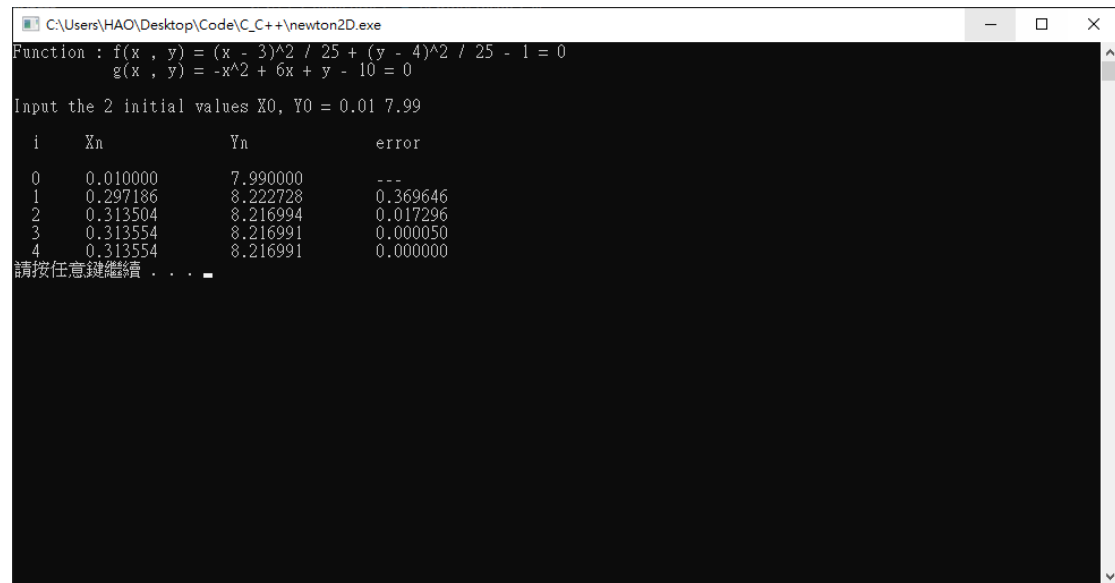


# 數值分析 Newton2D

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## 第一題

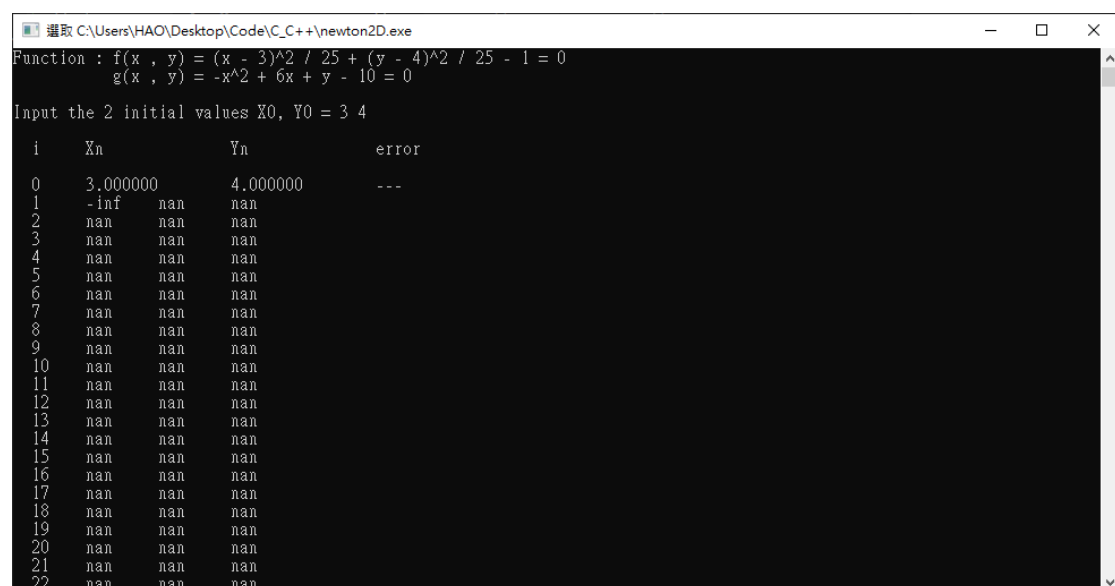
1.c Initial solution : (0.01 , 7.99) 結果 : 收斂到(0.313 , 8.216)



```
C:\Users\HAO\Desktop\Code\C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 0.01 7.99

  i   Xn           Yn           error
  ---
0    0.010000      7.990000      ---
1    0.297186      8.222728      0.369646
2    0.313504      8.216994      0.017296
3    0.313554      8.216991      0.000050
4    0.313554      8.216991      0.000000
請按任意鍵繼續 . . . .
```

1.d.1 Initial solution : (3 , 4) 結果 : 帶入圓點使  $f_x, f_y, dx$  的值為零，進而讓後面的  $\delta$  為零，造成除以零的錯誤，產生了 INF。



```
C:\Users\HAO\Desktop\Code\C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 3 4

  i   Xn           Yn           error
  ---
0    3.000000      4.000000      ---
1    -inf         nan          nan
2    nan          nan          nan
3    nan          nan          nan
4    nan          nan          nan
5    nan          nan          nan
6    nan          nan          nan
7    nan          nan          nan
8    nan          nan          nan
9    nan          nan          nan
10   nan          nan          nan
11   nan          nan          nan
12   nan          nan          nan
13   nan          nan          nan
14   nan          nan          nan
15   nan          nan          nan
16   nan          nan          nan
17   nan          nan          nan
18   nan          nan          nan
19   nan          nan          nan
20   nan          nan          nan
21   nan          nan          nan
22   nan          nan          nan
```

Initial solution : (2.999 3.999) 結果 : 將 X , Y 的值做了一點修改，各減去

0.001，最後在第十八次的迴圈收斂到(0.313 , 8.216)。

```

C:\Users\HAO\Desktop\Code\C_C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 2.999 3.999

i   Xn           Yn           error
0   2.999000     3.999000     ---
1   -12519.045089 26.044089    12522.063494
2   -6258.023114  15.265522    6261.031253
3   -3127.512302  10.328320    3130.514705
4   -1562.257356  8.543404     1565.255964
5   -779.630987   8.227553     782.626433
6   -388.320104   8.217002     391.310883
7   -192.669273   8.216991     195.650831
8   -94.853078    8.216991     97.816195
9   -45.963416    8.216991     48.889663
10  -21.555406     8.216991     24.408010
11  -9.424656      8.216991     12.130750
12  -3.502758      8.216991     5.921898
13  -0.806297      8.216991     2.696461
14  0.148819       8.216991     0.955115
15  0.308795       8.216991     0.159977
16  0.313550       8.216991     0.004755
17  0.313554       8.216991     0.000004
18  0.313554       8.216991     0.000000
請按任意鍵繼續 . . .

```

1.d.2 Initial solution : (0 , 8) 結果 : 收斂到(0.313 , 8.216)

```

C:\Users\HAO\Desktop\Code\C_C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 0 8

i   Xn           Yn           error
0   0.000000     8.000000     ---
1   0.296296     8.222222     0.370370
2   0.313499     8.216993     0.017979
3   0.313554     8.216991     0.000056
4   0.313554     8.216991     0.000000
請按任意鍵繼續 . . .

```

1.d.3 Initial solution : (6 , 0) 結果 : 發散 (解釋在第三題)

```

C:\Users\HAO\Desktop\Code\C_C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 6 0

i   Xn           Yn           error
0   6.000000     0.000000     ---
1   4.095238     -1.428571     2.380952
2   2.533441     -1.221532     1.575460
3   5.142620     -1.216993     2.609183
4   3.553955     -1.216991     1.588665
5   1.275921     -1.216991     2.278034
6   2.780910     -1.216991     1.504989
7   7.949987     -1.216991     5.169077
8   5.251054     -1.216991     2.698932
9   3.633093     -1.216991     1.617961
10  1.565628     -1.216991     2.067466
11  3.055622     -1.216991     1.489995
12  -16.901141   -1.216991     19.956763
13  -6.894870    -1.216991     10.006270
14  -1.835408    -1.216991     5.059462
15  0.811542     -1.216991     2.646949
16  2.412290     -1.216991     1.600748
17  4.592270     -1.216991     2.179980
18  3.099962     -1.216991     1.492308
19  -8.039227    -1.216991     11.139189
20  -2.419199    -1.216991     5.620028
21  0.494950     -1.216991     2.914149
22  2.189979     -1.216991     1.695029

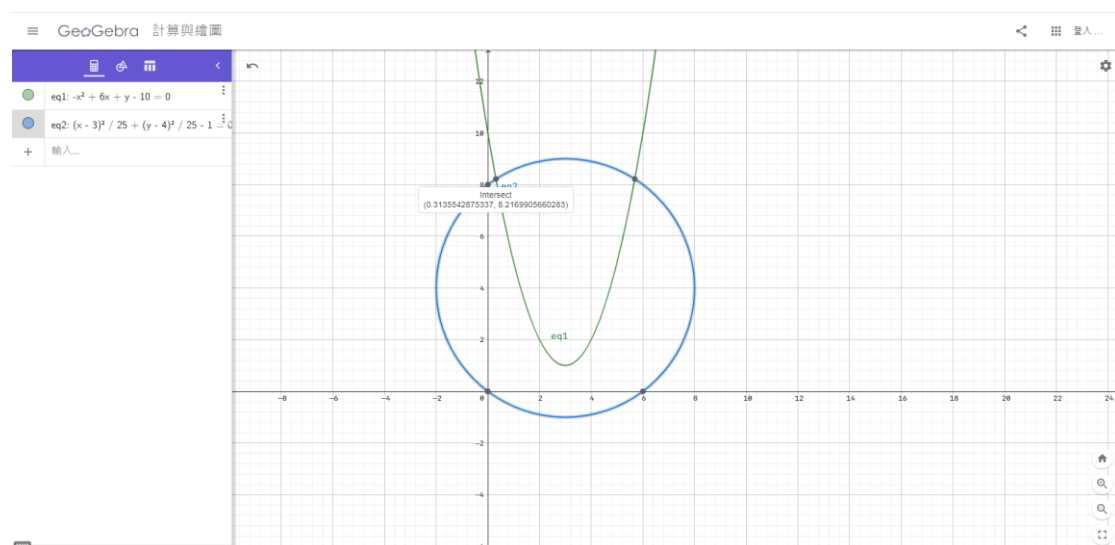
```

1.d.4 Initial solution : (6 , 8) 結果：收斂到(5.686 , 8.216)

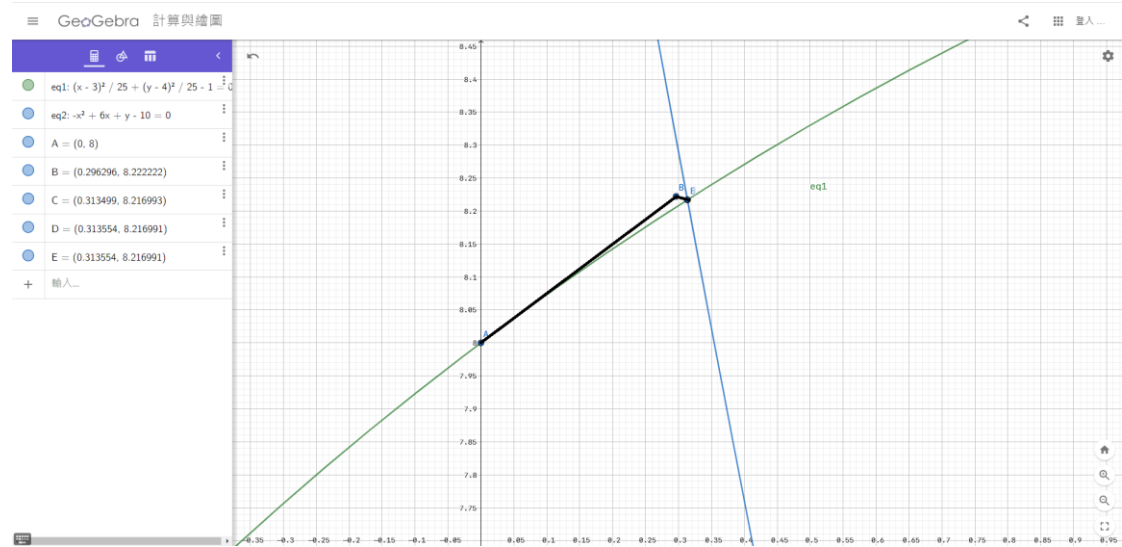
```
C:\Users\HAO\Desktop\Code\C_C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 6 8
i   Xn          Yn          error
0   6.000000    8.000000    ---
1   5.703704    8.222222    0.370370
2   5.686501    8.216993    0.017979
3   5.686446    8.216991    0.000056
4   5.686446    8.216991    0.000000
請按任意鍵繼續 . . .
```

第二題

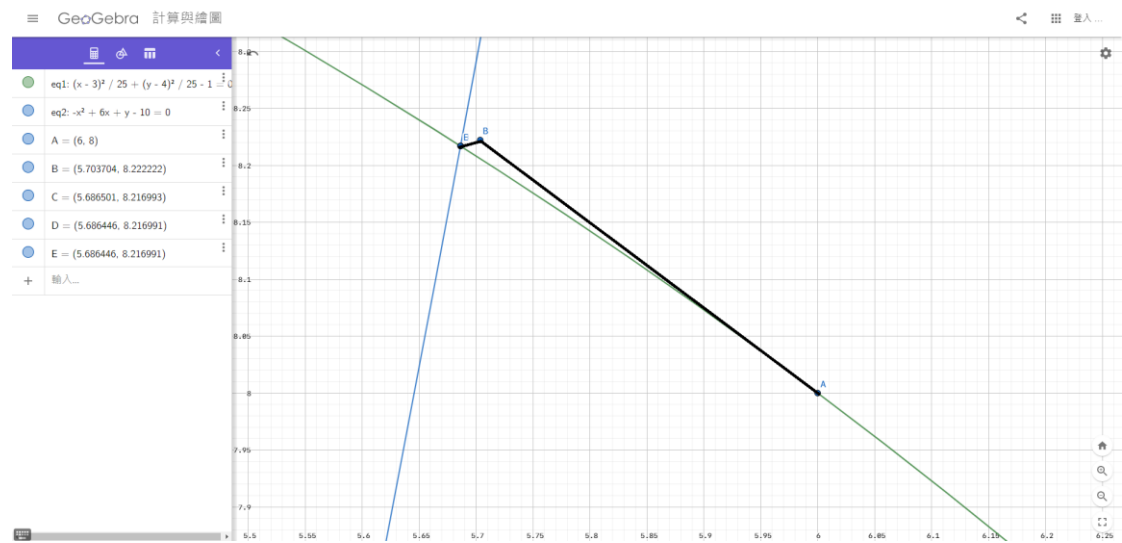
f(x) , g(x)方程式的圖



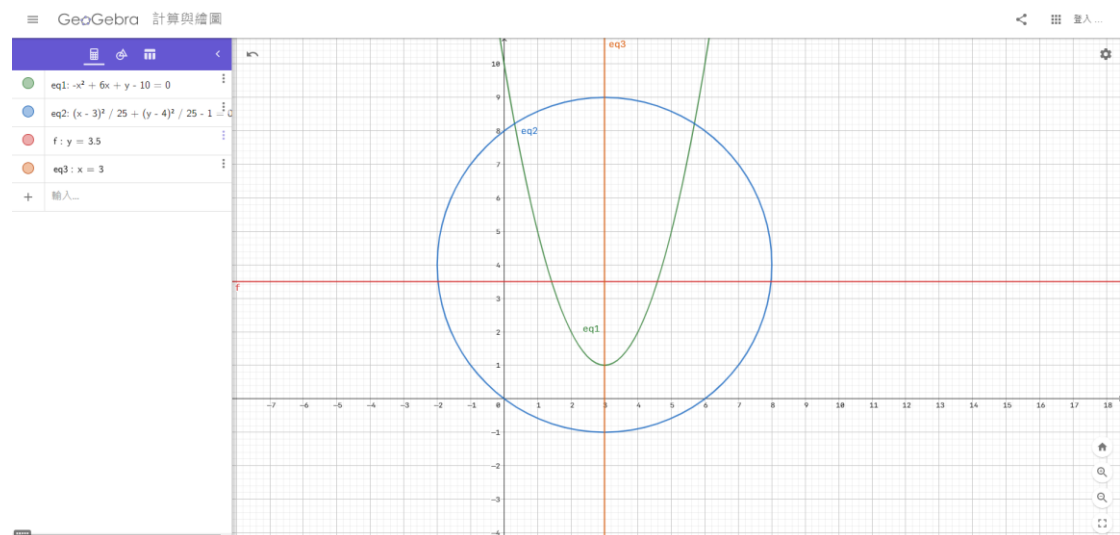
Initial solution : (0 , 8) 結果：收斂到(0.313 , 8.216)



Initial solution : (6 , 8) 結果：收斂到(5.686 , 8.216)



### 第三題 (電子檔的圖會沒有塗發散收斂的地方)



在  $x = 3$  這條線上的點，帶入  $f_x, g_x$  都會等於零，進而讓後面的  $\delta$  為零，

造成除以零的錯誤，產生了 INF。

ex: (3, 10000) (3, 0) (3, -10000)

```
選擇 C:\Users\HAO\Desktop\Code\C_C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 3 10000
i   Xn          Yn          error
0   3.000000    10000.000000  ---
1   -inf       nan         nan
2   nan        nan         nan
3   nan        nan         nan
```

```
選擇 C:\Users\HAO\Desktop\Code\C_C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 3 0
i   Xn          Yn          error
0   3.000000    0.000000    ---
1   inf         nan         nan
2   nan        nan         nan
3   nan        nan         nan
```

```
選擇 C:\Users\HAO\Desktop\Code\C_C++\newton2D.exe
Function : f(x , y) = (x - 3)^2 / 25 + (y - 4)^2 / 25 - 1 = 0
          g(x , y) = -x^2 + 6x + y - 10 = 0
Input the 2 initial values X0, Y0 = 3 -10000
i   Xn          Yn          error
0   3.000000    -10000.000000  ---
1   inf         nan         nan
2   nan        nan         nan
3   nan        nan         nan
```

經過我以  $\{x: -2 \sim 8, y: -1 \sim 9\}$  的範圍，每 0.25 為間格跑雙層 for 迴圈，一個一

個測試的結果， $y = 3.5$  這條線是收斂和發散的分水嶺， $y$  值小於 3.5 都會發

散，相反則都收斂，除了  $x=3$  之外。所以 1.d.3 Initial solution :  $(6, 0)$  發散的

原因也可以得到解釋。

