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MATH 4670
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1 Section 2.3, Problem 17

Using the Secant method, we will find the rate of change, w, accurate to within 10^{-5} for

$$x(t) = \frac{g}{2w^2}(\frac{e^{wt} - e^{-wt}}{2} - \sin wt)$$

with $x(t) = 1.7$, $t = 1$, and $g = -32.17$.

2 Source Code

The following C code can be used to an accurate value:

```
#include <stdlib.h>
#include <math.h>

#define E 2.71828182846

double f(double x);
void secant_method(double a, double b);

int main()
{
   secant_method(-0.999999, .999999);
   return 0;
}

double f(double x)
{
   return -1.7 + -32.17/(2*x*x) * ( (pow(E, x) - pow(E, -x))/2 - sin(x) );
}

void secant_method(double a, double b)
{
   double x[100];
   unsigned int k = 1;
   x[0] = a;
   x[1] = b;

   printf("%d \t %5.20f \t %5.20f \n", 0, x[0], f(x[0]) + 1.7);
   printf("%d \t %5.20f \t %5.20f \n", 1, x[1], f(x[1]) + 1.7);
```

```
   while( f(x[k]) != f(x[k-1]) )
   {
        x[k+1] = x[k] - ( f(x[k]) * (x[k] - x[k-1]) ) / ( f(x[k]) - f(x[k-1]) );
        printf("%d \t %5.20f \t %5.20f \n", k+1, x[k+1], f(x[k+1]) + 1.7 );
        k++;
   }
   printf("\n");
}
```

3 Results

	w	x(t)
0	-0.99999899999999997124	5.36804501554570911992
1	0.99999899999999997124	-5.36804501554570911992
2	-0.31668853280418701734	1.69799868219527794189
3	-0.31706145863303503152	1.69999830617676095379
4	-0.31706177452764378044	1.70000000000024042990
5	-0.31706177452759892743	1.70000000000000861533
6	-0.31706177452759726210	1.70000000000000417444
7	-0.31706177452759565227	1.69999999999999085176
8	-0.31706177452759676250	1.70000000000000572875
9	-0.31706177452759631841	1.69999999999999817923
10	-0.31706177452759642943	1.70000000000000661693
11	-0.31706177452759631841	1.69999999999999817923
12	-0.31706177452759631841	1.69999999999999817923

4 Summary

It is clearly shown that w converges to approximately -0.31706177452759631841.