In [1]:
```python
import numpy as np
```

In [2]:
```python
var_1 = np.array([5,7,4,6,2,5,2,9])
print("The first variable is ", var_1)
```
```
The first variable is  [5 7 4 6 2 5 2 9]
```

In [3]:
```python
print("This array's shape is ", var_1.shape)
```
```
This array's shape is  (8,)
```

In [4]:
```python
print("and it's data type is " , var_1.dtype)
```
```
and it's data type is  int32
```

In [5]:
```python
var_2 = np.array([[1,2,3],[4,5,6],[7,8,9],[10,11,12]])
print(var_2)
```
```
[[ 1  2  3]
 [ 4  5  6]
 [ 7  8  9]
 [10 11 12]]
```

In [6]:
```python
print("This array's shape is ", var_2.shape)
print("and its type is " , var_2.dtype)
```
```
This array's shape is  (4, 3)
and its type is  int32
```

In [7]:
```python
print("total number of elements is " , var_2.size)
```
```
total number of elements is  12
```

In [8]:
```python
print("this varriable type is ", type(var_2))
print("and it's data type is " , var_2.dtype)
```
```
this varriable type is  <class 'numpy.ndarray'>
and it's data type is  int32
```

In [9]:
```python
var_3 = np.array(var_2, dtype = np.int64)
```

In [10]:
```python
print(var_3)
```
```
[[ 1  2  3]
 [ 4  5  6]
 [ 7  8  9]
 [10 11 12]]
```

In [11]:
```python
print("it's data type is " , var_3.dtype)
```
```
it's data type is  int64
```

In [12]:
```python
var_4 = np.zeros((3,4))
var_5 = np.ones((5,6))
print(var_4)
print(var_5)
```
```
[[0. 0. 0. 0.]
 [0. 0. 0. 0.]
 [0. 0. 0. 0.]]
[[1. 1. 1. 1. 1. 1.]
 [1. 1. 1. 1. 1. 1.]
 [1. 1. 1. 1. 1. 1.]
 [1. 1. 1. 1. 1. 1.]
 [1. 1. 1. 1. 1. 1.]]
```

In [13]:
```python
var_6 = np.full((4,5), 7)
print(var_6)
```
```
[[7 7 7 7 7]
 [7 7 7 7 7]
 [7 7 7 7 7]
 [7 7 7 7 7]]
```

In [14]:
```python
print(var_6.size)
```
```
20
```

In [15]:
```python
var_7 = np.eye(5,5)
print(var_7)
```
```
[[1. 0. 0. 0. 0.]
 [0. 1. 0. 0. 0.]
 [0. 0. 1. 0. 0.]
 [0. 0. 0. 1. 0.]
 [0. 0. 0. 0. 1.]]
```

In [16]:
```python
var_8 = np.diag([1,2,3,4,5])
print(var_8)
```
```
[[1 0 0 0 0]
 [0 2 0 0 0]
 [0 0 3 0 0]
 [0 0 0 4 0]
 [0 0 0 0 5]]
```

In [17]:
```python
var_9 = np.arange(15)
print(var_9)
```
```
[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14]
```

In [18]:
```python
var_10 = np.arange(15, 25)
print(var_10)
```
```
[15 16 17 18 19 20 21 22 23 24]
```

In [19]:
```python
var_11 = np.arange(15, 61, 5)
print(var_11)
```
```
[15 20 25 30 35 40 45 50 55 60]
```

In [20]:
```python
var_12 = np.linspace(15, 61, 9)
print(var_12)
```
```
[15.   20.75 26.5  32.25 38.   43.75 49.5  55.25 61.  ]
```

In [21]:
```python
var_13 = np.arange(30).reshape(5,6)
print(var_13)
```
```
[[ 0  1  2  3  4  5]
 [ 6  7  8  9 10 11]
 [12 13 14 15 16 17]
 [18 19 20 21 22 23]
 [24 25 26 27 28 29]]
```

In [22]:
```python
var_14 = np.linspace(0,20,6).reshape(3,2)
print(var_14)
```
```
[[ 0.  4.]
 [ 8. 12.]
 [16. 20.]]
```

In [23]:
```python
var_15 = var_13[1:4,1:5]
print(var_15)
```
```
[[ 7  8  9 10]
 [13 14 15 16]
 [19 20 21 22]]
```

In [24]:
```python
var_16 = var_13[4,1:4]
print(var_16)
```
```
[25 26 27]
```

In [25]:
```python
var_17 = var_13[1:4,1]
print(var_17)
```
```
[ 7 13 19]
```

In [26]:
```python
var_18 = np.random.random((4,5))
print(var_18)
```
```
[[0.44632122 0.71073326 0.6055191  0.69441643 0.21568011]
 [0.57385362 0.69060708 0.14620244 0.47628377 0.35645338]
 [0.05502075 0.06206024 0.13726641 0.97932283 0.71419447]
 [0.20597925 0.84291861 0.39910338 0.59099432 0.26557733]]
```

In [27]:
```python
var_19 = np.random.randint(4,15,size = (3,4))
print(var_19)
```
```
[[ 9 13  7 13]
 [ 9 10  7 12]
 [ 7  5  9  5]]
```

In [28]:
```python
var_20 = np.random.normal(5,10,size = (5,5))
print(var_20)
```
```
[[ 0.76168    27.1860471   3.18634379 -4.2060944  15.24112466]
 [19.72421593  0.8894779  -7.42679047 10.73470204  6.60776804]
 [ 1.97966726 -6.72869844 13.61470556  3.0927096  19.98362504]
 [-1.9383996  -3.05768149 10.89356174  3.67004633 -0.7915309 ]
 [10.67900287  7.09366299 18.79348446 -8.64569506  8.12165201]]
```

In [29]:
```python
var_20[3] = 20
var_20[1,1] = 20
print(var_20)
```
```
[[ 0.76168    27.1860471   3.18634379 -4.2060944  15.24112466]
 [19.72421593 20.         -7.42679047 10.73470204  6.60776804]
 [ 1.97966726 -6.72869844 13.61470556  3.0927096  19.98362504]
 [20.         20.         20.         20.         20.        ]
 [10.67900287  7.09366299 18.79348446 -8.64569506  8.12165201]]
```

In [30]:
```python
var_21 = np.arange(11,31).reshape(4,5,)
print(var_21)
```
```
[[11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]
 [26 27 28 29 30]]
```

In [31]:
```python
var_22 = np.delete(var_21,[1,4])
print(var_22)
```
```
[11 13 14 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30]
```

In [32]:
```python
var_23 = np.delete(var_21,1,axis= 0)
print(var_23)
```
```
[[11 12 13 14 15]
 [21 22 23 24 25]
 [26 27 28 29 30]]
```

In [33]:
```python
var_23 = np.delete(var_21,[1,2],axis= 1)
print(var_23)
```
```
[[11 14 15]
 [16 19 20]
 [21 24 25]
 [26 29 30]]
```

In [34]:
```python
var_24 = np.append(var_21,  [[1,2,3,4,5]], axis=0)
print(var_24)
```
```
[[11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]
 [26 27 28 29 30]
 [ 1  2  3  4  5]]
```

In [35]:
```python
var_25 = np.append(var_21,  [[1],[2],[3],[4]], axis=1)
print(var_25)
```
```
[[11 12 13 14 15  1]
 [16 17 18 19 20  2]
 [21 22 23 24 25  3]
 [26 27 28 29 30  4]]
```

In [36]:
```python
print(var_21)
```
```
[[11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]
 [26 27 28 29 30]]
```

In [37]:
```python
var_26 = np.insert(var_21,2, [1,2,3,4,5], axis=0)
print(var_26)
```
```
[[11 12 13 14 15]
 [16 17 18 19 20]
 [ 1  2  3  4  5]
 [21 22 23 24 25]
 [26 27 28 29 30]]
```

In [38]:
```python
var_27 = np.insert(var_21,2, 100, axis=1)
print(var_27)
```
```
[[ 11  12 100  13  14  15]
 [ 16  17 100  18  19  20]
 [ 21  22 100  23  24  25]
 [ 26  27 100  28  29  30]]
```

In [39]:
```python
var_28 = np.array([5,6])
var_29 = np.array([[1,2],[3,4]])
var_30 = np.vstack((var_29,var_28))
var_31 = np.hstack((var_29,var_28.reshape(2,1)))
print(var_30)
print(var_31)
```
```
[[1 2]
 [3 4]
 [5 6]]
[[1 2 5]
 [3 4 6]]
```

In [40]:
```python
print(var_21)
```
```
[[11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]
 [26 27 28 29 30]]
```

In [41]:
```python
    var_32 = np.copy(var_21[1:3,1:4])
    print(var_32)
```
```
[[17 18 19]
 [22 23 24]]
```

In [42]:
```python
var_33 = var_21[1:3,1:4].copy()
print(var_33)
```
```
[[17 18 19]
 [22 23 24]]
```

In [43]:
```python
var_34 = np.diag(var_21, k=1)
print(var_34)
```
```
[12 18 24 30]
```

In [44]:
```python
var_35 = np.diag(var_21, k=-1)
print(var_35)
```
```
[16 22 28]
```

In [45]:
```python
var_36 = np.unique(var_21)
print(var_36)
```
```
[11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30]
```

In [46]:
```python
print(var_21)
```
```
[[11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]
 [26 27 28 29 30]]
```

In [47]:
```python
print(var_21[var_21<20])
```
```
[11 12 13 14 15 16 17 18 19]
```

In [48]:
```python
print(var_21[var_21>20])
print(var_21[(var_21<20) & (var_21>15)])
```
```
[21 22 23 24 25 26 27 28 29 30]
[16 17 18 19]
```

In [49]:
```python
var_37 = np.array([1,2,6,7,9])
var_38 = np.array([1,2,5,7,4])
print(var_37)
print(var_38)
```
```
[1 2 6 7 9]
[1 2 5 7 4]
```

In [50]:
```python
print(np.intersect1d(var_37,var_38))
```
```
[1 2 7]
```

In [51]:
```python
print(np.setdiff1d(var_37,var_38))
```
```
[6 9]
```

In [52]:
```python
print(np.union1d(var_37,var_38))
```
```
[1 2 4 5 6 7 9]
```

In [53]:
```python
var_39 = np.sort(np.unique(var_37))
print(var_39)
```
```
[1 2 6 7 9]
```

In [54]:
```python
var_40 = np.sort(var_37, axis = 0)
print(var_40)
```
```
[1 2 6 7 9]
```

In [55]:
```python
var_41 = np.arange(1,26).reshape(5,5)
var_42 = np.arange(1,26).reshape(5,5)
print(var_41)
print(var_42)
```
```
[[ 1  2  3  4  5]
 [ 6  7  8  9 10]
 [11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]]
[[ 1  2  3  4  5]
 [ 6  7  8  9 10]
 [11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]]
```

In [56]:
```python
np.add(var_41,var_42)
np.subtract(var_41,var_42)
np.multiply(var_41,var_42)
np.divide(var_41,var_42)
```

Out[56]:
```
array([[1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1.]])
```

In [57]:
```python
np.exp(var_41)
```

Out[57]:
```
array([[2.71828183e+00, 7.38905610e+00, 2.00855369e+01, 5.45981500e+01,
        1.48413159e+02],
       [4.03428793e+02, 1.09663316e+03, 2.98095799e+03, 8.10308393e+03,
        2.20264658e+04],
       [5.98741417e+04, 1.62754791e+05, 4.42413392e+05, 1.20260428e+06,
        3.26901737e+06],
       [8.88611052e+06, 2.41549528e+07, 6.56599691e+07, 1.78482301e+08,
        4.85165195e+08],
       [1.31881573e+09, 3.58491285e+09, 9.74480345e+09, 2.64891221e+10,
        7.20048993e+10]])
```

In [58]:
```python
np.sqrt(var_41)
```

Out[58]:
```
array([[1.        , 1.41421356, 1.73205081, 2.        , 2.23606798],
       [2.44948974, 2.64575131, 2.82842712, 3.        , 3.16227766],
       [3.31662479, 3.46410162, 3.60555128, 3.74165739, 3.87298335],
       [4.        , 4.12310563, 4.24264069, 4.35889894, 4.47213595],
       [4.58257569, 4.69041576, 4.79583152, 4.89897949, 5.        ]])
```

In [59]:
```python
np.power(var_41,2)
```

Out[59]:
```
array([[  1,   4,   9,  16,  25],
       [ 36,  49,  64,  81, 100],
       [121, 144, 169, 196, 225],
       [256, 289, 324, 361, 400],
       [441, 484, 529, 576, 625]], dtype=int32)
```

In [60]:
```python
print(var_41.mean())
```
```
13.0
```

In [61]:
```python
print(var_41.mean(axis=0))
```
```
[11. 12. 13. 14. 15.]
```

In [62]:
```python
print(var_41.mean(axis=1))
```
```
[ 3.  8. 13. 18. 23.]
```

In [63]:
```python
print(var_41.sum())
```
```
325
```

In [64]:
```python
print(var_41.std())
```
```
7.211102550927978
```

In [65]:
```python
print(np.median(var_41))
```
```
13.0
```

In [66]:
```python
print(var_41.max())
```
```
25
```

In [67]:
```python
print(var_41.min())
```
```
1
```

In [68]:
```python
print(4*var_41)
print(4/var_41)
print(4+var_41)
print(4-var_41)
```
```
[[  4   8  12  16  20]
 [ 24  28  32  36  40]
 [ 44  48  52  56  60]
 [ 64  68  72  76  80]
 [ 84  88  92  96 100]]
[[4.         2.         1.33333333 1.         0.8       ]
 [0.66666667 0.57142857 0.5        0.44444444 0.4       ]
 [0.36363636 0.33333333 0.30769231 0.28571429 0.26666667]
 [0.25       0.23529412 0.22222222 0.21052632 0.2       ]
 [0.19047619 0.18181818 0.17391304 0.16666667 0.16      ]]
[[ 5  6  7  8  9]
 [10 11 12 13 14]
 [15 16 17 18 19]
 [20 21 22 23 24]
 [25 26 27 28 29]]
[[  3   2   1   0  -1]
 [ -2  -3  -4  -5  -6]
 [ -7  -8  -9 -10 -11]
 [-12 -13 -14 -15 -16]
 [-17 -18 -19 -20 -21]]
```

In [69]:
```python
print(var_41+var_42)
print(var_41-var_42)
```
```
[[ 2  4  6  8 10]
 [12 14 16 18 20]
 [22 24 26 28 30]
 [32 34 36 38 40]
 [42 44 46 48 50]]
[[0 0 0 0 0]
 [0 0 0 0 0]
 [0 0 0 0 0]
 [0 0 0 0 0]
 [0 0 0 0 0]]
```

In [ ]:
```python
```