

Primes:

Part of mathematical number theory

Is there a secret pattern?

Thin line between number theory and conspiracy theories.

Dates back to 1550 BC

Euclid's Elements proves the infinitude of primes: Euclid's theorem

Before computers mathematicians formed tables of primes. The longest included all numbers up to 100,000,000, i.e. almost 6 million primes.

Two questions:

1. How many primes smaller than the number n ?
2. There are infinitely many primes, but how big of an infinity?

The prime number theorem: $n/\log(n)$

The n 'th prime is about $n \cdot \log(n)$

The chance of a random integer n being prime is about $1/\log(n)$

Palindromes

Beastly:

Twin Primes:

5 is the only prime that belongs to two pairs.

Every twin prime pair except (3, 5) has a common form $(6n-1, 6n+1)$

The sum of any pair of twin primes is divisible by 12

Ulam's spiral:

Start Ulams spiral på 41.

Dette gir en ubrutt diagonal på 40 primtall

Prime formulas:

Fermat: $F_n = 2^{2^n} + 1$. Holds for $n = 0, 1, 2, 3, 4$, but not for $n = 5, \dots, 32$. Unknown for $n > 32$.

Euclid: $E_n = p_n + 1$, where p_n is the product of the first n primes. Holds for $n = 1, \dots, 5$, but not for $n = 6$. Used to prove that there are an infinite number of primes.

Wilson:

Holds for all primes, but not very efficient.

Mersenne: $M_n = 2^n - 1$

Take 2 to the power of a known prime and subtract 1

Early 17th century

Mersenne failed to recognise 61, 89 and 107 and was wrong about 67 and 257.

M127 er det største primtallet funnet for hånd. Det største kjente primtallet i 75 år

Marin Mersenne 1588-1648

Alle Mersenneprimtall er binære palindromprimtall

Fast algorithms for finding Mersenne primes are available

The seven largest known primes are Mersenne primes.

Search for large primes:

GIMPS – Great Internet Mersenne Prime Search-project

Through the EFF Cooperative Computing Awards, EFF will confer prizes of:

\$50,000 to the first individual or group who discovers a prime number with at least 1,000,000 decimal digits (awarded Apr. 6, 2000)

\$100,000 to the first individual or group who discovers a prime number with at least 10,000,000 decimal digits (awarded Oct. 22, 2009)

\$150,000 to the first individual or group who discovers a prime number with at least 100,000,000 decimal digits

\$250,000 to the first individual or group who discovers a prime number with at least 1,000,000,000 decimal digits

Computing primes:

Sieve or Eratosthenes works for small primes $< 10\,000\,000\,000$.