

C++ code 8.13.7: Sub-problem (8-13.c): The function `pointLevelSet()`

```
2 template <typename Functor>
3 Eigen::Vector2d pointLevelSet(Functor&& f, const Eigen::Vector2d& d, double c,
4                               const Eigen::Vector2d& x0, double rtol = 1e-10,
5                               double atol = 1e-16) {
6     Eigen::Vector2d intersect = Eigen::VectorXd::Zero(2);
7
8     // TODO: (8-13.c) Use the secant method to find the intersection.
9     // START
10    // the function whose zero has to be found
11    auto F = [&f, &d, &c](double t) { return f(t * d) - c; };
12
13    double upd = 1.;
14    // initial guesses for the secant method
15    double t0 = x0.norm() / d.norm();
16    double t1 = 1.1 * t0;
17
18    double fo = F(t0);
19    // check correction based termination criterion
20    while (std::abs(upd) > std::max(atol, rtol * std::min(t0, t1))) {
21        const double fn = F(t1);
22        // secant update
23        upd = fn * (t1 - t0) / (fn - fo);
24        // new iteration points
25        t0 = t1;
26        t1 = t1 - upd;
27        fo = fn;
28    }
29    // compute intersection of the boundary of the level set with the ray
30    intersect = t1 * d;
31    // END
32    return intersect;
33 }
```

Get it on  GitLab ([levelset.hpp](#)).