

```
»type august4
```

```
%
%                               Homework - August 4
%
% We are faced here with finding not just a root of the given equation,
%but the smallest positive root. We must thus study the equation and decide
%how we can tell if we have the correct root. Meditate on the secant function.
%At 0, it is 1, and it increases without bound on the interval (0, pi/2). A
%bit of reflection should convince you that our problem has exactly one root
%on the interval from zero to where the argument of the secant is pi/2, or
%where (L/2)*sqrt(x/E)=pi/2. In other words, where x=E*(pi/L)^2. We shall call
%this the "critical value." If we find a positive root less than this critical
%value, it must be the one we seek. A root larger than this is not one we seek.
%
% To make some of the algebra a bit simpler, I set t=sqrt(x/E), and solved
%for t. I used Newton's method, modified slightly to force the iterates to stay
%below the critical value. I hope my code is reasonably clear. Here it is:
```

```
»type s
```

```
ul=pi/L;
t=ul/1.5; mm=1000;
k=1;T=[t];
while k<20 & abs(mm)> 1E-10
    mm=del(t,L,e);
    t=t-mm;
    if t> ul
        t=(t+mm+ul)/2;
    end
    k=k+1;
end
[e L E*ul^2 E*t^2 ]
```

```
»type del
```

```
function y=del(t,L,e)
    K=4/3E3;arg=L*t/2;
    top=t^2-K/(1+e*sec(arg));
    bottom=2*t+(K*e*L/2)*(sec(arg)*tan(arg))/(1+e*sec(arg))^2;
    y=top/bottom;
```

```
»%Here are the computations. Note that each line gives e, L, the critical value
»%and the desired root.
```

```
»E=30E6;
```

```
»
```

```
»e=0.3;L=50;s
```

```
ans =
```

3.0000e-01	5.0000e+01	1.1844e+05	2.8236e+04
------------	------------	------------	------------

```
»L=100;s
```

```
ans =
```

3.0000e-01	1.0000e+02	2.9609e+04	1.9606e+04
------------	------------	------------	------------

```
»L=150;s
```

```
ans =
```

3.0000e-01	1.5000e+02	1.3159e+04	1.1260e+04
------------	------------	------------	------------

```
»L=200;s
```

```
ans =
```

3.0000e-01	2.0000e+02	7.4022e+03	6.8310e+03
------------	------------	------------	------------

```
»e=0.1;L=50;s
```

```
ans =
```

1.0000e-01	5.0000e+01	1.1844e+05	3.4733e+04
------------	------------	------------	------------

```
»L=100;s
```

```
ans =
```

1.0000e-01	1.0000e+02	2.9609e+04	2.4133e+04
------------	------------	------------	------------

```
»L=150;s
```

```
ans =
```

1.0000e-01	1.5000e+02	1.3159e+04	1.2416e+04
------------	------------	------------	------------

```
»L=200;s
```

```
ans =
```

1.0000e-01	2.0000e+02	7.4022e+03	7.1969e+03
------------	------------	------------	------------

```
»e=0.05;L=50;s
```

```
ans =
```

5.0000e-02	5.0000e+01	1.1844e+05	3.7092e+04
------------	------------	------------	------------

```
»L=100;s
```

```
ans =
```

5.0000e-02	1.0000e+02	2.9609e+04	2.6151e+04
------------	------------	------------	------------

```
»L=150;s
```

```
ans =
```

5.0000e-02	1.5000e+02	1.3159e+04	1.2770e+04
------------	------------	------------	------------

```
»L=200;s
```

```
ans =
```

5.0000e-02	2.0000e+02	7.4022e+03	7.2974e+03
------------	------------	------------	------------

```
»e=0.01;L=50;s
```

```
ans =
```

1.0000e-02	5.0000e+01	1.1844e+05	3.9362e+04
------------	------------	------------	------------

```
»L=100;s
```

```
ans =
```

1.0000e-02	1.0000e+02	2.9609e+04	2.8663e+04
------------	------------	------------	------------

```
»L=150;s
```

```
ans =
```

```
1.0000e-02 1.5000e+02 1.3159e+04 1.3078e+04
```

```
»L=200;s
```

```
ans =
```

```
1.0000e-02 2.0000e+02 7.4022e+03 7.3809e+03
```

```
»
```