

## Primes in Base 4

In “normal” (base 10) numbers 2132 means  $2 \times 10^3 + 1 \times 10^2 + 3 \times 10 + 2 \times 1$

In base 4 2132 means  $2 \times 4^3 + 1 \times 4^2 + 3 \times 4 + 2 \times 1$

So 2132 base 4 = 158 base 10

### Task 1

Convert from base 4 to base 10

- a) 32    14
- b) 1000    64
- c) 333    63
- d) 112233    1455

To convert 483 base 10 we need to write it as the sum of the powers of 4.

$$\underline{\quad} \times 4^4 + \underline{\quad} \times 4^3 + \underline{\quad} \times 4^2 + \underline{\quad} \times 4 + \underline{\quad} + 1$$

Start with the highest power of four and then the next. You end up with:

$$1 \times 4^4 + 3 \times 4^3 + 2 \times 4^2 + 0 \times 4 + 3 \times 1 = 13203$$

### Task 2

Convert from base 10 to base 4

- a) 12    30
- b) 35    203
- c) 221    3131

### Task 3

Prove or disprove this conjecture:

“A prime number in base 10 always makes a prime number in base 4 (in base 10)”

E.g. 19 in base 10 is 103 in base 4. 103 is a prime number in base 10. Is this true for every prime number?