excercise7

November 18, 2023

[1]:
```
import numpy as np
from itertools import product
import matplotlib.pyplot as plt
```

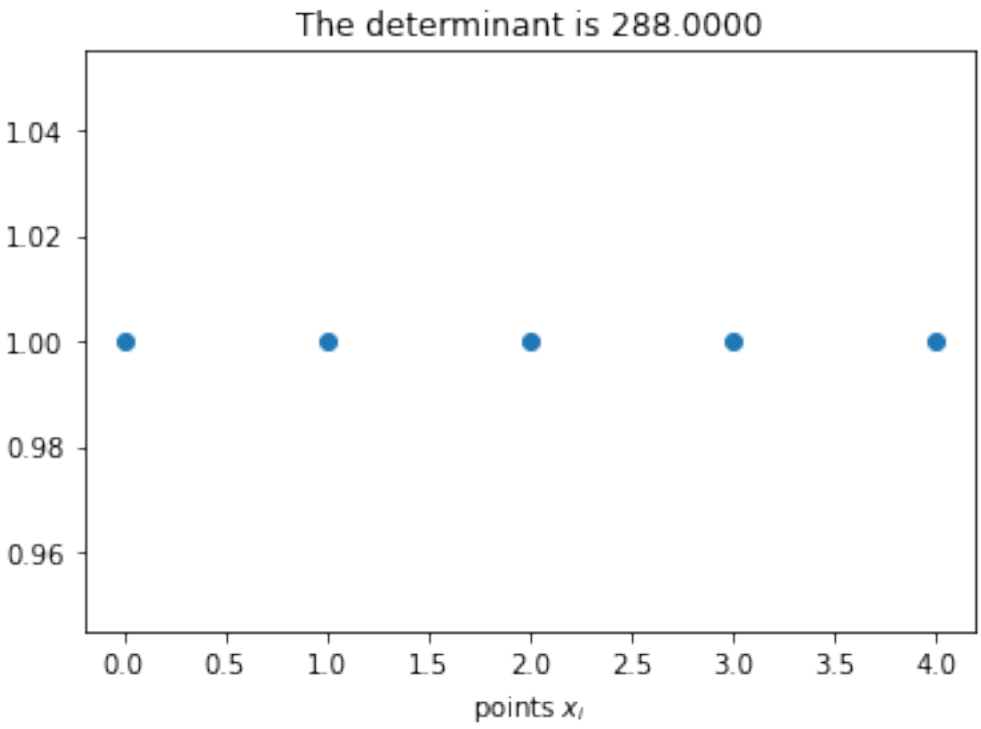
[2]:
```
def determinant_Vandermonde(points):
    """Computes the determinant of a vandermonde matrix given the pair of␣
 ↪points"""
    all_pairs = [tuple({a,b}) for a in points for b in points if a!=b]
    all_unique_pairs = set(all_pairs)
    pairs = [a-b for a,b in all_unique_pairs]
    det = np.product(pairs)

    return det
```

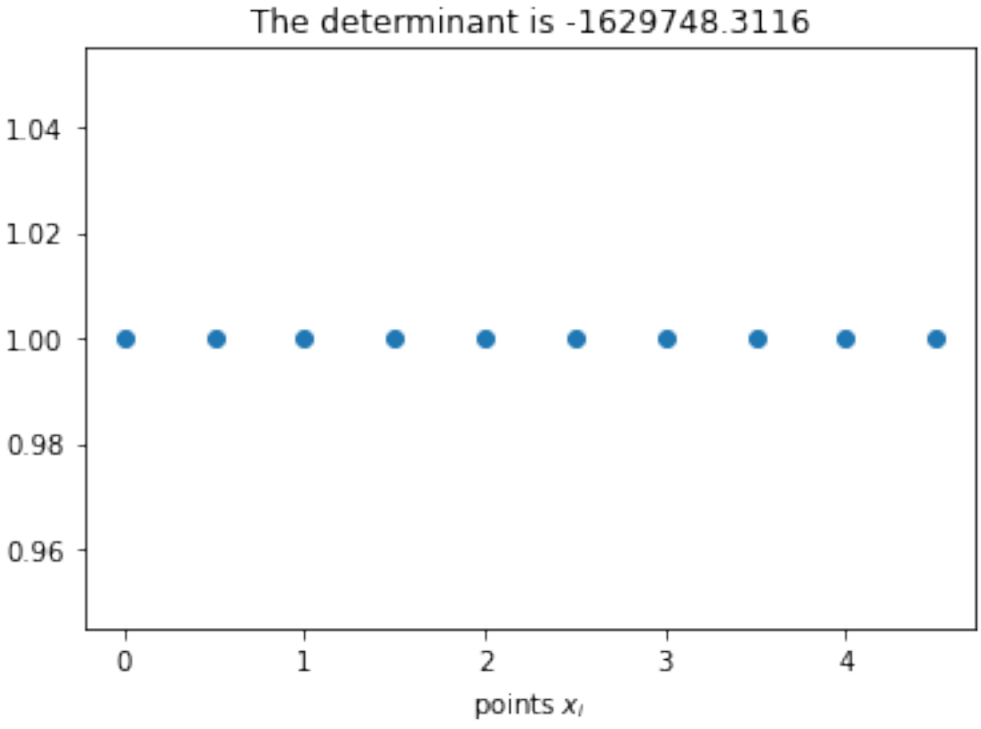
0.1 Determinant of the Vandermonde Matrix V for differently spaced values of x_i. s.t. $0 \leq x_i \leq 5$.

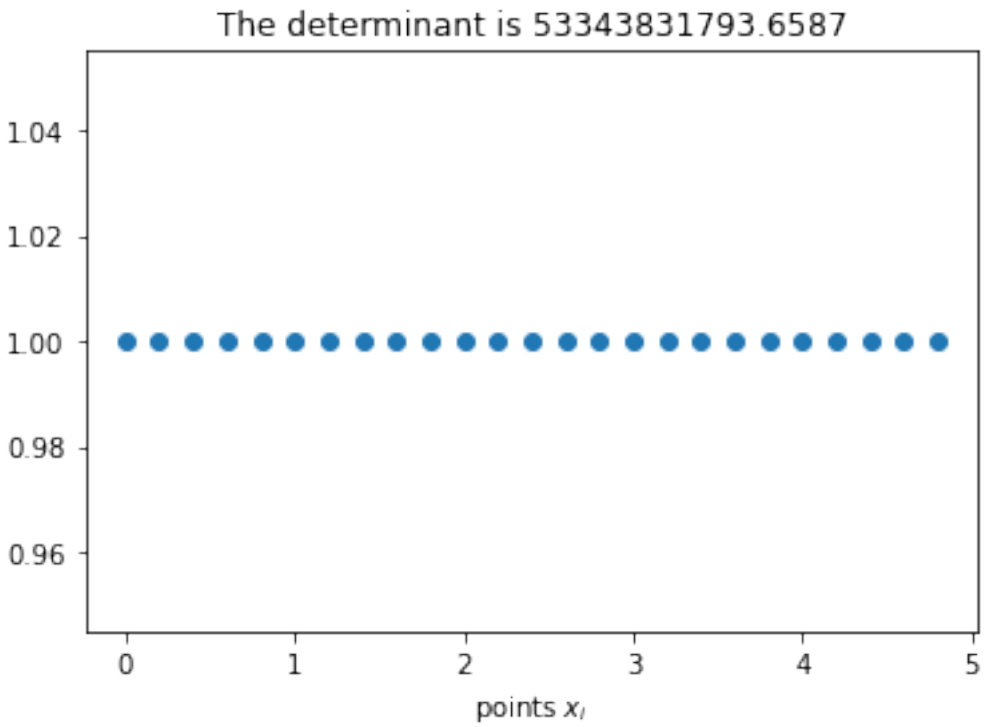
Recall that

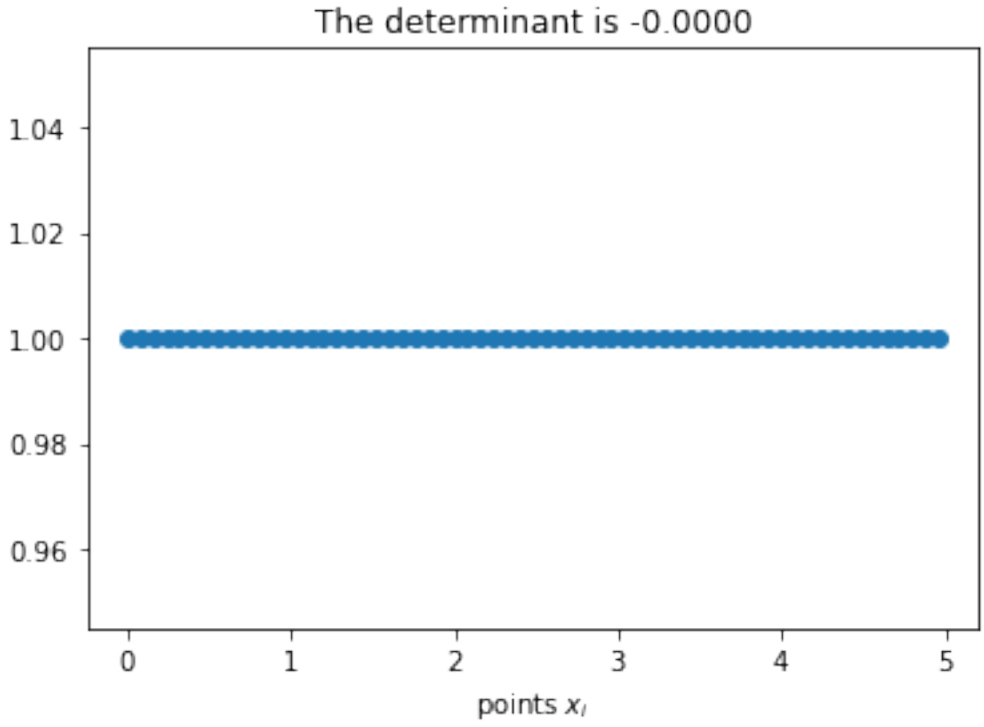
$$\det(V) = \prod_{0 \leq i,j \leq n} (x_j - x_i) \tag{1}$$

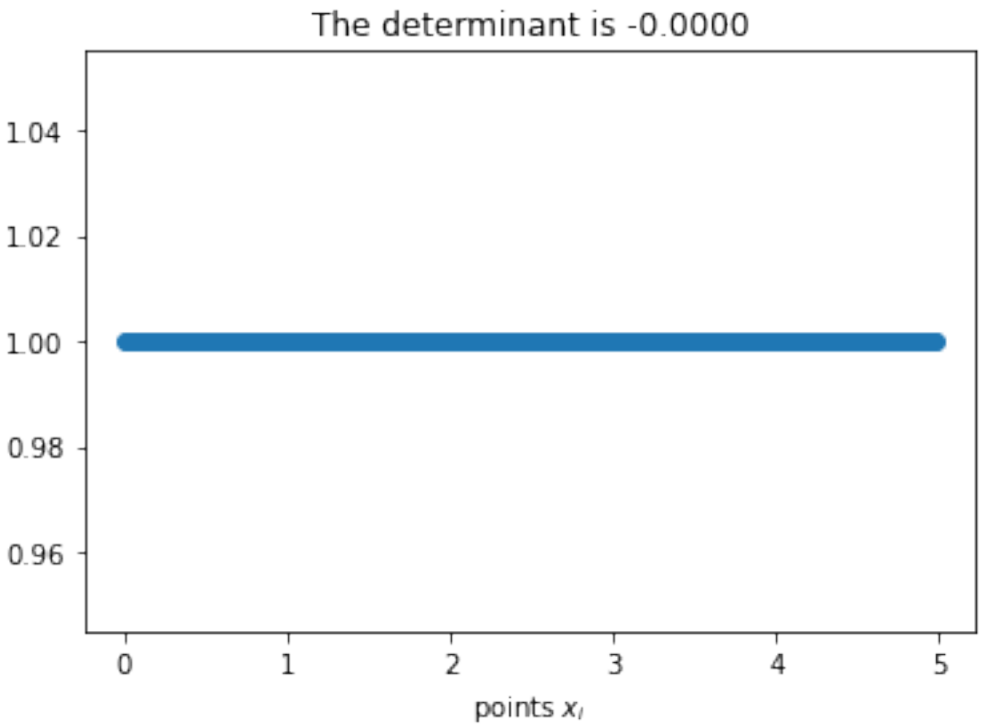
[3]:
```
# See the closeness of points
spacing_list = [1, 0.5, 0.2, 0.08, 0.02]

for space in spacing_list:
    points = np.arange(0, 5, space)
    determinant = determinant_Vandermonde(points)
    plt.scatter(points,[1]*len(points))
    plt.xlabel(r"points $x_i$")
    plt.title(f"The determinant is {determinant:.4f}")
    plt.show()
```


The determinant is 288.0000
1.04
1.02
1.00
0.98
0.96
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
points x_i


The determinant is -1629748.3116
1.04
1.02
1.00
0.98
0.96
0
1
2
3
4
points x_i


The determinant is 53343831793.6587
1.04
1.02
1.00
0.98
0.96
0
1
2
3
4
5
points x_i


The determinant is -0.0000
1.04
1.02
1.00
0.98
0.96
0
1
2
3
4
5
points x_i


The determinant is -0.0000
1.04
1.02
1.00
0.98
0.96
0
1
2
3
4
5
points x_i

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