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MATH 4670
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1   Section 2.4, Problem 4.a.

Using the Secant method, we will find solutions accurate to within 10^{-5} for the equation

$$2x \cos 2x - (x - 2)^2 = 0$$

on the intervals $[2, 3]$ and $[3, 4]$.

2   Source Code

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

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

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

int main()
{
    secant_method(2.00, 3.00);
    secant_method(3.00, 4.00);
    return 0;
}

double f(double x)
{
    return 2 * x * cos(2*x) - pow(x - 2, 2);
}

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

    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]) );
        k++;
    }
    printf("\n");
}
```

3 Results

```
          x                                  f(x)
------------------------------------------------------------------
0        2.00000000000000000000       -2.61457448345444776194
1        3.00000000000000000000        4.76102171990219602549
2        2.35448991666118478960       -0.14171667468317672434
3        2.37314878342557689095        0.02166938733547552065
4        2.37067411572036901291       -0.00011259714367339857
5        2.37068690796688885669       -0.00000008527421954674
6        2.37068691766229999729        0.00000000000033764658
7        2.37068691766226180562        0.00000000000000172085
8        2.37068691766226180562        0.00000000000000172085



------------------------------------------------------------------
0        3.00000000000000000000        4.76102171990219602549
1        4.00000000000000000000       -5.16400027046890830462
2        3.47969885855378135986        3.23846480905971878528
3        3.68023250204280705233        0.66366098393942207778
4        3.73192046127778542797       -0.16091127764696500080
5        3.72183380672132102518        0.00454727816958344633
6        3.72211101707071856382        0.00002862926173330393
7        3.72211277342041713112       -0.00000000519474463445
8        3.72211277310178756395        0.00000000000000399680
9        3.72211277310178800803       -0.00000000000000355271
10       3.72211277310178800803       -0.00000000000000355271
```

4 Summary

It is clearly shown that x converges to approximately 2.37068691766226180562
on the interval $[2, 3]$ and to approximately 3.72211277310178800803 on $[3, 4]$.