MATRICES

Problem 1: Python doesn't have a built-in type for matrices. However, we can treat a list of a list as a matrix. For example:

```
import numpy
x = numpy.array([[1, 2, 3], [4, 5, 6],[7, 8, 9]])
y = numpy.array([[7, 8], [9, 10]])
print(x)
print(y)
```

Problem 2: Matrix manipulations in Python.

```
import numpy
x = numpy.array([[1, 2], [4, 5]])
y = numpy.array([[7, 8], [9, 10]])
#  add()is used to add matrices
print ("Addition of two matrices: ")
print (numpy.add(x,y))
# subtract()is used to subtract matrices
print ("Subtraction of two matrices : ")
print (numpy.subtract(x,y))
#multiplication a number and a matrix
print(2*x)
print ("The product of two matrices : ")
print (numpy.dot(x,y))
print ("square root is : ")
print (numpy.sqrt(x))
print ("The summation of elements : ")
print (numpy.sum(y))
print ("The column wise summation  : ")
print (numpy.sum(y,axis=0))
print ("The row wise summation: ")
print (numpy.sum(y,axis=1))
# using "T" to transpose the matrix
print ("Matrix transposition : ")
print (x.T)
#Determinant
print(numpy.linalg.det(x))
```

Problem 3: How to calculate power and inverse of a matrix?

```
import numpy
y = numpy.array([[7, 8], [9, 10]])
print(numpy.linalg.matrix_power(y, 2))
print(numpy.linalg.inv(y))
```

Exercises

1. Let $A=\begin{pmatrix}3 & 1\\ 2 & 3\end{pmatrix}, B=\begin{pmatrix}1 & 2 & 3\\ 4 & 2 & 1\\ 2 & 4 & 4\end{pmatrix}$. Print following:

   a. The 2nd row of A.

   b. The 3rd row of B.

   c. The first element of the 2nd row of B.

   d. The 3rd element of the 1st row of B.

   e. The 3rd column of B.

   f. The 2nd colum of B.

   g. The 1st column of A.

2. Let $A=\begin{pmatrix}12 & 3\\ 2 & 7\end{pmatrix}, B=\begin{pmatrix}3 & -1\\ 1 & 2\end{pmatrix}$. Compute the following

   a. A + B

```
import numpy
a = numpy.array([[12, 3], [2,7]])
b = numpy.array([[3, -1], [1, 2]])
print ("Addition of two matrices: ")
print (numpy.add(a,b))
```

   b. A – B

```
import numpy
a = numpy.array([[12,3], [2,7]])
b = numpy.array([[3, -1], [1, 2]])
print ("Addition of two matrices: ")
print (numpy.subtract(a,b))
```

   c. 2A+3B

```
import numpy
a = numpy.array([[12,3], [2,7]])
b = numpy.array([[3, -1], [1, 2]])
print ("Addition of two matrices: ")
print (numpy.add(2*a,3*b))
```

   d. A.B

```
import numpy
a = numpy.array([[12,3], [2,7]])
```

```
b = numpy.array([[3, -1], [1, 2]])
print( numpy.dot(a,b))
```

e. B.A

f. A^2

g. $A^2 - 2B^2$

3. Find the inverse of the following matrices

a. $A = \begin{pmatrix} 4 & 5 \\ 3 & 4 \end{pmatrix}$

```
import numpy
a = numpy.array([[4, 5], [3, 4]])
print(numpy.linalg.inv(a))
```

b. $A = \begin{pmatrix} -1 & 0 \\ 1 & 1 \end{pmatrix}$

c. $A = \begin{pmatrix} 1 & 2 & 1 \\ 3 & 2 & 1 \\ 1 & 2 & 1 \end{pmatrix}$

d. $A = \begin{pmatrix} 1 & 2 & 1 \\ 3 & 2 & 1 \\ 1 & 2 & 1 \end{pmatrix}$

4. Let $A = \begin{pmatrix} \frac{1}{2} & 2 & 0 \\ 2 & 4 & 4 \\ 2 & 3 & \frac{4}{9} \end{pmatrix}, B = \begin{pmatrix} -\frac{3}{4} & 2 & 1 \\ 2 & 4 & 3 \\ 3 & 4 & 2 \end{pmatrix}$. Calculate the following

a. $A^{-1}.B$

b. $2A^{T}.B$

c. $\left(A^T + B^{-1}\right)^{-1}$

d. $[(A-B).(A+B)]^T$