

C++ code 6.10.6: Sub-problem (6-10.a): Monitoring convergence of symplectic timestepping method for oscillator equation → [GITHUB](#)

```
2 void sympTimesteppingODETest() {
3     int nlter = 7;    // total number of iterations
4     unsigned int m;  // number of equidistant steps
5     Eigen::Vector2d approx_sol;
6
7     // Initial conditions
8     Eigen::Vector2d init_cond;
9     init_cond << 0.0, 1.0; // initial conditions
10
11    // Evaluating the error at the final step between the approx solutions as
12    // given by the symplectic method and the exact solution computed from
13    // the analytic formula.
14    double errors[nlter]; // errors vector for all approx. sols
15    double tau;
16    for (int k = 0; k < nlter; k++) {
17        m = 10 * std::pow(2, k);
18        // Computing approximate solution
19        approx_sol = init_cond;
20        tau = 2.0 * PI / m;
21        for (int i = 0; i < m; i++) {
22            sympTimestep(tau, approx_sol);
23        }
24        // Computing the error in the maximum norm
25        errors[k] = std::abs(std::sin(2.0 * PI) - approx_sol[0]) +
26                   std::abs(std::cos(2.0 * PI) - approx_sol[1]);
27    }
28    // Printing results
29    std::cout << "Convergence of Symplectic Time Stepping Method:\n";
30    std::cout << "\tM\t\tterr(M)\n";
31    for (int k = 0; k < nlter; k++) {
32        std::cout << "\t" << 10 * std::pow(2, k) << "\t\t" << errors[k]
33                << std::endl;
34    }
35 }
```