https://colab.research.google.com/drive/1Tv9iBvjVDG1YkBrY-UiuEK685AqFzHsP?usp=sharing

```
import numpy as np
```

```
A = np.arange(12).reshape(3,4)
A
```

```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11]])
```

```
A.reshape(1, 1)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-4-902e5c35e0d3> in <module>
----> 1 A.reshape(1, 1)

ValueError: cannot reshape array of size 12 into shape (1,1)
```

SEARCH STACK OVERFLOW

```
A.reshape(1, 12)
```

```
array([[ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11]])
```

Saving...

```
5,  6,  7,  8,  9, 10, 11])
```

```
A.flatten()
```

```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11])
```

```
A.reshape(6, -1)
```

```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11]])
```

```
A.reshape(-1, 4)
```

```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11]])
```

```
A.reshape(6, -10) # any neg num is a placeholder
```

```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11]])
```

```
A.reshape(7, -1)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-11-e0ac03534b24> in <module>
----> 1 A.reshape(7, -1)

ValueError: cannot reshape array of size 12 into shape (7,newaxis)
```

SEARCH STACK OVERFLOW

```
a = np.arange(5)
b = np.ones(5) * 2
print(a, b)
```

```
[0 1 2 3 4] [2. 2. 2. 2. 2.]
```

```
a * b
```

```
array([0., 2., 4., 6., 8.])
```

```
A = np.arange(12).reshape(3, 4)
A
```

```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11]])
```

```
B = np.arange(12).reshape(3, 4)
B
```

```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11]])
```

```
A * B
```

```
array([[  0,   1,   4,   9],
       [ 16,  25,  36,  49],
       [ 64,  81, 100, 121]])
```

```
np.matmul(A, B)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-17-04c68bb92949> in <module>
----> 1 np.matmul(A, B)

erand 1 has a mismatch in its core dimension 0, with gufunc signature (n?,k),(k,m?)->(n?,m?)
```



```
np.matmul(A, B.T)
```

```
array([[ 14,  38,  62],
       [ 38, 126, 214],
       [ 62, 214, 366]])
```

```
np.matmul(A.T, B)
```

```
array([[ 80,  92, 104, 116],
       [ 92, 107, 122, 137],
       [104, 122, 140, 158],
       [116, 137, 158, 179]])
```

```
A.T @ B
```

```
array([[ 80,  92, 104, 116],
       [ 92, 107, 122, 137],
       [104, 122, 140, 158],
       [116, 137, 158, 179]])
```

```
np.dot(A.T, B)
```

```
array([[ 80,  92, 104, 116],
       [ 92, 107, 122, 137],
       [104, 122, 140, 158],
       [116, 137, 158, 179]])
```

```
# 2D arrays -> np.dot performs mat mul
# 1D arrays -> dot producr
```

```
a = np.array([1,2,3])
b = np.array([1,1,1])
a, b
```

```
(array([1, 2, 3]), array([1, 1, 1]))
```

```
np.dot(a, b)
```

```
6
```

```
np.dot(4, 5)
```

```
20
```

```
A = np.arange(12).reshape(3, 4)
A
```

```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11]])
```

```
a = np.array([1, 2, 3])
a
```

```
array([1, 2, 3])
```

```
np.matmul(A, a)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-28-76efef6bd8e9> in <module>
----> 1 np.matmul(A, a)

ValueError: matmul: Input operand 1 has a mismatch in its core dimension 0, with gufunc signature (n?,k),(k,m?)->(n?,m?)
```

SEARCH STACK OVERFLOW

```
np.matmul(a, A)
```

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```
A = np.arange(1, 10)
A
```

```
array([1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
A * 2
```

```
array([ 2,  4,  6,  8, 10, 12, 14, 16, 18])
```

```
import math
math.log(3)
```

```
1.0986122886681098
```

```
math.log(A)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-41-550515851926> in <module>
----> 1 math.log(A)

TypeError: only size-1 arrays can be converted to Python scalars
```

SEARCH STACK OVERFLOW

```
log_vec = np.vectorize(math.log)
```

```
log_vec(A)
```

```
array([0.        , 0.69314718, 1.09861229, 1.38629436, 1.60943791,
       1.79175947, 1.94591015, 2.07944154, 2.19722458])
```

```
A = np.arange(1, 13).reshape(3, 4)
log_vec(A)
```

```
array([[0.        , 0.69314718, 1.09861229, 1.38629436],
       [1.60943791, 1.79175947, 1.94591015, 2.07944154],
       [2.19722458, 2.30258509, 2.39789527, 2.48490665]])
```

```
B = np.arange(24).reshape(2, 3, 4)
B
```

```
array([[[ 0,  1,  2,  3],
        [ 4,  5,  6,  7],
        [ 8,  9, 10, 11]],
```

```
       [[12, 13, 14, 15],
        [16, 17, 18, 19],
        [20, 21, 22, 23]]])
```

```
B.ndim
```

```
3
```

```
B.shape
```

```
(2, 3, 4)
```

```
B
```

```
array([[[ 0,  1,  2,  3],
        [ 4,  5,  6,  7],
        [ 8,  9, 10, 11]],

       [[12, 13, 14, 15],
        [16, 17, 18, 19],
        [20, 21, 22, 23]]])
```

```
B[0]
```

```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11]])
```

```
B[1, 1, 1]
```

Saving...

```
!gdown 17tYTDPBU5hpby9t0kGd7w_-zBsbY7sEd
```

```
Downloading...
From: https://drive.google.com/uc?id=17tYTDPBU5hpby9t0kGd7w_-zBsbY7sEd
To: /content/fruits.png
100% 4.71M/4.71M [00:00<00:00, 46.0MB/s]
```

```
!gdown 1o-8yqdTM7cfz_mAaNCi2nH0urFu7pcqI
```

```
Downloading...
From: https://drive.google.com/uc?id=1o-8yqdTM7cfz_mAaNCi2nH0urFu7pcqI
To: /content/emma_stone.jpeg
100% 80.3k/80.3k [00:00<00:00, 64.0MB/s]
```

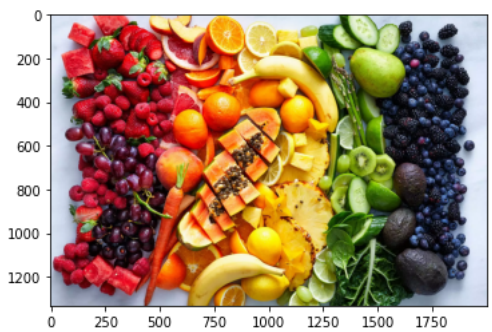
```
img = plt.imread("fruits.png")
```

```
type(img)
```

```
numpy.ndarray
```

```
plt.imshow(img)
```

```
<matplotlib.image.AxesImage at 0x7fbe108385b0>
```




```
img.shape
```

```
(1333, 2000, 3)
```

✓ 0s completed at 22:58

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