1.

```python
import random
import numpy as np
experiments=10
numNeedles=10**6
piGuess=0.0
tmp=[]

def throwNeedles(numNeedles):
    inCircle=0
    for i in range(1, numNeedles+1):
        l=[random.uniform(-1,1) for i in range(5)]   # [x1, x2, ..., x5]
        x=np.array(l)

        x_square_sum=np.sum(np.square(x))   # x1^2 + ... + x5^2

        if x_square_sum<=1:
            inCircle+=1
    return 32*(inCircle/numNeedles)

for i in range(experiments):
    piGuess=throwNeedles(numNeedles)
    tmp.append(piGuess)

ans=np.array(tmp)
print('Mean =',np.mean(ans))
print('Standard deviation =',np.std(ans))
```

```
Mean = 5.2558816
Standard deviation = 0.00709091479570865
```

3.

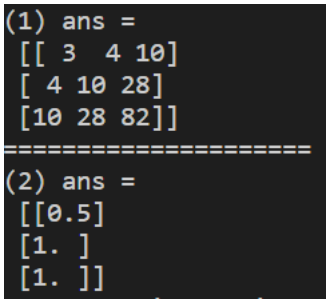
```python
import numpy as np

x1, y1 = 0, 0.5
x2, y2 = 1, 2.5
x3, y3 = 3, 12.5

X = np.array([[1, x1, x1**2], [1, x2, x2**2], [1, x3, x3**2]])
#print('X shape =',X.shape)
#print('X.T =',X.T,'\nX =',X)

y = np.array([[y1, y2, y3]]).T
#print('y shape =',y.shape)
#print('y =',y)

print('(1) ans =\n',X.T @ X)
print('====================')
print('(2) ans =\n',np.linalg.inv(X.T @ X) @ X.T @ y)
```



2.