Shader Art Coding

🧪 Exercise 1: Animated Gradient

🎯 **Goal:** Create a full-screen gradient that smoothly evolves over time.

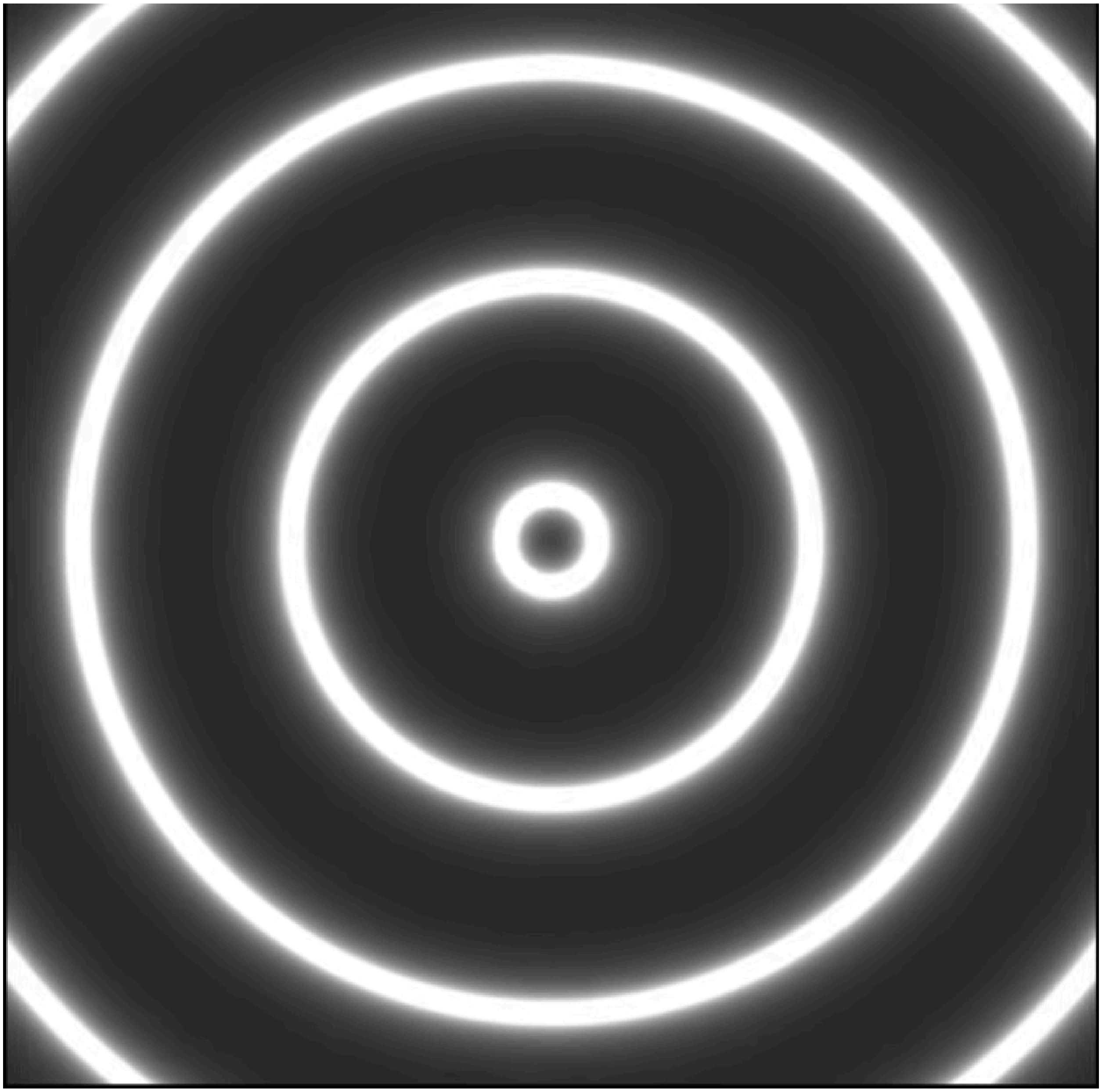
🧠 **Tip:** Use `fragCoord`, normalize it with `iResolution`, and combine it with `iTime` to animate.

Formula Example:

```
void mainImage(out vec4 fragColor, in vec2 fragCoord) {
    vec2 uv = fragCoord / iResolution.xy;
    float t = iTime * 0.5;
    vec3 color = vec3(uv.x + sin(t), uv.y + cos(t), sin(t + uv.x));
    fragColor = vec4(color, 1.0);
}
```

🌊 Exercise 2: Wave Propagation

🎯 **Goal:** Simulate a ripple or wave moving from a central point.



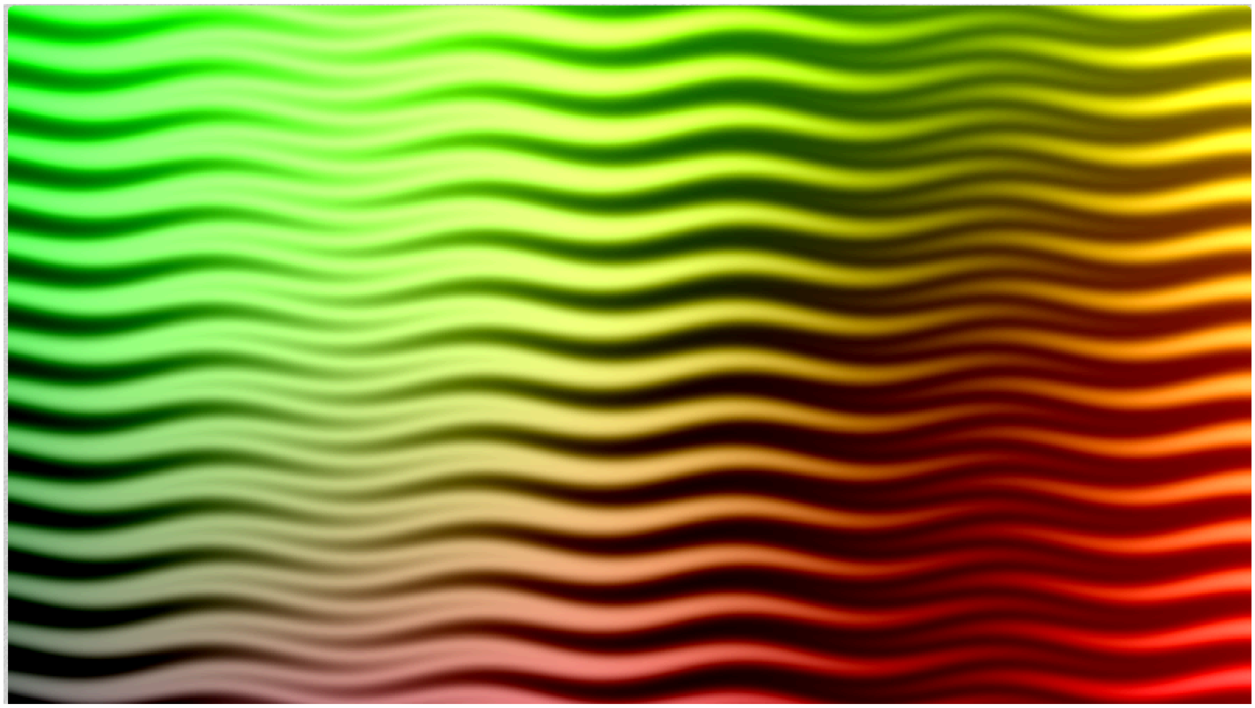
🧠 **Tip:** Use distance to the center (`length(uv - center)`) and animate using sine.

Formula Example:

```
void mainImage(out vec4 fragColor, in vec2 fragCoord) {
    vec2 uv = fragCoord / iResolution.xy;
    vec2 center = vec2(0.5);
    float dist = length(uv - center);
    float wave = sin(dist * 30.0 - iTime * 5.0);
    fragColor = vec4(vec3(wave), 1.0);
}
```

🌊🌊 Exercise 3: Complex Waveform

🎯 **Goal:** Animate a more complex and layered wave pattern.



🧠 **Tip:** Combine multiple sine waves and experiment with `mix`, `abs`, or `fract`.

Formula Example:

```
void mainImage(out vec4 fragColor, in vec2 fragCoord) {
    vec2 uv = fragCoord / iResolution.xy;
    float wave1 = sin((uv.x + uv.y + iTime) * 10.0);
    float wave2 = sin((uv.x - uv.y - iTime) * 15.0);
    float combined = wave1 * wave2;
    fragColor = vec4(vec3(combined), 1.0);
}
```

🔍 **Explore:** Use `cos`, `tan`, or polar coordinates for spirals or vortex-like effects.

🖱️ Exercise 4: Mouse Interaction

🎯 **Goal:** Use the mouse to control your shader animation.

🧠 **Tip:** Normalize `iMouse.xy` and use it to influence position, color, or animation speed.

Formula Example:

```
void mainImage(out vec4 fragColor, in vec2 fragCoord) {
    vec2 uv = fragCoord / iResolution.xy;
    vec2 mouse = iMouse.xy / iResolution.xy;
    float dist = length(uv - mouse);
    float ring = sin(dist * 30.0 - iTime * 5.0);
    fragColor = vec4(vec3(ring), 1.0);
}
```

🎨 Exercise 5: Free Art

🎯 **Goal:** Create your own generative artwork using what you learned.

🧠 **Tip:** Combine techniques — gradients, waves, user input, even fractals or ray marching.

Ideas to Try:

- Mandelbrot/Julia fractal zooms
- 2D cellular automata (e.g., Conway's Game of Life)
- Procedural fire, water, or sky effects
- Lissajous curves or spirograph loops

🔍 **Present your shader to others!** Explain the idea and your creative approach.