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/*
```

```
A program to find out the eigen value of a differential equation using Sturm Liouville method.
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```
This program is created by Mohammad Sazzad Hossain.
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```
*/
```

```
# include <iostream>
```

```
using namespace std;
```

```
int n = 100, step = 0;
```

```
double f (double l);
```

```
double secant (double x);
```

```
double sturmliouville(double h, double u0, double u1, double p[], double p1[], double q[], double s[]);
```

```
int main (){
```

```
double l = 0.5;
```

```
l = secant (l);
```

```
cout << "The eigen value is: " << l << endl;
```

```
return 0;
```

```
}
```

```
double secant (double x)
```

```
{
```

```
double dl = 1E-6, funct; //Error
```

```
int tag = 0;
```

```
do {
```

```
funct = x + dl * f(x) / (f(x) - f(x - dl));
```

```
if (x + dl < funct && x + dl > -funct)
```

```
tag = 1;
```

```
x += dl;
```

```
}while (tag != 1);
```

```
return x;
```

```
}
```

```
double f(double l)
```

```
{
```

```
double u, p[n], q[n], s[n], p1[n];
```

```
double h = 1.0 / n;
```

```

double u0 = 0;
double u1 = h;

for (int i = 0; i <= n; ++i){
    double x = h * i;
    p[i] = 1 - x * x;
    p1[i] = -2 * x;
    q[i] = 1 * (1 + 1);
    s[i] = 0;
}
u = sturmliouville (h, u0, u1, p, p1, q, s);
step++;
return u - 1;
}

double sturmliouville(double h, double u0, double u1, double p[], double p1[], double q[], double s[]){
double u[n];
double h2 = h * h;
    u[0] = u0;
    u[1] = u1;

for (int i = 1; i < n; ++i)

{
    double c2 = 2 * p[i] + h * p1[i];
    double c1 = 4 * p[i] - 2 * h2 * q[i];
    double c0 = 2 * p[i] - h * p1[i];
    double d = 2 * h2 * s[i];
    u[i+1] = (c1 * u[i] - c0 * u[i-1] + d) / c2;
}
return u[n];
}

```