

Exercise 1

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1. Here are equations that contain trigonometric functions:

$$x = r \cos \psi$$

$$y = r \sin \psi$$

2. Here is an expression that contains the dot product of two vectors:

$$\vec{u} \cdot \vec{v} = \cos \phi \mid \vec{u} \mid \mid \vec{v} \mid$$

3. Here is an expression that contains the cross product of two vectors:

$$\mid \vec{u} \times \vec{v} \mid = \sin \phi \mid \vec{u} \mid \mid \vec{v} \mid$$

4. Here is a matrix:

$$\begin{bmatrix} m_{00} & m_{01} & m_{02} & m_{03} \\ m_{10} & m_{11} & m_{12} & m_{13} \\ m_{20} & m_{21} & m_{22} & m_{23} \\ m_{30} & m_{31} & m_{32} & m_{33} \end{bmatrix}$$

5. Here is a product of a matrix and a column vector:

$$\begin{bmatrix} m_{00} & m_{01} & m_{02} & m_{03} \\ m_{10} & m_{11} & m_{12} & m_{13} \\ m_{20} & m_{21} & m_{22} & m_{23} \\ m_{30} & m_{31} & m_{32} & m_{33} \end{bmatrix} \begin{bmatrix} u_0 \\ u_1 \\ u_2 \\ u_3 \end{bmatrix}$$

6. Here is a product of a matrix and a column vector with the result:

$$\begin{bmatrix} m_{00} & m_{01} & m_{02} & m_{03} \\ m_{10} & m_{11} & m_{12} & m_{13} \\ m_{20} & m_{21} & m_{22} & m_{23} \\ m_{30} & m_{31} & m_{32} & m_{33} \end{bmatrix} \begin{bmatrix} u_0 \\ u_1 \\ u_2 \\ u_3 \end{bmatrix} = \begin{bmatrix} v_0 \\ v_1 \\ v_2 \\ v_3 \end{bmatrix}$$

7. Here is a product of a row vector, a matrix, and a column vector with the result:

$$\begin{bmatrix} u_0 & u_1 & u_2 & u_3 \end{bmatrix} \begin{bmatrix} m_{00} & m_{01} & m_{02} & m_{03} \\ m_{10} & m_{11} & m_{12} & m_{13} \\ m_{20} & m_{21} & m_{22} & m_{23} \\ m_{30} & m_{31} & m_{32} & m_{33} \end{bmatrix} \begin{bmatrix} v_0 \\ v_1 \\ v_2 \\ v_3 \end{bmatrix} = x$$

8. Here is some JavaScript:

```
var f = function( u, v ) {
  var r = 1 + Math.sin( 8 * u ) / 10;
  var x = r * Math.cos( v );
  var y = r * Math.sin( v );
  var z = u;

  return new THREE.Vector3( x, y, z );
}; // f()
```

9. See this image [1](#):

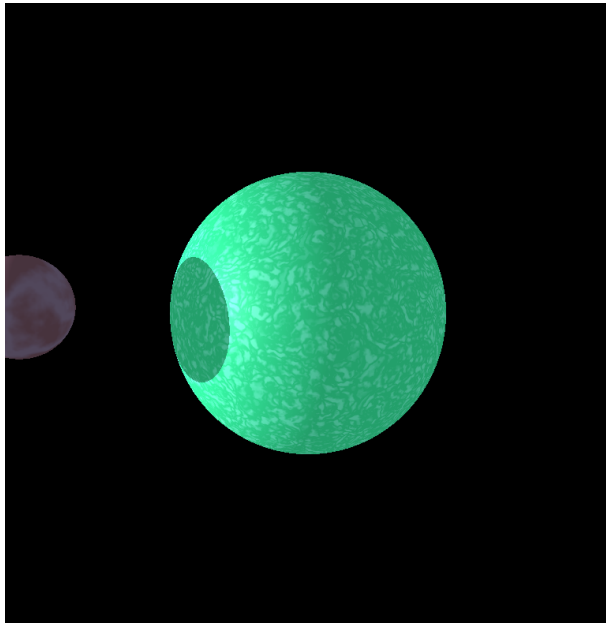


Figure 1: Planets