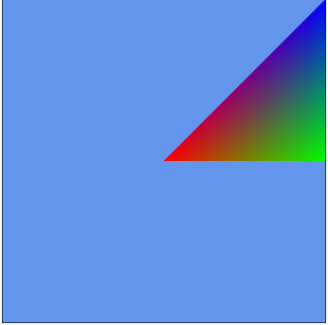
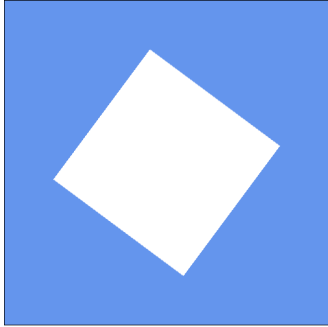
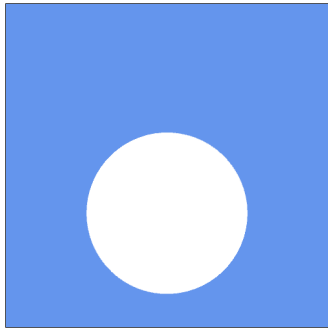


**Worksheet 1: Getting started with WebGL (or WebGPU)**

Reading	Angel: Chapter 2 and Section 3.1. (Optional) Angel: Chapter 1 (especially Sections 1.3-1.5).
Purpose	<p>The purpose of this set of exercises is to get started with WebGL (if you prefer, you can use WebGPU instead of WebGL). You will setup a WebGL application from scratch, create a canvas and a WebGL context, compile and use simplistic shader programs, setup the needed buffers for drawing, and draw and animate simple shapes.</p> <p>A handy WebGL quick reference card can be downloaded here:  <a href="https://www.khronos.org/files/webgl/webgl-reference-card-1_0.pdf">https://www.khronos.org/files/webgl/webgl-reference-card-1_0.pdf</a></p> <p>Basic JavaScript reference:  <a href="http://www.w3schools.com/jsref/">http://www.w3schools.com/jsref/</a></p> <p>Tips:</p> <ul style="list-style-type: none"> <li>- You can press F12 or right click and choose “Inspect [element]” in most browsers to show the developer/debug menus which can be quite helpful.</li> </ul>
Part 1	<p>Setup a basic WebGL application.</p> <ul style="list-style-type: none"> <li>• Create a HTML document with a 512x512 canvas element and write a script to create a WebGL context. [Angel 2.8]</li> <li>• Setup a viewport and clear the canvas with the color cornflower blue (0.3921, 0.5843, 0.9294, 1.0). [Angel 2.5.1]</li> <li>• If not already done, move the script to a separate JavaScript file and include it in the HTML document.</li> <li>• Setup the WebGL context using Angel’s “setupWebGL”. You can use the window.onload event to initialize and setup the application. [Angel 2.8]</li> </ul>
Part 2	<p>Shaders and buffers.</p> <ul style="list-style-type: none"> <li>• Load and compile a shader program. Write a basic vertex shader and a constant color fragment shader. [Angel 2.8.3 to 2.8.8]</li> <li>• Setup a vertex buffer with the corresponding attribute pointer. Add the coordinates and draw three points of size 20 pixels, like in the figure. [Angel 2.4, 2.8, and 2.5.3]          [If using WebGPU, note that points can only be of size 1. These points then need to be drawn as two triangles forming a square.]</li> </ul>

**Worksheet 1: Getting started with WebGL (or WebGPU)**

<p>Part 3</p> 	<p>Triangles.</p> <ul style="list-style-type: none"><li>• Change the code in the previous example to draw triangles instead of points. [Angel 2.4.2]</li><li>• Extend the application to include a second buffer for vertex colors and draw the triangle with a red, a green, and a blue vertex color. [Angel 2.5.1 and 2.10]</li></ul>
<p>Part 4</p> 	<p>A rotating square.</p> <ul style="list-style-type: none"><li>• Add a second triangle to the previous part such that you have a quadrilateral (which is maybe even a square). [Angel 2.4]</li><li>• Center your quad (short form of quadrilateral) and rotate it such that it has its vertices on the coordinate axes.</li><li>• Add a rotation so the quad rotates around its center. Animate the rotation angle over time. Use <code>requestAnimationFrame</code> to continuously call your render function. [Angel 3.1]</li></ul>
<p>Part 5</p> 	<p>A fan of triangles.</p> <ul style="list-style-type: none"><li>• Create and draw a circle using the triangle fan drawing mode. [Angel 2.4.2]</li><li>• Make the circle bounce up and down over time.</li></ul>