

## Activity 2

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### Checkpoint 1

$$\begin{aligned} 1. & \begin{pmatrix} \cos(\pi/4) & 0 & \sin(\pi/4) \\ 0 & 1 & 0 \\ -\sin(\pi/4) & 0 & \cos(\pi/4) \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\pi/4) & -\sin(\pi/4) \\ 0 & \sin(\pi/4) & \cos(\pi/4) \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \\ &= \begin{pmatrix} \cos(\pi/4) & 0 & \sin(\pi/4) \\ 0 & 1 & 0 \\ -\sin(\pi/4) & 0 & \cos(\pi/4) \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\pi/4) & -\sin(\pi/4) \\ 0 & \sin(\pi/4) & \cos(\pi/4) \end{pmatrix} \\ &= \begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{2} & \frac{1}{2} \\ 0 & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{2} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \\ &= \begin{pmatrix} \frac{1+\sqrt{2}}{\sqrt{2}} \\ 0 \\ \frac{-1+\sqrt{2}}{\sqrt{2}} \end{pmatrix} \end{aligned}$$

### Checkpoint 2

$$2. \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\pi/4) & -\sin(\pi/4) \\ 0 & \sin(\pi/4) & \cos(\pi/4) \end{pmatrix} \begin{pmatrix} \cos(\pi/4) & 0 & \sin(\pi/4) \\ 0 & 1 & 0 \\ -\sin(\pi/4) & 0 & \cos(\pi/4) \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\pi/4) & -\sin(\pi/4) \\ 0 & \sin(\pi/4) & \cos(\pi/4) \end{pmatrix} \begin{pmatrix} \cos(\pi/4) & 0 & \sin(\pi/4) \\ 0 & 1 & 0 \\ -\sin(\pi/4) & 0 & \cos(\pi/4) \end{pmatrix}$$

$$\begin{pmatrix} \frac{1}{\sqrt{2}} & 0 & \frac{1}{\sqrt{2}} \\ \frac{1}{2} & \frac{1}{\sqrt{2}} & -\frac{1}{2} \\ -\frac{1}{2} & \frac{1}{\sqrt{2}} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} \sqrt{2} \\ \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{pmatrix}$$

Checkpoint 3

$$3. \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ -1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} ? \\ ? \\ ? \\ ? \end{pmatrix}$$

$$= \begin{pmatrix} 1 \cdot 2 + 0 \cdot (-1) + 0 \cdot 1 + 1 \cdot 1 \\ 0 \cdot 2 + 1 \cdot (-1) + 0 \cdot 1 + 1 \cdot 1 \\ 0 \cdot 2 + 0 \cdot (-1) + 1 \cdot 1 + 2 \cdot 1 \\ 0 \cdot 2 + 0 \cdot (-1) + 0 \cdot 1 + 1 \cdot 1 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \\ 0 \\ 3 \\ 1 \end{pmatrix}$$

Checkpoint 4

$$4. \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} & 1 & 0 \\ 0 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & 2 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} 2 \\ -1 \\ 1 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1 \cdot 2 + 0 \cdot (-1) + 0 \cdot 1 + 1 \cdot 1 \\ 0 \cdot 2 + \frac{\sqrt{2}}{2} \cdot (-1) + \left(-\frac{\sqrt{2}}{2}\right) \cdot 1 + 1 \cdot 1 \\ 0 \cdot 2 + \frac{\sqrt{2}}{2} \cdot (-1) + \frac{\sqrt{2}}{2} \cdot 1 + 2 \cdot 1 \\ 0 \cdot 2 + 0 \cdot (-1) + 0 \cdot 1 + 1 \cdot 1 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \\ 1 - \sqrt{2} \\ 2 \\ 1 \end{pmatrix}$$

### Checkpoint 5

1.



2.



3.



### **Checkpoint 6**

When the Location of the camera focal length is changed and we see different perspective angles of the image. In this monkey image, The structure of the monkey shifts by zooming into the face and highlighting/focusing on different spots.

### **Checkpoint 7**

