonathan Pace is an electrical engineer living in Tennessee. His computer found the number using special software called Great Internet Mersenne Prime Search (GIMPS). Other experts developed the software. After the number was found, four different experts checked it and confirmed that it is a prime number.

"What's special about this prime isn't that it's prime, it's that we actually know it's prime," writes Robert Lemke Oliver. He's a mathematician at Tufts University in Massachusetts.

Determining if a number is a prime sounds simple. All you need to do is divide it by all primes smaller than itself. If no other primes can divide it evenly, it must be a new prime number. It's harder in practice. It's difficult to divide primes that are millions of numbers long. Even modern computers capable of very quick calculations take a long time. Instead, computers use a number trick called the Lucas-Lehmer test. The test only works for Mersenne primes. It makes doing the math a lot faster.

It still takes a lot of computer power to test possible prime numbers. Pace's computer took six days to discover M77232917. The verifications took an additional 12 days. The discovery is a first for Pace. He's been running software to hunt for big prime numbers for the past 14 years.

Discover New Primes, Win Money

A lot of people are interested in finding new prime numbers. GIMPS offers awards for the discovery of new Mersenne prime numbers. Pace won \$3,000 for his recent discovery.

The Electronic Frontier Foundation (EFF) makes sure technology is fair for everyone. It's also interested in prime numbers, though. It has challenges for the first person to discover primes of bigger and bigger sizes. GIMPS estimates it will take 15 years of calculations to reach the next big step forward. That will involve finding a prime number that is at least 100 million numbers long.

The prize was set up in the 1990s. "The awards are meant to show how the Internet is useful," says Seth Schoen. Schoen works for the EFF.

Experts Must Work Together

The prize also shows that working together is important. It's often the only way to find big primes. Some people write the computer software. Others search for the numbers. Others prove whether the new numbers are really primes.

"A single person with a shovel might find a large gem, but it is very unlikely," writes Caldwell. "But if you can organize 100,000 people with shovels, coordinate where and how they dig, the chance of the group finding a gem is far far higher."

Welcome to the list of primes, M77232917, and enjoy your time as the largest prime number while you can. One thing is certain: One day, a new largest prime number will be discovered.

Quiz

- 1 Which selection from the article BEST supports the article's CENTRAL idea?
- (A) Prime numbers are very important. They are used in security for protecting banking information. They are also used for protecting messages and pictures sent on phones.
 - (B) The new number is called M77232917 for short. It is nearly 1 million numbers longer than the last big prime discovered in 2016. It's the 50th Mersenne prime discovered.
 - (C) The Electronic Frontier Foundation (EFF) makes sure technology is fair for everyone. It's also interested in prime numbers, though.
 - (D) Welcome to the list of primes, M77232917, and enjoy your time as the largest prime number while you can. One thing is certain: One day, a new largest prime number will be discovered.

- 2 Read the following detail from the article.

Jonathan Pace is an electrical engineer living in Tennessee. His computer found the number using special software called Great Internet Mersenne Prime Search (GIMPS). Other experts developed the software. After the number was found, four different experts checked it and confirmed that it is a prime number.

HOW does this detail develop the CENTRAL idea of the article?

- (A) It explains the reason GIMPS created an award for new prime numbers.
- (B) It describes what a Mersenne Prime is and how to find one using computers.
- (C) It tells how people use prime numbers to make information more secure.
- (D) It shows that finding and testing a new prime number takes teamwork.

- 3 Read the selection from the section “Finding A New Prime Is Harder Than It Seems.”

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Which word from the selection helps the reader to understand the meaning of “verifications”?

- (A) test
 - (B) discover
 - (C) running
 - (D) hunt
- 4 Read the following sentence from the article.

GIMPS offers awards for the discovery of new Mersenne prime numbers.

Which sentence uses “offers” in the SAME way as the sentence above?

- (A) She had received offers from many different schools across the country.
- (B) After receiving many job offers, he decided to move to a new company.
- (C) The school offers a bonus for the teacher with the best test scores.
- (D) The old man had gotten many offers to buy his company over the years.

Answer Key

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