

## Quadratic primes

### [Problem 27 \(http://projecteuler.net/problem=27\)](http://projecteuler.net/problem=27)

Euler discovered the remarkable quadratic formula:  $n^2+n+41$

It turns out that the formula will produce 40 primes for the consecutive integer values  $0 \leq n \leq 39$ . However, when  $n=40$ ,  $40^2+40+41=40(40+1)+41$  is divisible by 41, and certainly when  $n=41$ ,  $41^2+41+41$  is clearly divisible by 41.

The incredible formula  $n^2-79n+1601$  was discovered, which produces 80 primes for the consecutive values  $0 \leq n \leq 79$ . The product of the coefficients,  $-79$  and  $1601$ , is  $-126479$ .

Considering quadratics of the form:  $n^2+an+b$ , where  $|a| < 1000$  and  $|b| \leq 1000$ , where  $|n|$  is the modulus/absolute value of  $n$ , e.g.  $|11|=11$  and  $|-4|=4$

Find the product of the coefficients,  $a$  and  $b$ , for the quadratic expression that produces the maximum number of primes for consecutive values of  $n$ , starting with  $n=0$ .

## Solution

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In [1]: ► def prime(m=0):
        if m > 2:
            yield 2
        if m > 3:
            yield 3
        p, n, q = 5, 3, 9
        while (not m) or (p < m):
            if all(p % x for x in range(3, n+1, 2)):
                yield p
            p += 2
            while p>q:
                q += n
                n += 1
                q += n

        ptable = list(prime(1000))

    def isprime(n):
        if n <= ptable[-1]:
            return n in ptable
        q = int(n ** 0.5) + 1
        for x in ptable:
            if n % x == 0:
                return False
            if x > q:
                return True
        if q>ptable[-1]:
            for x in range(ptable[-1],q,2):
                if n % x == 0:
                    return False
            return True
        return True

    def qlen(a,b):
        x, n = b, 0
        while isprime(x):
            n += 1
            x = n * n + a * n + b
        return n

    maxlen = 0
    ab = 0
    for b in ptable[1:]:
        for a in range(2-b,1000,2):
            ql = qlen(a, b)
            if maxlen < ql:
                maxlen = ql
                ab = a * b
    print(ab)

```