**Numerical Method hw1**

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1. Find five iterative functions.
2. Compute the table.

The table below is obtained through Matlab.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | g1(x) | g2(x) | g3(x) | g4(x) | g5(x) |
| 0.99 | -Inf | 2.72571 | 1 | 1.949102 | 1 |
| 1.01 | 2 | Inf | 1 | 1.939217 | 1 |
| 1.99 | 2 | Inf | 1.000005 | 1.999443 | 2 |
| 2.01 | 2 | 2.72571 | 2.978898 | 2.000568 | 2 |
| 2.99 | 2 | 2.72571 | 2.999997 | 2.93418 | 3 |
| 3.01 | 2 | 3.20722 | 3.000003 | 3.067043 | 3 |
| 3.99 | -Inf | 3.20722 | 3.000824 | 3.999866 | 4 |
| 4.01 | -Inf | Inf | NaN | 4.000129 | 4 |
| 0.5 | -Inf | Inf | 1 | 1.970074 | 1 |
| 1.5 | 2 | Inf | 1 | 1.979689 | 1 |
| 2.5 | 2 | 2.72571 | 2.999769 | 2.058289 | NaN |
| 3.5 | 2 | 3.20722 | 3.000129 | 3.978951 | 4 |

1. Discuss whether x\* =1, 2, 3, 4 are points of attraction.

The plots of are as follows.

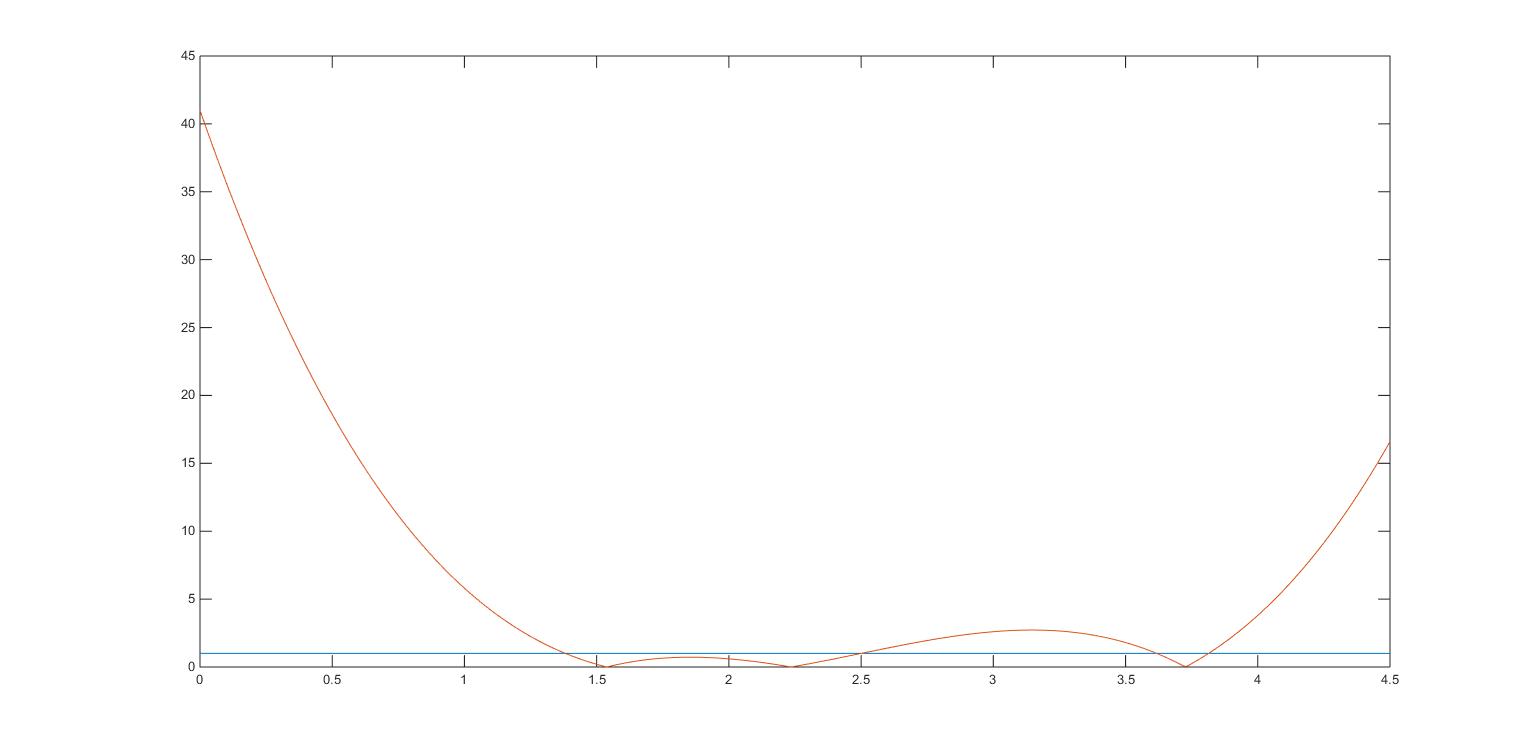


Fig1.

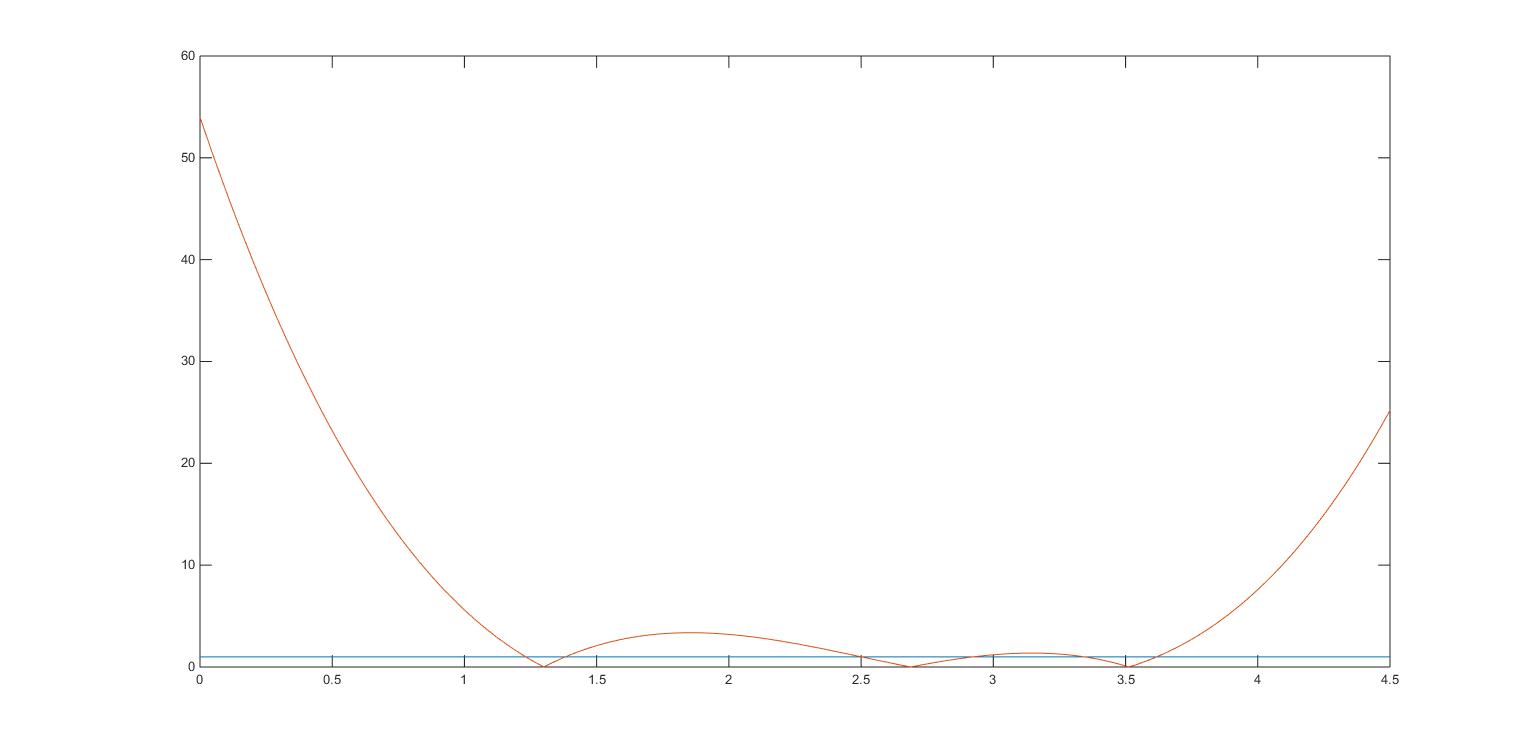


Fig2.

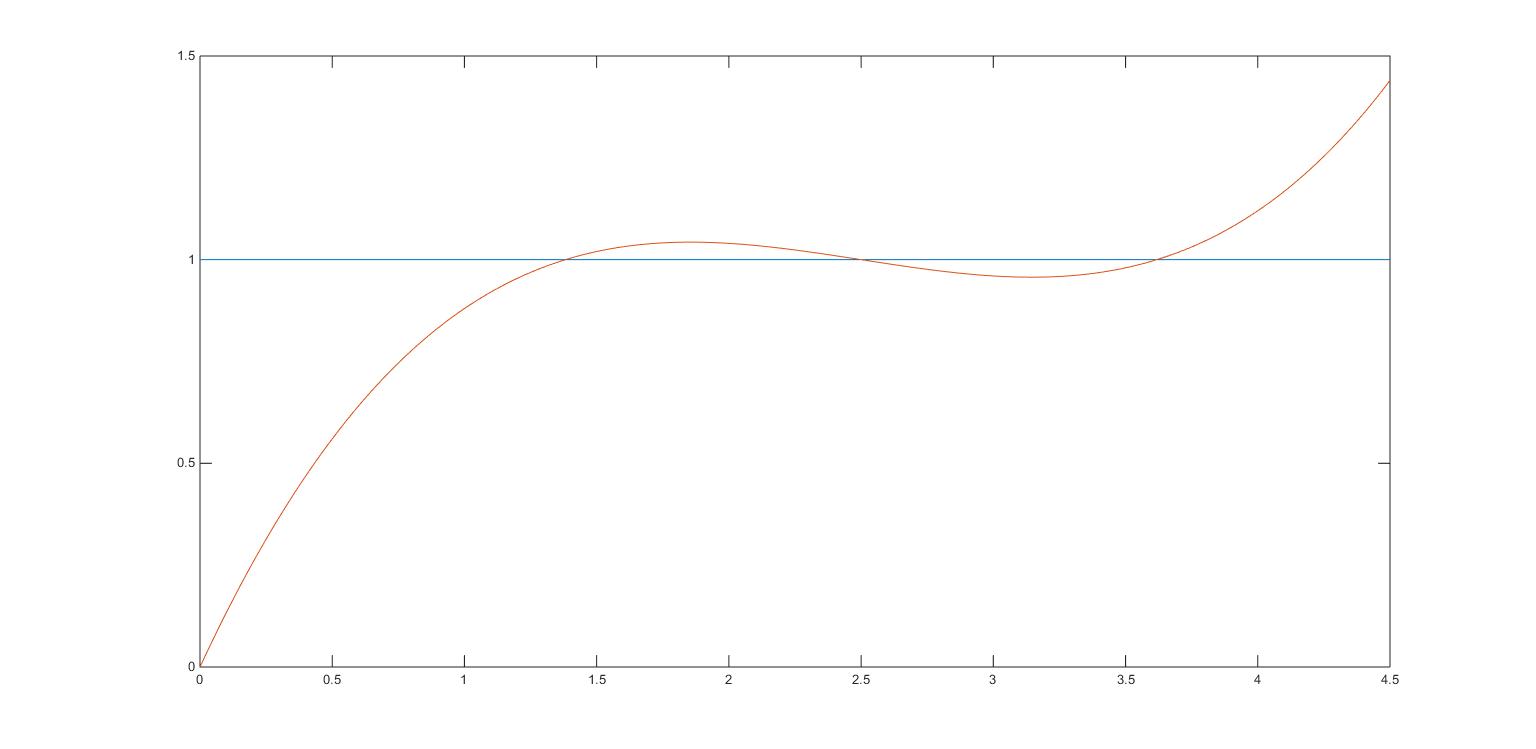


Fig3.

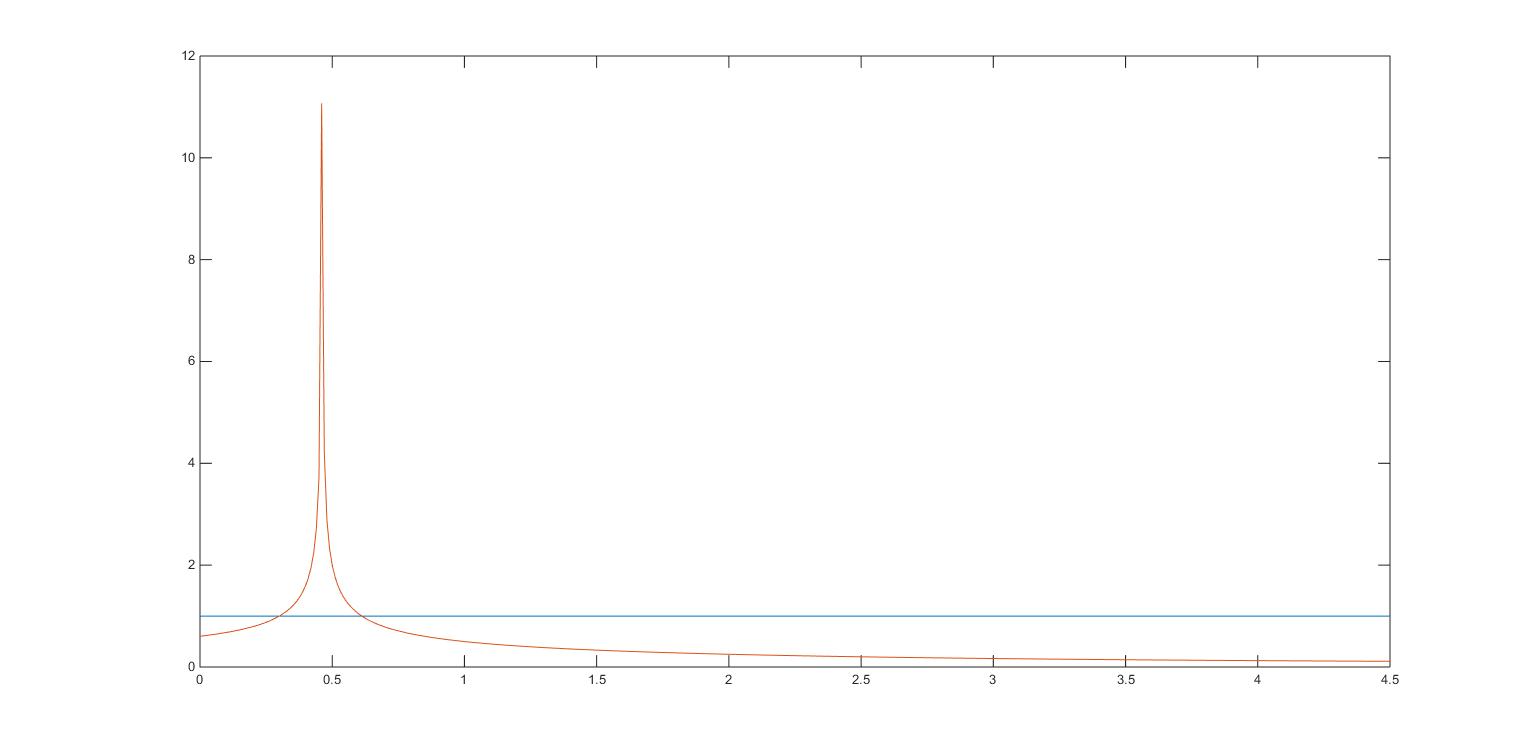


Fig4.

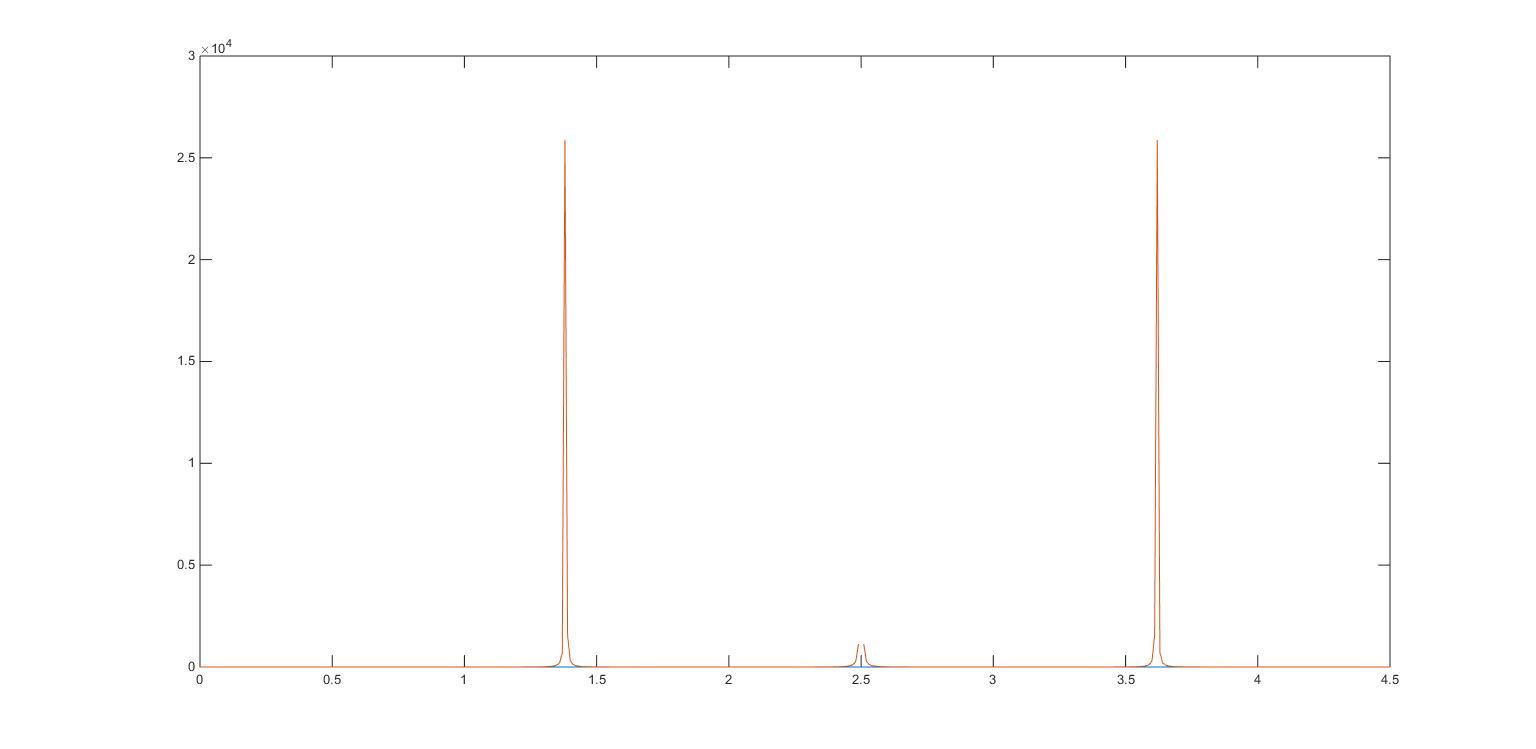


Fig5.

According to the condition for x to be a point of attraction:

1) For g1(x), x = 2 is the only point of attraction.

2) For g2(x), there is no point of attraction.

3) For g3(x), x = 1 and x = 3 are points of attraction.

4) For g4(x), x = 1, x = 2, x = 3 and x = 4 are all points of attraction.

5) For g5(x), x = 1, x = 2, x = 3 and x = 4 are all points of attraction.

**Appendix: Matlab code**

**Iterative Solver:**

*x = [0.99; 1.01; 1.99; 2.01; 2.99; 3.01; 3.99; 4.01; 0.5; 1.5; 2.5; 3.5];*

*gx = [x,x,x,x,x];*

*for i = 1:200*

*fx = (gx - 1) .\* (gx - 2) .\* (gx - 3) .\* (gx - 4);*

*g1\_n = gx(:, 1) - 0.8 \* fx(:, 1);*

*g2\_n = gx(:, 2) + 1.1 \* fx(:, 2);*

*g3\_n = (gx(:, 3).^4 - 10\*gx(:, 3).^3 + 35\*gx(:, 3).^2 + 24) ./ 50;*

*g4\_n = ((-gx(:, 4).^4 + 10\*gx(:, 4).^3 + 50\*gx(:, 4) - 24) ./ 35).^0.5;*

*fp\_n = 4\*gx(:, 5).^3 - 30\*gx(:, 5).^2 + 70\*gx(:, 5) - 50;*

*g5\_n = gx(:, 5) - fx(:, 5) ./ fp\_n;*

*gx = [g1\_n, g2\_n, g3\_n, g4\_n, g5\_n];*

*end;*

*gx*

**Point of Attraction:**

*x = 0:0.01:4.5;*

*% y0 = 1*

*y0 = x.^0;*

*fx = (x - 1) .\* (x - 2) .\* (x - 3) .\* (x - 4);*

*fpx = 4\*x.^3 - 30\*x.^2 + 70\*x - 50;*

*fp2x = 12\*x.^2 - 60\*x + 70;*

*% yn = gn'*

*y1 = abs(1 - 0.8 \* fpx);*

*y2 = abs(1 + 1.1 \* fpx);*

*y3 = abs((4\*x.^3 - 30\*x.^2 + 70\*x)/50);*

*y4 = abs(0.5 \* ((-x.^4 + 10\*x.^3 + 50\*x - 24) ./ 35).^(-0.5));*

*y5 = abs(1 - (fpx.^2 - fx .\* fp2x) ./ fpx.^2);*

*% plot*

*plot(x, y0);*

*hold on;*

*plot(x, y1);*

*figure;*

*plot(x, y0);*

*hold on;*

*plot(x, y2);*

*figure;*

*plot(x, y0);*

*hold on;*

*plot(x, y3);*

*figure;*

*plot(x, y0);*

*hold on;*

*plot(x, y4);*

*figure;*

*plot(x, y0);*

*hold on;*

*plot(x, y5);*