Compte-rendu TP sur l'intégration numérique

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1 : Exercice 1 : Résolution de systèmes d'équations linéaires

```python
import numpy as np
```

```python
A = np.matrix([
  [ 0, 2, 0, 1],
  [ 2, 2, 3, 2],
  [ 4,-3, 0, 1],
  [ 6, 1,-6,-5]
])

B = np.matrix([
  [ 0],
  [-2],
  [-7],
  [ 6],
])

print(np.linalg.inv(A).dot(B))
```

```
[[-0.5       ]
 [ 1.        ]
 [ 0.33333333]
 [-2.        ]]
```

2 : Exercice 2

```python
A = np.matrix([
  [ 5, 6 ],
  [ 6, 7 ],
  [ 1, 1 ]
])

B = np.matrix([
  [ 3],
  [ 1],
  [-5],
])

# print(np.linalg.inv(A).dot(B))
# il n'y a pas de solutions

def f(A,B,x,y):
  ax = np.matrix([[x],[y]])
  return np.linalg.norm( A.dot(ax) - B )
```

```
f(A,B,-28,24)
```

```
1.7320508075688772
```

2.1 : Moore-Penrose pseudo-inverse

```
import time

def solveMoore(A,B):
  A_plus = np.linalg.inv(A.T.dot(A)).dot(A.T)
  return A_plus.dot(B)

t = time.time()

res = solveMoore(A,B)

print("temps" , time.time()-t)
print(res)
```

```
temps 0.0
[[-28.]
 [ 24.]]
```

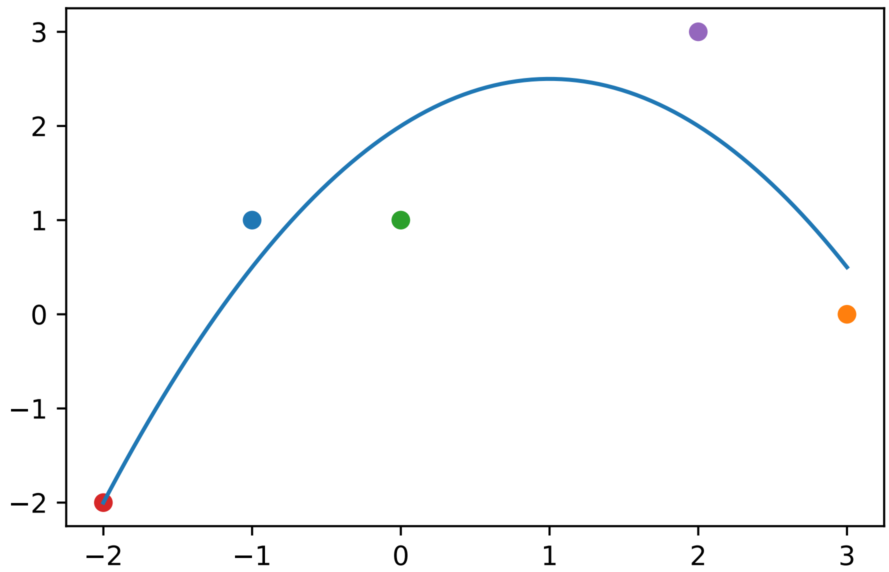
2.2 : passage à l'échelle

```
import numpy.random as rd

def surdeter(row,col):
  A = np.random.randint(1024, size=(row, col)) - 512
  B = np.random.randint(1024, size=(row, 1)) - 512
  return A,B

A,B = surdeter(3,2)

# res = solveMoore(A,B)

# print(A)
# print(B)
# print(res)
# print(f(A,B,res[0,0],res[1,0]))
```

2.3 : Regression polynomiale

```
import matplotlib.pyplot as plt
```

```python
pts = [(-1,1),(3,0),(0,1),(-2,-2),(2,3)]

for x,y in pts:
  plt.scatter(x, y)


# def Lagrange(pts):
#   x = np.poly1d([1,0])
#   P=0

#   for i in range(len(pts)):
#     Li = 1
#     xi = pts[i][0]
#     for j in range(len(pts)):
#       if i!=j:
#         xj = pts[j][0]
#         Li *= (x-xj)/(xi-xj)
#     P += Li * pts[i][1]

#   return P

xs = np.linspace(-2,3,100)

A = np.matrix([[pt[0]**i for i in range(3)] for pt in pts])
B = np.matrix([[pt[1]] for pt in pts])

res = solveMoore(A,B)

res = [r[0,0] for r in res]
res.reverse()


plt.plot( xs,np.polyval(np.poly1d(res),xs) )

plt.show()
```


3
2
1
0
−1
−2
−2
−1
0
1
2
3