

Idea 19: cryptography – crack the code

Students work in pairs. Student A uses prime numbers to generate a code for a message for student B to decode. . (A list of the prime numbers in the range 0 to 100 is given below.)

Student A

- Select any four prime numbers.
- Work out all the semi-primes that can be generated from the four prime numbers. There will be six possibilities. (A number cannot be multiplied by itself.)
- Choose two semi-primes. Substitute letters for numbers to make a short message.
- Write a number-to-letter code to link each number to a letter in the message. There may be extra spaces so include extra vowels although these will not be used.
- Student A gives the four prime numbers (the key codes) and the number-to-letter code to student B.

Student B

- Calculate all the semi-primes.
- Decode the word for each semi-prime and select a message.
- Check if this is the correct message.

Prime numbers between 0 and 100

2	3	5	7	11	13	17	19	23	29
31	37	41	43	47	53	59	61	67	71
73	79	83	89	97					

Further investigations

There is an enormous amount of information about prime numbers on the internet.

A good place to start is the website *Maths Is Fun* which has a Prime Numbers Calculator which can check if any number up to 4,294,967,295 is prime. There are lists of prime numbers up to 1 million. (The largest prime under 1 million is 999,983.)

[Pierce, Rod, 2018, 'Prime Numbers Chart and Calculator', Math Is Fun, Available at: <http://www.mathsisfun.com/prime_numbers.html>. [Accessed 30 Apr 2019]

People are continually hunting for very large prime numbers. By December 2018, the largest known prime was $2^{82,589,933} - 1$. The number would contain 24,862,048 digits if written using the conventional place value system.

[“GIMPS Project Discovers Largest Known Prime Number: $2^{82,589,933} - 1$ ”. Mersenne Research, Inc. 21 December 2018. Retrieved 30 April 2019.]