1.

```python
import random
numNeedles=10**6
piGuess=0.0

def throwNeedles(numNeedles):
    inCircle=0
    for i in range(1, numNeedles+1):
        x=random.uniform(0,1)
        y=random.uniform(0,1)
        if y <= x*x:    # y <= x^2 means point y is under the graph x^2
            inCircle+=1
    return 1*(inCircle/numNeedles)  # area(under the graph) / area(square) = # in circle / # of all

piGuess=throwNeedles(numNeedles)
print('Est =',piGuess)
```

```
PS D:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1> python -u "d:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1\1.py"
Est = 0.333321
PS D:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1>
```

2.

```python
import random
numNeedles=10**6
piGuess=0.0

def throwNeedles(numNeedles):
    inBall=0
    for i in range(1, numNeedles+1):
        x=random.uniform(0,1)
        y=random.uniform(0,1)
        z=random.uniform(0,1)
        if x*x + y*y + z*z < 1:    # inside the ball
            inBall+=1
    return 1*(inBall/numNeedles)    # volume of 1/8 ball / volume of cube = # in ball / # of needle

piGuess=throwNeedles(numNeedles)
print('Est =',piGuess)
```

```
PS D:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1> python -u "d:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1\2.py"
Est = 0.523562
PS D:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1>
```

3.

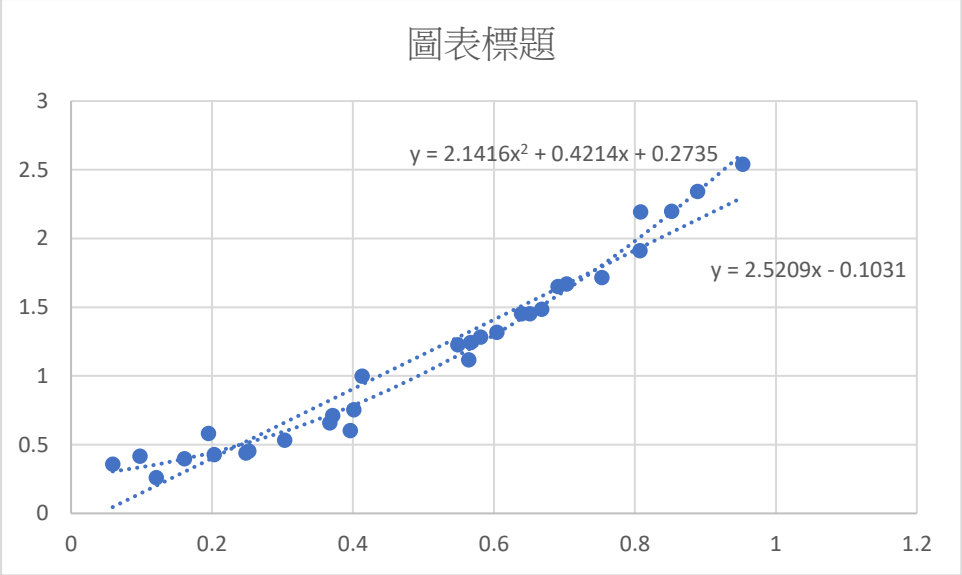
將 output 寫到一個 csv 檔裡比較方便將資料匯入 excel

3.py

```python
import random
w2=2.0
w1=0.5
w0=0.3
num_sample=30

with open('random points.csv','w') as fh:
    fh.write("x,r\n")
    for i in range(0,num_sample):
        x=random.uniform(0,1)
        r=w2*x**2 + w1*x + w0 + random.gauss(0,0.1)
        print('x =', round(x,3), ', r =', round(r,3))
        fh.write(f"{round(x,3)},{round(r,3)}\n")
```

```
PS D:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1> python -u "d:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1\3.py"
x = 0.852 , r = 2.197
x = 0.098 , r = 0.417
x = 0.367 , r = 0.658
x = 0.668 , r = 1.485
x = 0.203 , r = 0.427
x = 0.889 , r = 2.341
x = 0.413 , r = 0.998
x = 0.303 , r = 0.532
x = 0.808 , r = 2.194
x = 0.753 , r = 1.716
x = 0.195 , r = 0.581
x = 0.396 , r = 0.603
x = 0.581 , r = 1.282
x = 0.651 , r = 1.453
x = 0.371 , r = 0.713
x = 0.252 , r = 0.454
x = 0.953 , r = 2.54
x = 0.161 , r = 0.397
x = 0.807 , r = 1.911
x = 0.059 , r = 0.359
x = 0.567 , r = 1.244
x = 0.703 , r = 1.668
x = 0.401 , r = 0.753
x = 0.691 , r = 1.651
x = 0.549 , r = 1.226
x = 0.564 , r = 1.116
x = 0.639 , r = 1.452
x = 0.248 , r = 0.439
x = 0.604 , r = 1.318
x = 0.121 , r = 0.26
PS D:\Profile\Daniel\OneDrive\桌面\大三下\機器學習導論\HW1>
```


圖表標題
y = 2.1416x² + 0.4214x + 0.2735
y = 2.5209x - 0.1031
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2