Seive in C++

```
#include <iostream>
#include <cmath>
#include <vector>
using namespace std;

class SeiveofErastostenins {
public:
    static void main() {
        vector<bool> myseive = seive(20);
        for (int i = 0; i < myseive.size(); i++) {
            cout << i << " " << (myseive[i] ? "true" : "false") << endl;
        }
    }

    static vector<bool> seive(int n) {
        vector<bool> arr(n + 1, true);
        arr[0] = false;
        arr[1] = false;
        for (int i = 2; i <= sqrt(n); i++) {
            if (arr[i]) {
                for (int j = i * i; j <= n; j += i) {
                    arr[j] = false;
                }
            }
        }
        return arr;
    }
};

    int main() {
        SeiveofErastostenins::main();
        return 0;
    }
```

Sieve of Eratosthenes Dry Run for n = 20

🔢 Step 1: Initialize Boolean Vector

vector<bool> arr(n + 1, true); // arr[0..20] all set to true
arr[0] = false;
arr[1] = false;

📋 Initial Table:

i	isPrime
0	false
1	false
2	true
3	true
4	true
5	true
6	true
7	true
8	true
9	true
10	true
11	true
12	true
13	true
14	true
15	true
16	true
17	true
18	true
19	true
20	true

🔁 Step 2: Outer loop — for (int i = 2; i <= sqrt(n); i++)

- sqrt(20) is ~4.47 → so i goes from 2 to 4

➤ i = 2:

arr[2] == true → mark all multiples of 2 from 4 onward as false

Inner loop (j = i*i; j <= n; j += i) → j = 4, 6, 8, 10, 12, 14, 16, 18, 20

❌ Marked False:

4, 6, 8, 10, 12, 14, 16, 18, 20

➤ i = 3:

arr[3] == true → mark all multiples of 3 from 9 onward as false

j = 9, 12, 15, 18

❌ Marked False:

9, 15

(12 and 18 already marked by i = 2)

➤ i = 4:

arr[4] == false → skip

✅ Final Table After Sieve:

i	isPrime
0	false
1	false
2	true
3	true
4	false
5	true
6	false
7	true
8	false
9	false
10	false
11	true
12	false
13	true
14	false
15	false
16	false
17	true
18	false
19	true
20	false

🧾 Output Printed by the Code:

```
0 false
```

	1 false 2 true 3 true 4 false 5 true 6 false 7 true 8 false 9 false 10 false 11 true 12 false 13 true 14 false 15 false 16 false 17 true 18 false 19 true 20 false ✅ **Prime Numbers ≤ 20:** **2, 3, 5, 7, 11, 13, 17, 19**
0 false 1 false 2 true 3 true 4 false 5 true 6 false 7 true 8 false 9 false 10 false 11 true 12 false 13 true 14 false 15 false 16 false 17 true 18 false 19 true 20 false	