

Assignment: Homework Seven Name: Cody Strange

Disclaimer: This is my work, not that of others

Total Score: 50 (in points, not percentage)

Problem 1 score: 10

Problem 2 score: 10

Problem 3 score: 10

Problem 4 score: 20

1. A.

$$f'(x) = -2x + 8$$

$$\begin{array}{r} -2x + 8 = 0 \\ -8 \quad -8 \end{array}$$

$$-2x = -8$$

$$\begin{array}{r} \hline -2 \quad -2 \end{array}$$

$$x = 4$$

175%

4

B.

$$x_0 = 0$$

$$x_1 = 2$$

$$D = (1-0)(3-0)$$

$$= (1-0.666)(3)$$

$$= 0.76344$$

$$x_1 = 0 + 0.76344$$

$$= 0.76344$$

$$x_2 = 2 - 0.66644$$

$$= 1.23356$$

$$f(x_1) = -1.5(0.76344)^6 - 2(0.76344)^4 + 12(0.76344)$$

$$= 8.197937225$$

$$f(x_2) = -1.5(1.23356)^6 - 2(1.23356)^4 + 12(1.23356)$$

$$= 4.919396851$$

$$f(x_1) < f(x_2)$$

$$x_1 = 0$$

$$x_2 = 1.23606$$

$$D = (1-0)(1.23606)$$

$$= 0.4721378382$$

$$x_1 = 0 + 0.4721378382$$

$$x_2 = 1.23606 - 0.4721378382$$

$$f(x_1) = -1.5(0.4721378382)^6 - 2(0.4721378382)^4 + 12(0.4721378382)$$

$$= 5.54965748811$$

$$f(x_2) = -1.5(0.763922618)^6 - 2(0.763922618)^4 + 12(0.763922618)$$

$$= 8.1878251178$$

$$-f(x_2) = -8.1878251178$$

$$+ 9$$

$$x = 0.763922618$$

2.

-8.1878231178 at x = 0.7639221618

$$- f(x_3) = 1.5(2)^6 + 2(2)^4 - 12(2) \\ = 104$$

$$- f(x_2) = 1.5(1)^6 + 2(1)^4 - 12(1) \\ = 1.5 + 2 - 12 \\ = -8.5$$

$$- f(x_1) = 1.5(0)^6 + 2(0)^4 - 12(0) \\ = 0$$

$$x_1 = 0 \\ x_2 = 1 \\ x_3 = 2$$

$$f(x) = 1.5x^6 - 2x^4 + 12x$$

$$x_4 = 1 - \frac{\frac{(1-0)^2[f(x_3) - f(x_1)] - (1-2)^2[f(x_2) - f(x_1)]}{(1-0)[f(x_3) - f(x_1)] - (1-2)[f(x_2) - f(x_1)]}}{2} \\ = 1 - \frac{1}{2} \frac{2.5 - 104}{-8.5 - 104} = 1 - \frac{1}{2} \left(\frac{102}{-112.5} \right) \\ = 1 - \frac{1}{2} \left(\frac{102}{-112.5} \right) = 1 - \frac{1}{2} (-0.9057777777777778) \\ = 1 + 0.4528888888888889 \\ = 1.4528888888888889$$

$$x_4 = 0.57024$$

$$- f(x_4) = 1.5(0.57024)^6 + 2(0.57024)^4 - 12(0.57024) \\ = -6.57019$$

$$f(x_2) < f(x_4) < f(x_1)$$

$$x_1 = x_4$$

$$x_4 = 1 - \frac{\frac{(1-0.57024)^2[f(x_3) - f(x_1)] - (1-2)^2[f(x_2) - f(x_1)]}{(1-0.57024)[f(x_3) - f(x_1)] - (1-2)[f(x_2) - f(x_1)]}}{2} \\ = 1 - \frac{1}{2} \frac{0.1846934[f(x_3) - f(x_1)] - (-8.5 - 104)}{0.42976[f(x_3) - f(x_1)] - (-112.5 - 6.57019)} \\ = 1 - \frac{1}{2} \frac{0.1846934 \cdot 102 - (-112.5 - 6.57019)}{0.42976 \cdot 102 - (-112.5 - 6.57019)} \\ = 0.81243$$

$$- f(x_4) = -8.94652$$

-8.44652 at x = 0.81243

```
1  from math import sin, sqrt
2  import sys
3  eps = sys.float_info.epsilon
4
5  def func(x):
6      return (x**2/10) - (2*sin(x))
7
8  def golden(func, left, right, tol):
9      num = (sqrt(5)-1)/2
10     x1 = left
11     xu = right
12     d = num*(xu-x1)
13     x1 = x1 + d ; f1 = func(x1)
14     x2 = xu - d ; f2 = func(x2)
15     i = 0
16
17     while True:
18         i += 1
19         if f1 < f2:
20             xopt = x1
21             x1 = x2
22             x2 = x1
23             f2 = f1
24             x1 = x1 + (xu - x2)
25             f1 = func(x1)
26         elif f1 > f2:
27             xopt = x2
28             xu = x1
29             x1 = x2
30             f1 = f2
31             x2 = xu - (x1-x1)
32             f2 = func(x2)
33         if xopt != 0:
34             if (1-num)*(xu-x1)/abs(xopt)<=tol:
35                 break
36     return (xopt, func(xopt), i+1)
37
38 print(golden(func, 0, 4, eps))
39
```

4.

**The minimum is -1.77572565314715 at $x = 1.427551768051373$
It took 41 iterations**