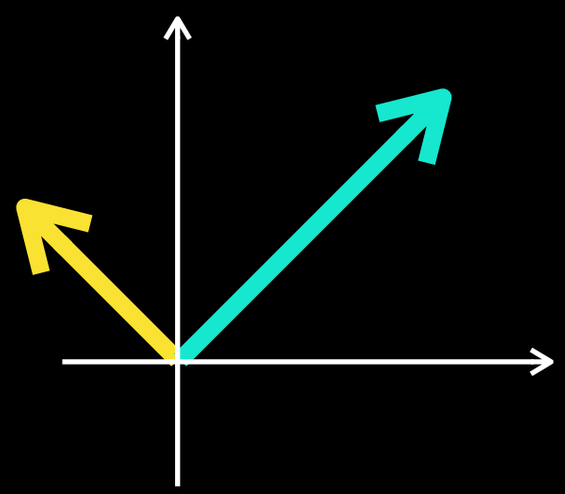
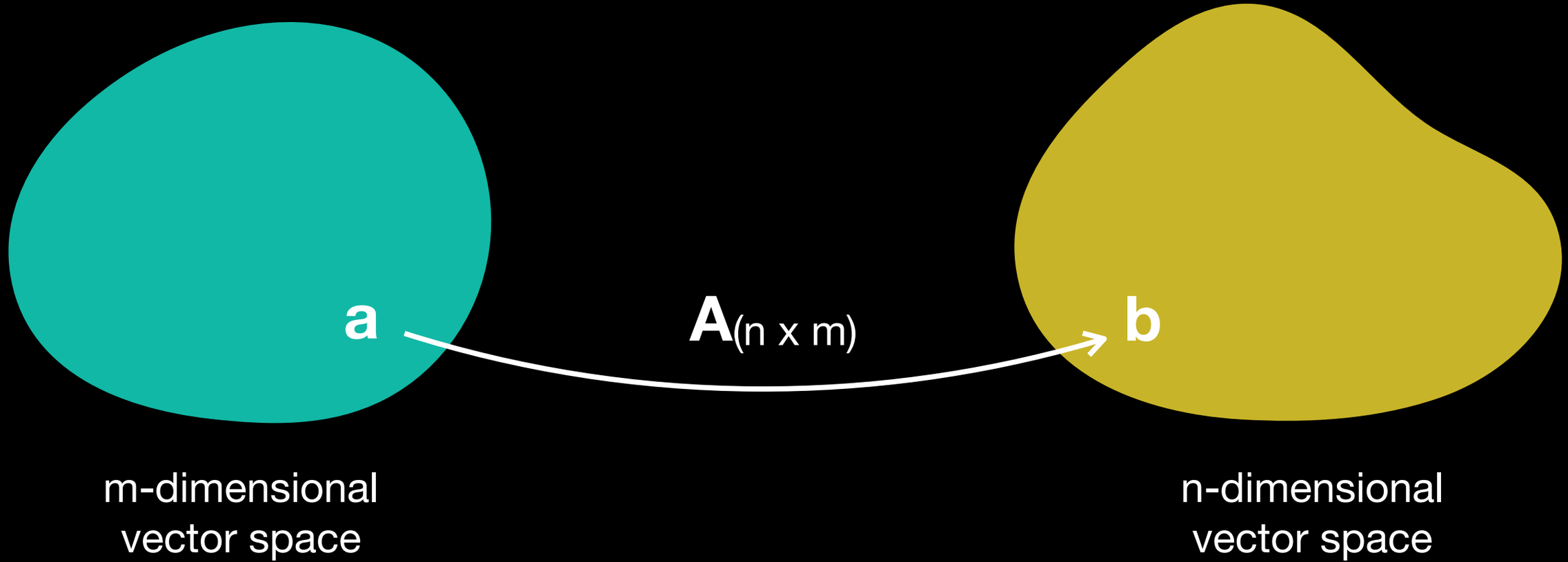
Matrix as function

Linear Algebra Essentials



$$\mathbf{A}_{(n \times m)}\ \mathbf{a}_{(m \times 1)} = \mathbf{b}_{(n \times 1)}$$

$$\mathbf{a}_{(m \times 1)} \xrightarrow{\mathbf{A}_{(n \times m)}} \mathbf{b}_{(n \times 1)}$$

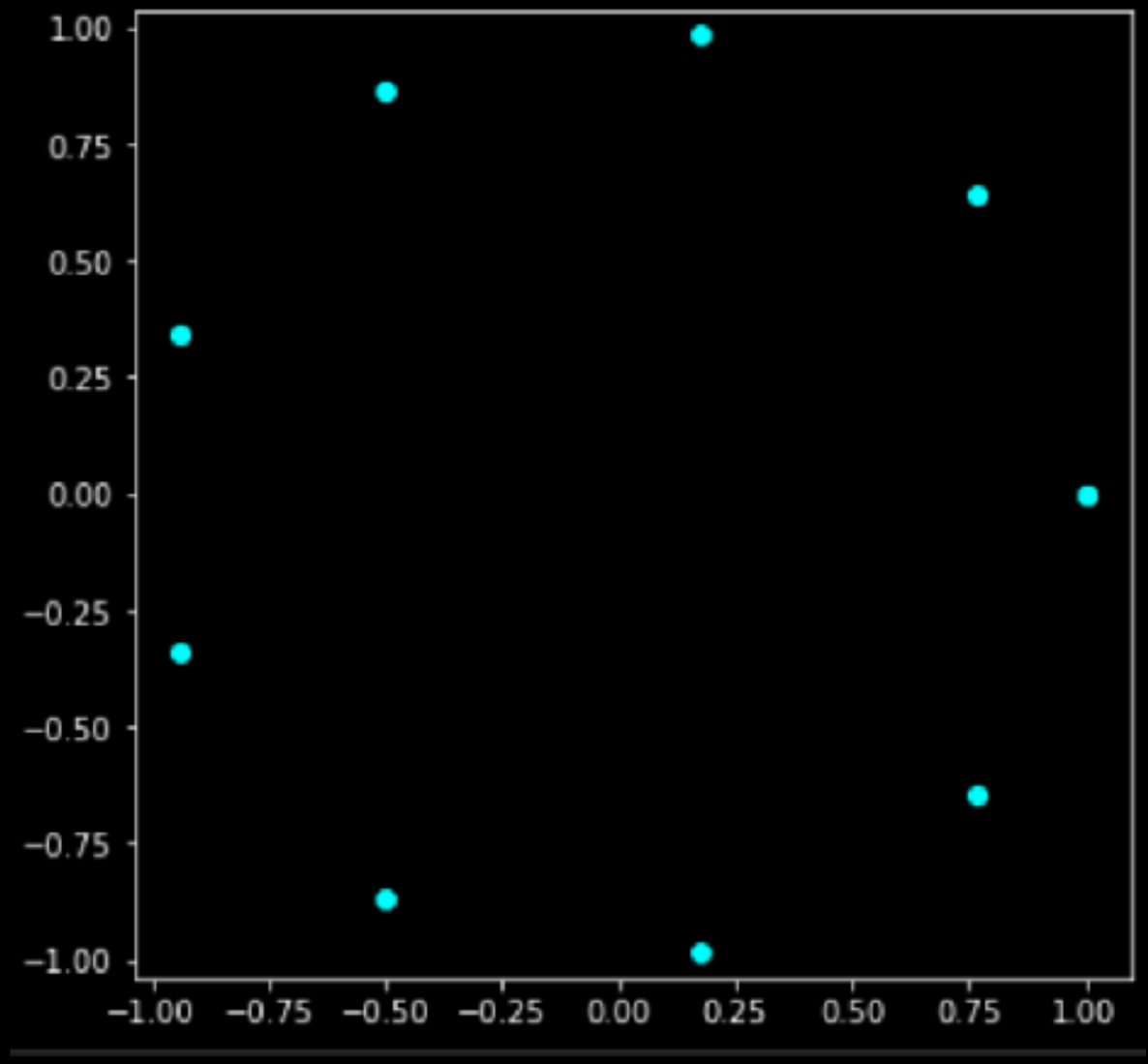


```python
import numpy as np
import matplotlib.pyplot as plt
```

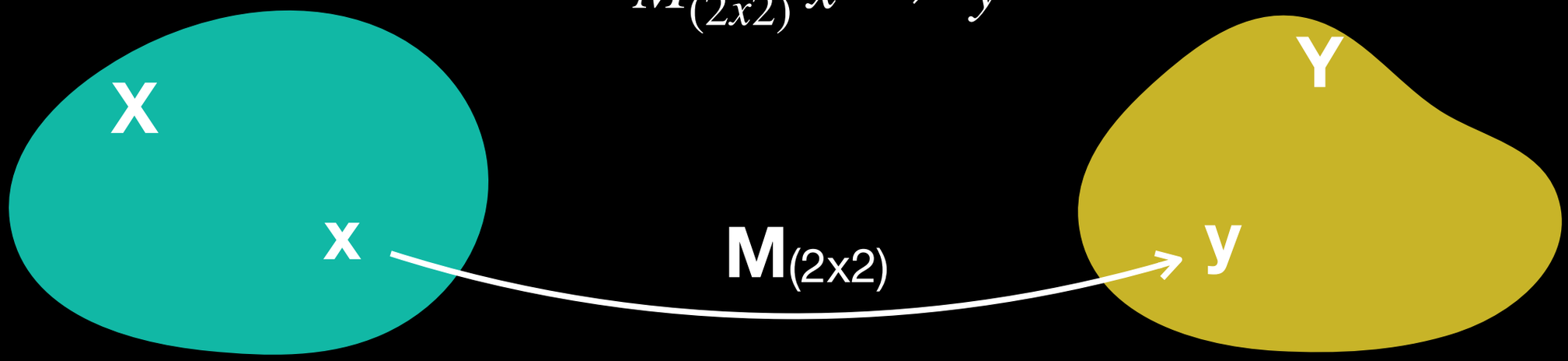
```python
M = np.array([[1, 3],
              [2, 0]])
```

```python
a = np.linspace(0, 2*np.pi, 10)
V = np.array([np.cos(a), np.sin(a)]).T
V
```

```
array([[ 1.00000000e+00,  0.00000000e+00],
       [ 7.66044443e-01,  6.42787610e-01],
       [ 1.73648178e-01,  9.84807753e-01],
       [-5.00000000e-01,  8.66025404e-01],
       [-9.39692621e-01,  3.42020143e-01],
       [-9.39692621e-01, -3.42020143e-01],
       [-5.00000000e-01, -8.66025404e-01],
       [ 1.73648178e-01, -9.84807753e-01],
       [ 7.66044443e-01, -6.42787610e-01],
       [ 1.00000000e+00, -2.44929360e-16]])
```

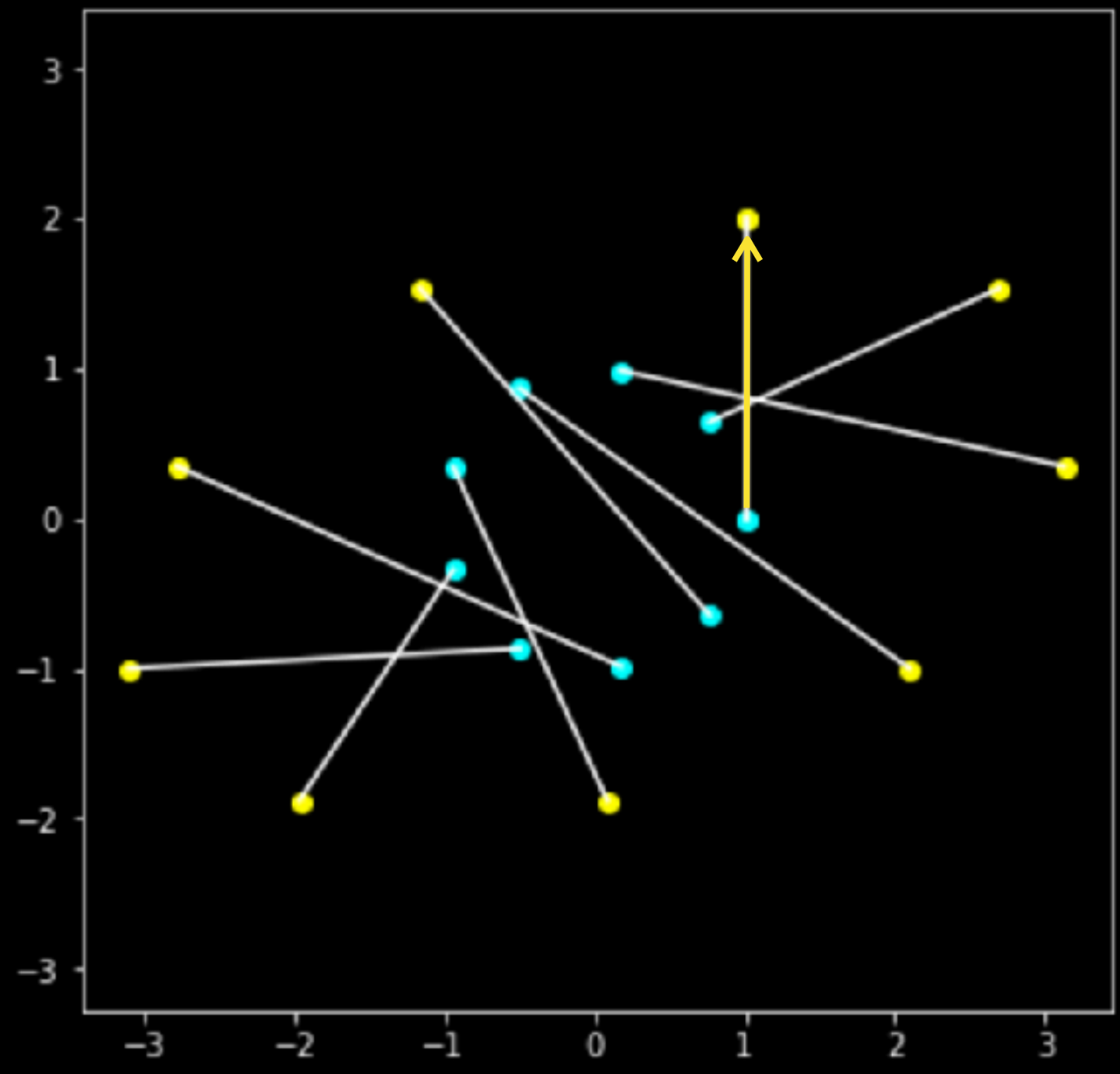


$$M_{(2x2)}\,\vec{x} \rightarrow \vec{y}$$



$$\vec{y} = \begin{bmatrix} 1 & 3 \\ 2 & 0 \end{bmatrix} \vec{x}$$

$$x = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \rightarrow y = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$



Identity matrix:

$$I\vec{x} = \vec{x}$$

$$I = \begin{bmatrix} 1 & 0 & \dots & 0 \\ 0 & 1 & \dots & 0 \\ & & \dots & \\ 0 & 0 & \dots & 1 \end{bmatrix}$$

$$\mathbf{f} = \mathbf{A}_{(n \times m)}: \quad \mathbf{a}_{(m \times 1)} \rightarrow \mathbf{b}_{(n \times 1)}$$