Assignment 1

4 March 2020

MAM2046W 2NA

KDSMIL001

1. Newton-Raphson root-finding

   (a) a

   (b) b

2. Fixed Point Iteration

   (a) Given the equation of the form $f(x) = x^2 - x - 2 = 0$, it doesn't take much manipulation to reduce it to the first two solutions:

$$g_1(x) = x^2 - 2$$

$$g_2(x) = \sqrt{x + 2}$$

   For the next two solutions, a little bit more manipulation is required:

$$\begin{aligned} & x^2 - x - 2 = 0 \\ \implies & x^2 - x = 2 \\ \implies & x(x - 1) = 2 \\ \implies & x = \frac{2}{x - 1} \\ \implies & g_3(x) = \frac{2}{x - 1} \end{aligned}$$

   and

$$\begin{aligned} & x^2 - x - 2 = 0 \\ \implies & x^2 - x = 2 \\ \implies & x(x - 1) = 2 \\ \implies & x - 1 = \frac{2}{x} \\ \implies & x = \frac{2}{x} + 1 \\ \implies & g_4(x) = \frac{2}{x} + 1 \end{aligned}$$

   (b) To plot these functions on the same axes, I used Python with the `matplotlib` module, below is the result [Figure 1].

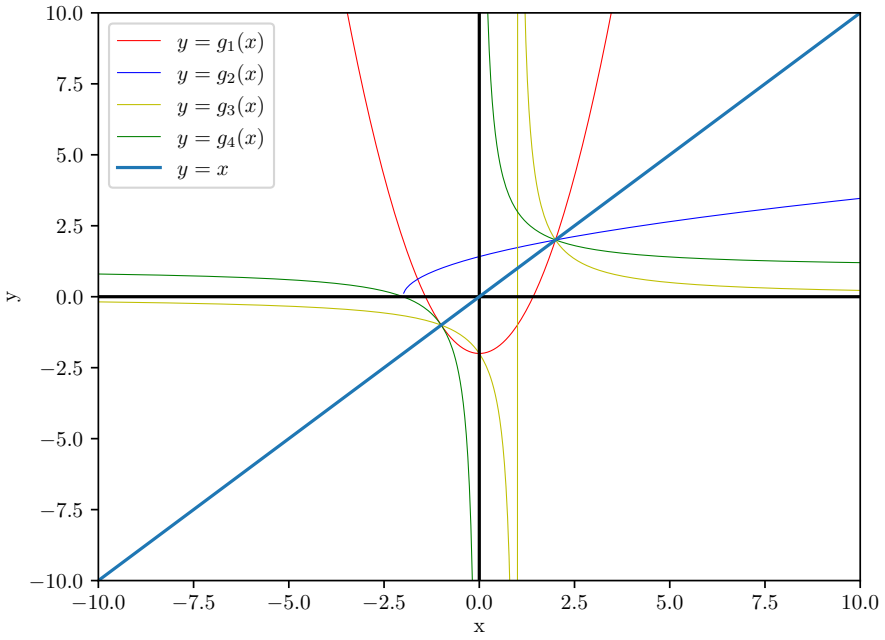

Figure 1: Plot of each $g_i(x)$

It's clear to see that all of the graphs intersect the $y = x$ line at two points with the exception of $g_2(x)$, which has no values < 0 as a function.

(c)

3. Halley's Method

   (a) Idk

```
initialGuess = 2
stringstyledef f(xn, xn2, count):
    count += 1
    xn2 = xn-(((xn**4)-(10*xn))/((2*xn**3)+(10)))
    stringstyleif (stringstyleabs(xn - xn2)) < 0.00001:
        stringstylereturn xn2, count
    stringstyleelse:
        stringstylereturn f(xn2, xn, count)

stringstyleprint(f(initialGuess, initialGuess, 0))
```

Q3.py