

## CSC 322 Introduction to Computer Graphics Spring 2025

### Homework #4

**Due Date:** 02/26/2025 before class

**Submission Link:** <https://learn.cua.edu>

Course textbook Chapter 2 (pages 50-51): Problems 12, 13

Course textbook Chapter 4 (page 88): Problems 1, 2

**Question A1:** Consider a ray that starts at  $\mathbf{e} = (-1, -3)$  and has direction  $\mathbf{d} = (\frac{1}{3}, 2)$ . The ray intersects the unit circle defined by  $x^2 + y^2 = 1$  at two points. We can write the parametric line of the ray as the following:  $\mathbf{p}(t) = \mathbf{e} + t\mathbf{d}$ .

- What is the parametric line of the ray in the full-form?
- Draw a picture presenting the ray  $\mathbf{p}(t)$  and the unit circle using the Cartesian coordinate.
- What is the vector form of the unit circle?
- Find the two points that the ray intersects the unit circle.

```
// Create OrbitControls
const controls = new OrbitControls(camera, renderer.domElement);
controls.enableDamping = true; // Adds smooth motion
controls.dampingFactor = 0.05;
controls.screenSpacePanning = false;
controls.minDistance = 10;
controls.maxDistance = 200;

// Create scene
const scene = new THREE.Scene();

// Create a circle
const circleMaterial = new THREE.LineBasicMaterial({ color: 0xff0000 });
const circlePoints = [];
const radius = 25; // Circle radius
const segments = 100; // Number of segments to approximate the circle

for (let i = 0; i <= segments; i++) {
    const theta = (i / segments) * 2 * Math.PI;
    const x = radius * Math.cos(theta);
    const y = radius * Math.sin(theta);
    circlePoints.push(new THREE.Vector3(x, y, 0));
}

const circleGeometry = new THREE.BufferGeometry().setFromPoints(circlePoints);
const circle = new THREE.Line(circleGeometry, circleMaterial);
scene.add(circle);

// Animation loop for rendering and controls update
function animate() {
    requestAnimationFrame(animate);
    controls.update(); // Required for damping to work
    renderer.render(scene, camera);
}

// Start the animation loop
animate();
```