# Problem 1

(1) Ans: $\pi = 4\sum_{n=1}^{\infty}(-1)^{n-1}\frac{1}{2n-1}$

The possible errors are roundoff errors, subtractive errors

To minimize the erross

I write $\pi = \begin{cases} 8\sum_{n=1,3,5}^{N}\frac{1}{4n^2-1} & N \text{ is odd} \\ 8\sum_{n=1,3,5}^{N-1}\frac{1}{4n^2-1} + \frac{4}{2N-1} & N \text{ is even} \end{cases}$

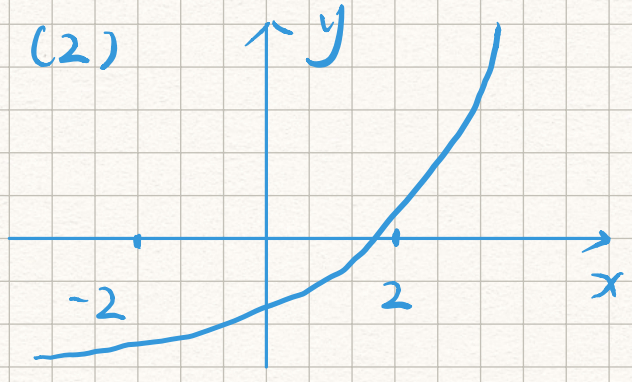
# Problem 2

Ans on ipynb.

# Problem 3.

Ans: (1) $x_{n+1} = g(x_n) = x_n - \frac{2f(x_n)f'(x_n)}{2(f'(x_n))^2 - f(x_n)f''(x_n)}$

(2)




(4) root = 1.7215 count = 18

(4) advantage: order of convergence is 3, it is count is smaller than them.

disadvantage: more complex than them we should know $f(x)$, $f'(x)$, $f''(x)$.

## Problem 4.

(1) $$\begin{pmatrix} 7 & -3 \\ -2 & 5 \\ 3 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 5 \\ -10 \\ 8 \end{pmatrix}$$

(2) and (3) numpy. qr method

$$Ax = b \qquad A = QR$$

$$QRx = b$$

$$Rx = Q^T b$$

$$x = R^{-1} Q^T b$$

code on ipynb

solution $x_1 = 0.58500436$

$x_2 = -1.37837838$

(4) Not satisfied.

## Problem 5

Ans: (1) (2) and (3) on ipynb

# Problem 6

Ans: (2)

$$J = \begin{pmatrix} \frac{\partial f_1}{\partial x_1} & \frac{\partial f_1}{\partial x_2} & \frac{\partial f_1}{\partial x_3} \\ \frac{\partial f_2}{\partial x_1} & \frac{\partial f_2}{\partial x_2} & \frac{\partial f_2}{\partial x_3} \\ \frac{\partial f_3}{\partial x_1} & \frac{\partial f_3}{\partial x_2} & \frac{\partial f_3}{\partial x_3} \end{pmatrix}$$