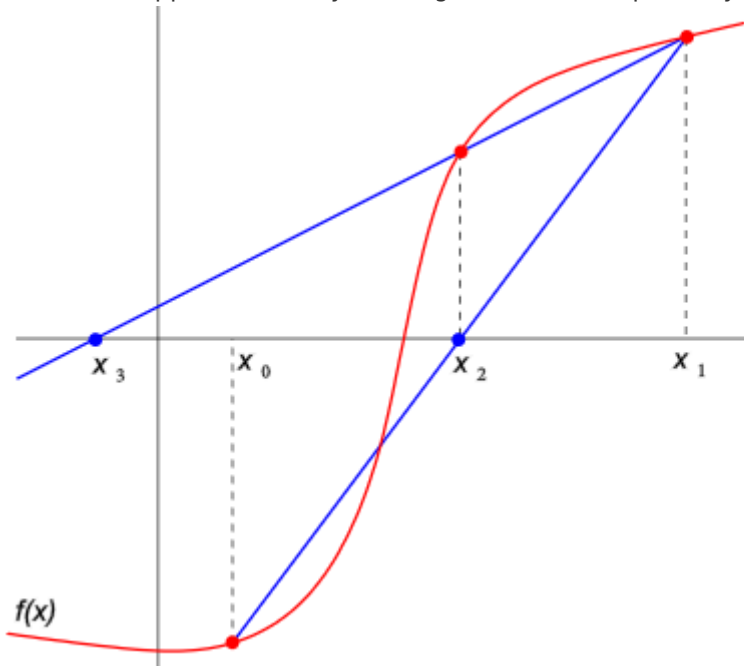


Secant Method, is a Numerical Technique to find the root of an algebraic or transcendental equation.

The root is approximated by drawing secant lines repeatedly.



A secant line is a line joining two points on a function. Secant method requires two initial guesses(x_0 and x_1), to draw the first secant line. The root of this line(x_2), that is, where this line touches the x-axis, becomes the new point, and now a secant line is drawn between the new point(x_2) and one of the last points(x_1).

This process is repeated until a root is found upto a certain tolerance.

The method is similar to Bisection Method, in that it requires two initial guesses, but still a lot different, as the guesses don't require to bracket(enclose) the root. Moreover, unlike Bisection Method, Secant Method may not always converge, so it might be a good idea to have a limit for the maximum iterations to be performed.

So, the program would ask the user to enter two initial guesses: x_1 and x_2 .

Then, it will calculate the new point(x_3) using the formula:

$$x_3 = \frac{x_1 f(x_2) - x_2 f(x_1)}{f(x_2) - f(x_1)}$$

PROGRAM (Simple Version):

```

/*****SECANT METHOD*****/
/*****/
#include<stdio.h>
#include<math.h>
/*Function whose root is to be determined*/
double f(double x){
    return x*x-4;
}
main(){
    int iter=1,maxSteps;
    double x1,x2,x3,eps;
    printf("Enter the accuracy desired: \n");
    scanf("%lf",&eps);
    printf("Enter the initial guesses: \nx1 = ");
    scanf("%lf",&x1);
    printf("x2 = ");
    scanf("%lf",&x2);
    printf("Enter the max number of iterations to be performed: ");
    scanf("%d",&maxSteps);
    printf("iter\tx1\ttx2\ttx3\ttf(x3)\n");
    printf("_____ \n");
    do{
        x3=(x1*f(x2)-x2*f(x1))/(f(x2)-f(x1));
        printf("%d\t%lf\t%lf\t%lf\t%lf\n",iter,x1,x2,x3,f(x3));
        x1=x2;
        x2=x3;
        iter++;
    }while(fabs(f(x3))>eps&&iter<=maxSteps);
    printf("\nOne of the roots is: %lf",x3);
}

```

OUTPUT:

For $x^3 - 27$:

```
Enter the accuracy desired:
0.00001
Enter the initial guesses:
x1 = 5
x2 = 10
iter      x1            x2            x3            f(x3)
1         5.000000     10.000000     4.440000     60.528384
2         10.000000     4.440000     4.071180     40.477798
3         4.440000     4.071180     3.326612     9.813446
4         4.071180     3.326612     3.088330     2.455808
5         3.326612     3.088330     3.008796     0.238203
6         3.088330     3.008796     3.000254     0.006845
7         3.008796     3.000254     3.000001     0.000020
8         3.000254     3.000001     3.000000     0.000000

One of the roots is: 3.000000
```

For x^*x-4 :


```

}
main(){
    int maxSteps;
    double x1,x2,x3,eps;
    printf("Enter the accuracy desired: \n");
    scanf("%lf",&eps);
    printf("Enter the intial guesses: \nx1 = ");
    scanf("%lf",&x1);
    printf("x2 = ");
    scanf("%lf",&x2);
    printf("Enter the max number of iterations to be performed: ");
    scanf("%d",&maxSteps);
    printf("\nOne of the roots is: %lf",secantPrint(f,x1,x2,eps,maxSteps));
}

```

OUTPUT:

```

Enter the accuracy desired:
0.001
Enter the intial guesses:
x1 = 0
x2 = 5
Enter the max number of iterations to be performed: 15

```

iter	x1	x2	x3	f(x3)
1	0.000000	5.000000	0.800000	-3.360000
2	5.000000	0.800000	1.379310	-2.097503
3	0.800000	1.379310	2.341772	1.483897
4	1.379310	2.341772	1.942991	-0.224785
5	2.341772	1.942991	1.995453	-0.018168
6	1.942991	1.995453	2.000066	0.000263

```

One of the roots is: 2.000066

```



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I'm a physicist specializing in computational material science with a PhD in Physics from Friedrich-Schiller University Jena, Germany. I write efficient codes for simulating light-matter interactions at atomic scales. I like to develop Physics, DFT, and Machine Learning related apps and software from time to time. Can code in most of the popular languages. I like to share my knowledge in Physics and applications using this Blog and a YouTube channel.

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