Assignment – 2

Name: Ishan Mehta

Roll No: 2019309

Question 1)

Part a)

The Camera Coordinates are given by the parametric equation of a sphere. When we press different arrow keys, we change the parameters in this equation and the camera moves in a sphere while looking at the target.

The coordinates for some parameters ϕ and θ are given by -

$$X = R\sin(-\phi)\cos(-\theta)$$

$$Z = R\sin(-\phi)\cos(-\theta)$$

$$Y = Rcos(\phi)$$

The camera always moves in a circle in a plane parallel to the XZ plane. This plane is uniquely given by the parameter ϕ, while the amount of rotation in this circle is given by the parameter θ.

Somewhere the parameters are negated to correct the movement of the camera as per the requirements in this assignment.

Key press and their changes

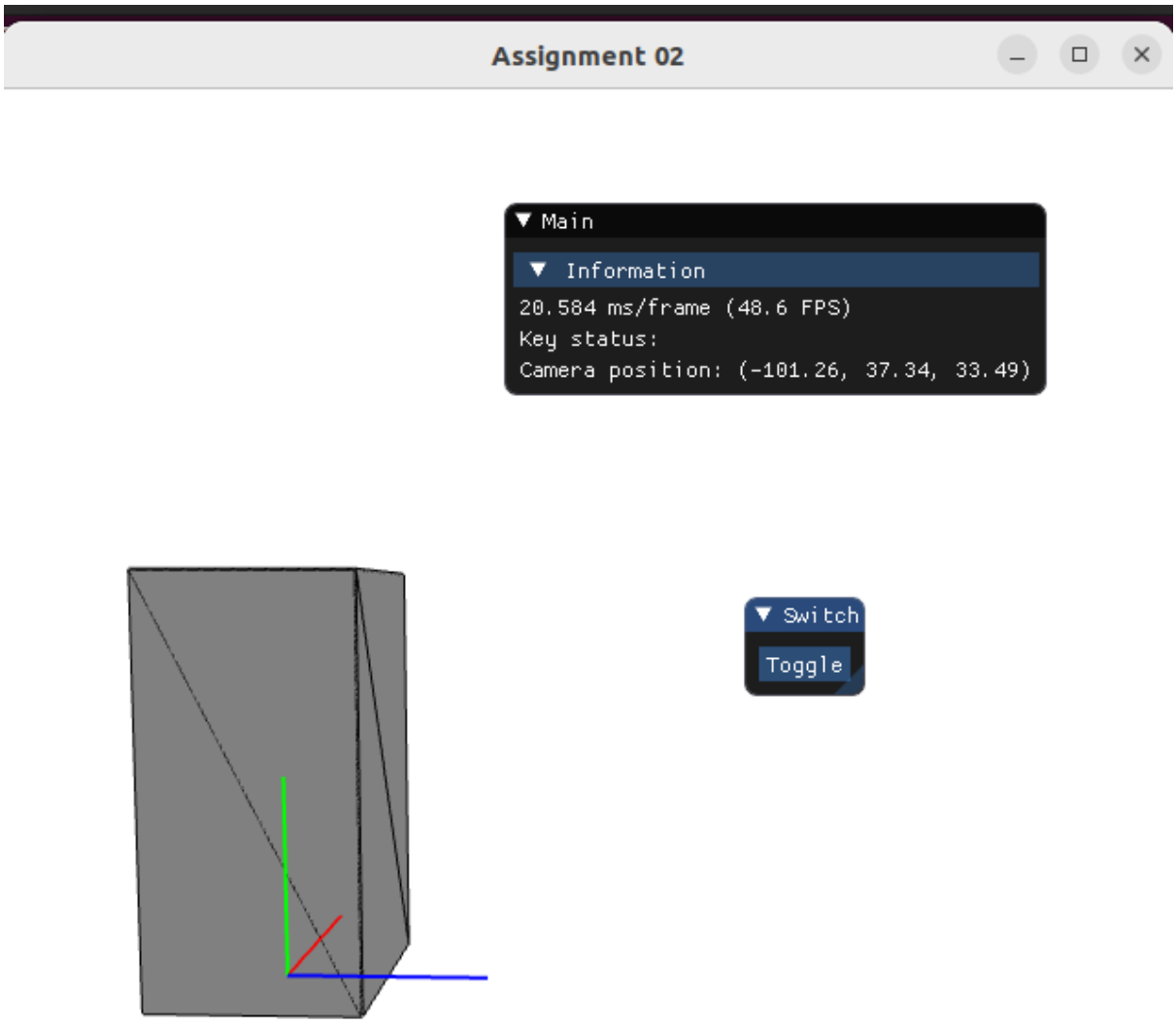
Left /Right arrow keys – decrease/increase the θ value to make the camera move in -X/+X direction.

Down/Up arrow keys – decrease/increase the ϕ value to make the camera move in -Y/+Y direction.

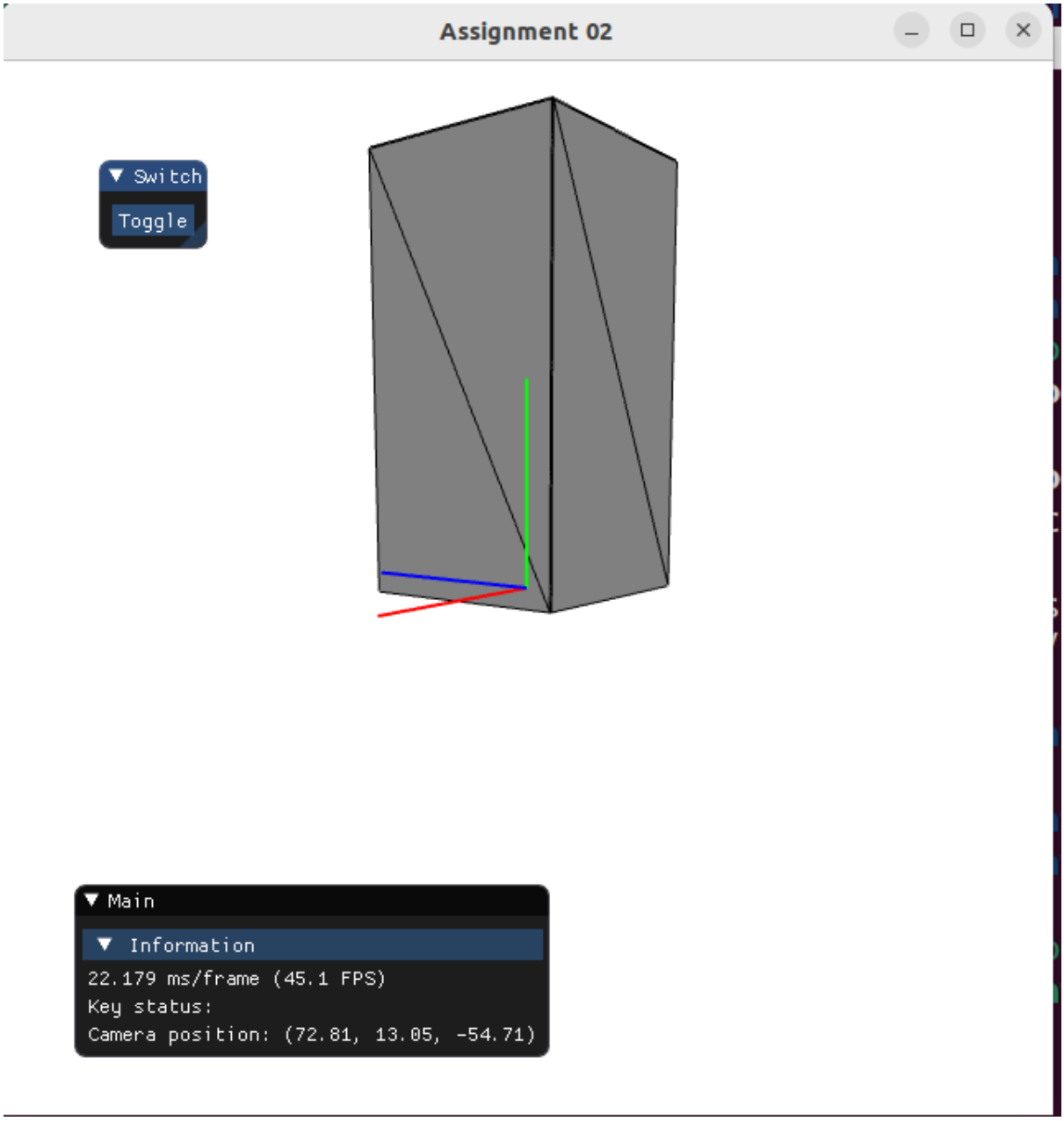
Shift + Down/Up – decrease/increase the value of R to make the sphere smaller/bigger and move the camera in the -Z/+Z direction.

Part b)

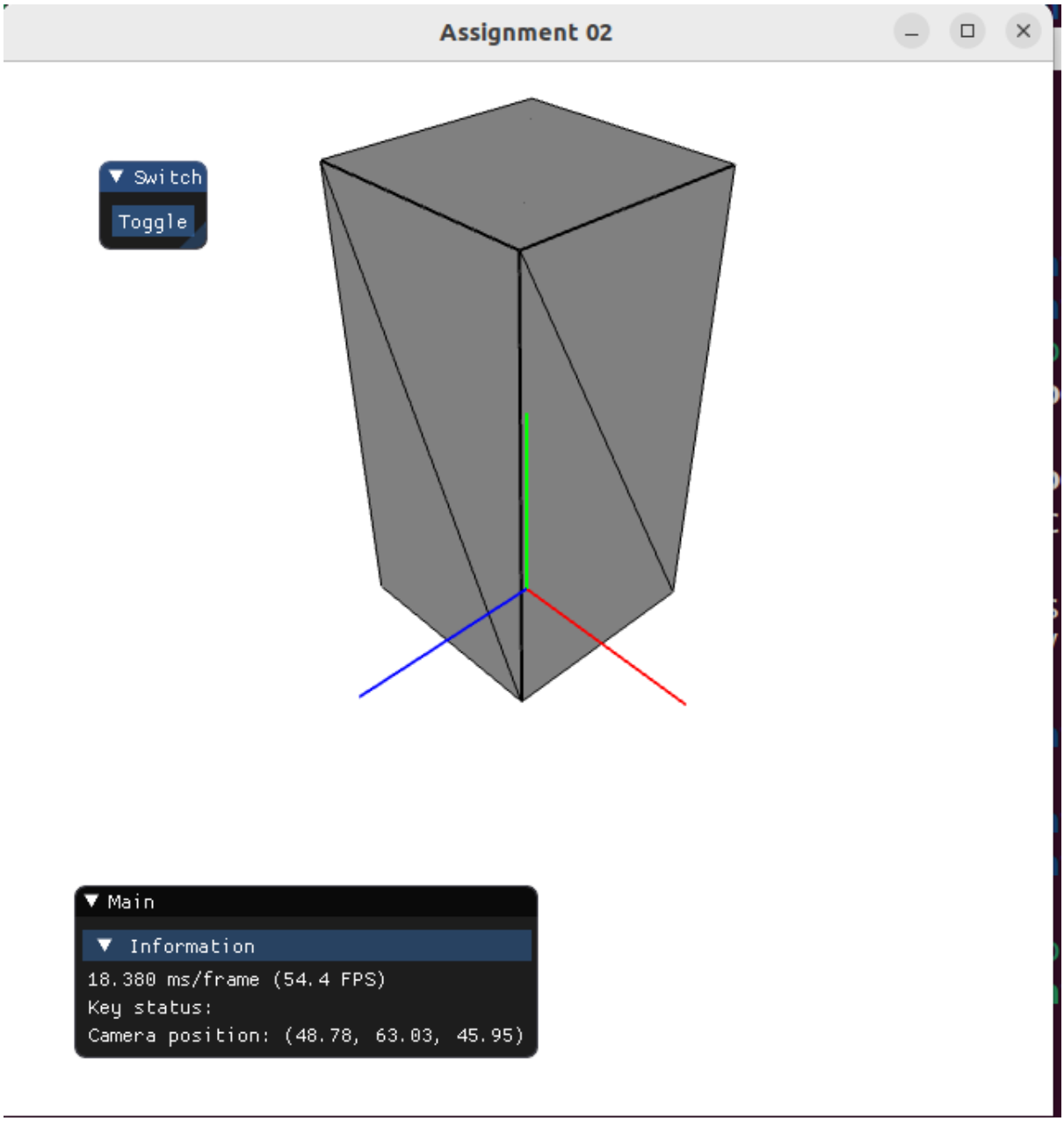
One-point perspective



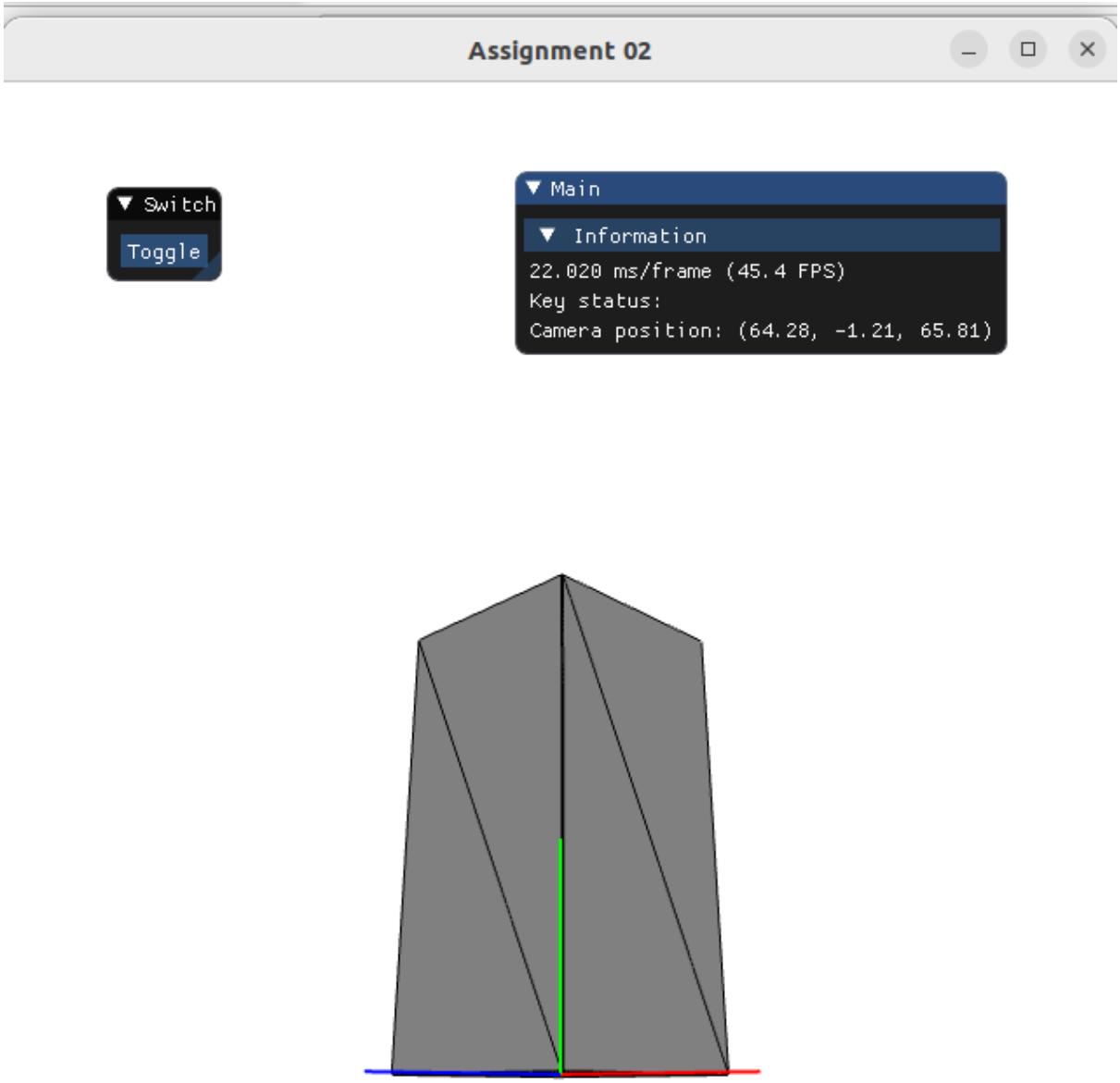
Two-point perspective



Birds eye view



Rat eye view


Assignment 02
Switch
Toggle
Main
Information
22.020 ms/frame (45.4 FPS)
Key status:
Camera position: (64.28, -1.21, 65.81)

Question 2)

Part a)

I have used a button called switch. When we press ‘toggle’ it toggles between perspective and orthographic projection.

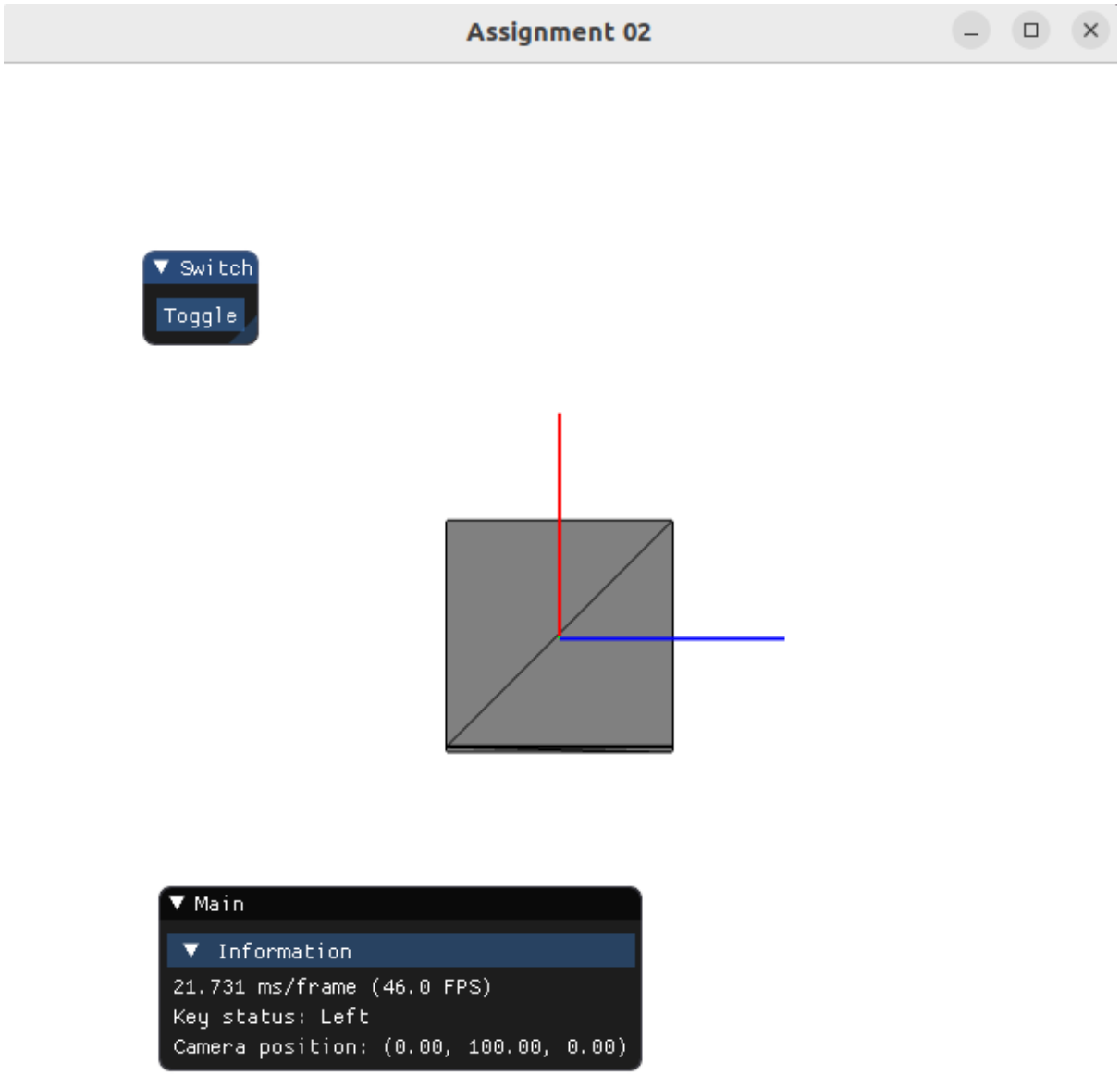
For orthographic projection I have used glm::ortho() function which takes input the distances of sides of the cuboid from the origin. It then maps everything in this cuboid to the screen. So we have to make sure that the width and the height of the cuboid has the same aspect ratio as that of our screen. This can be done using the variable –

Float aspect = (GLfloat)screen_width/(GLfloat)screen_height. We must maintain this ratio. As for the value for the znear and zfar we must set them in a way that the target shape always remains in this cuboid even when rotated this was done using trial and error.

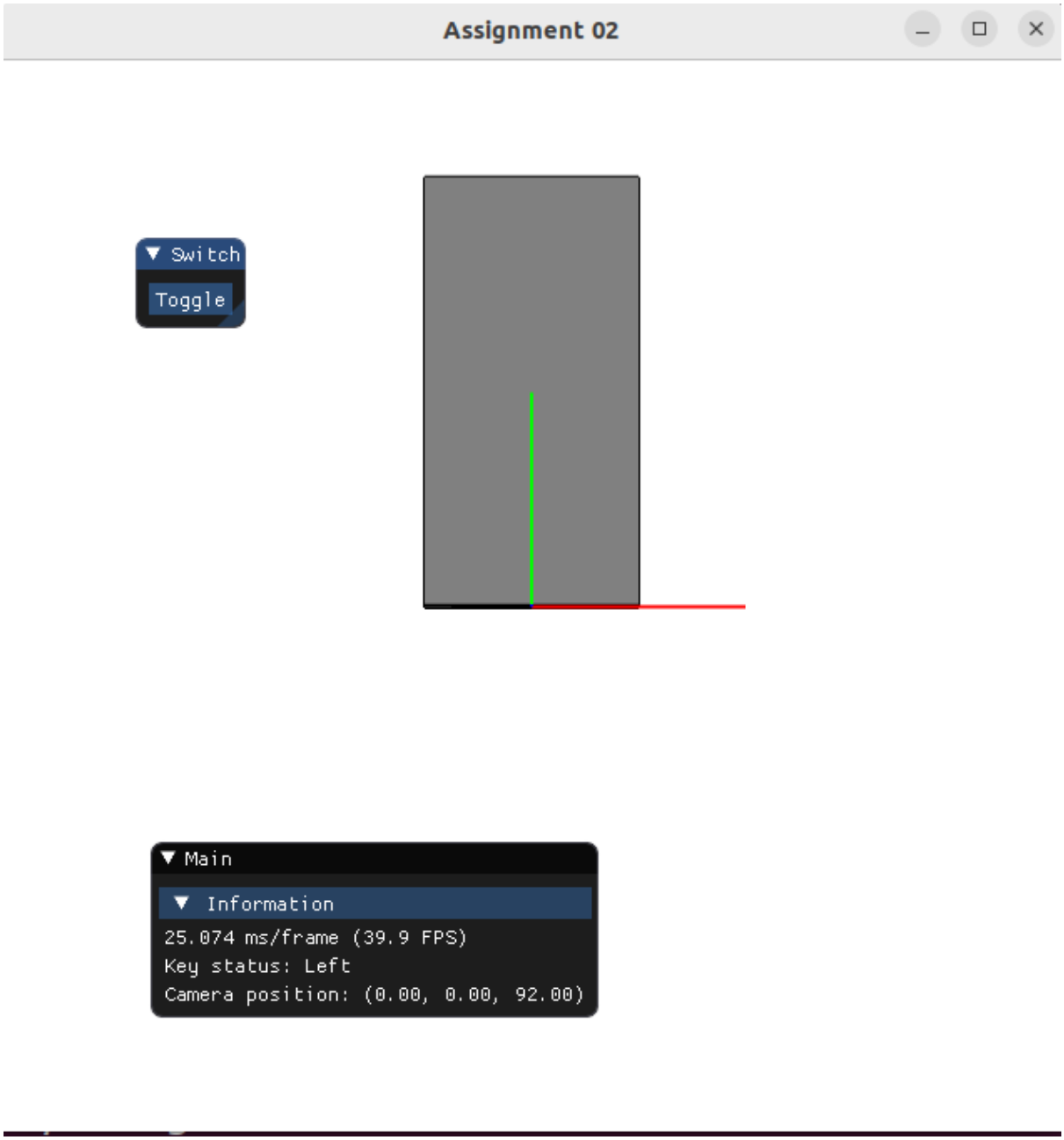
Part b)

When user presses the ‘Z’ key while in the orthographic projection then the view changes between top view, front view, side view in a circular fashion.

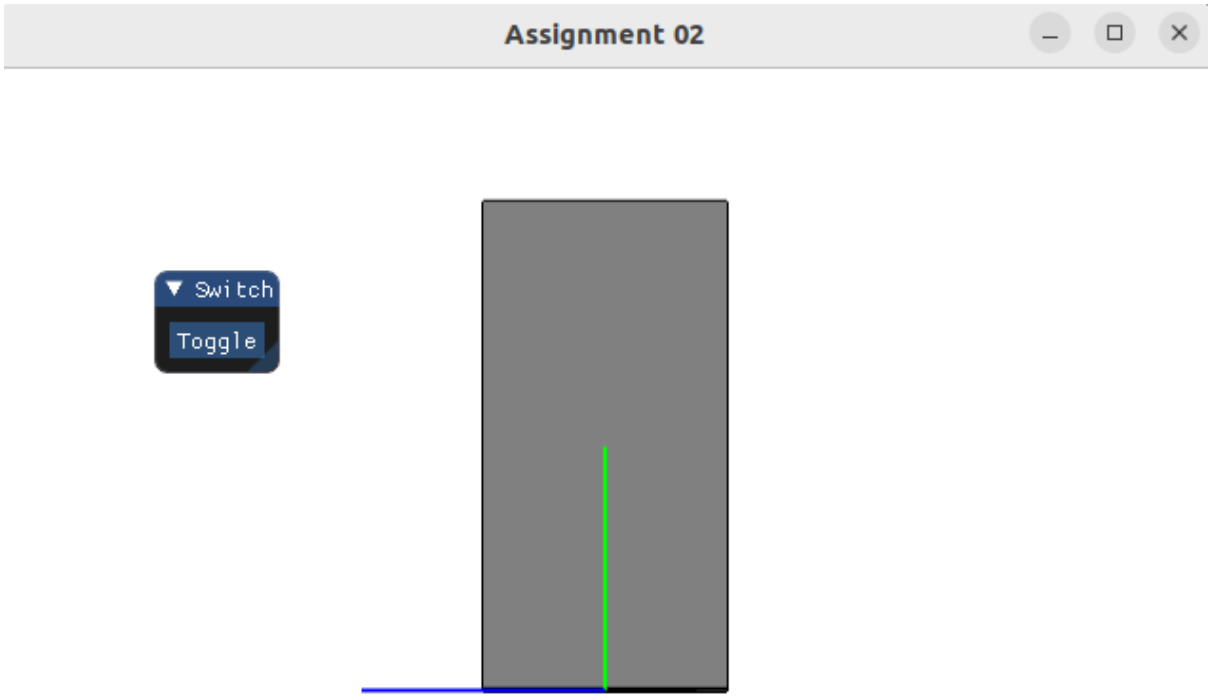
Top view



Front View


Assignment 02
Switch
Toggle
Main
Information
25.074 ms/frame (39.9 FPS)
Key status: Left
Camera position: (0.00, 0.00, 92.00)

Side View


Assignment 02
Switch
Toggle
Main
Information
21.036 ms/frame (47.5 FPS)
Key status: Left
Camera position: (92.00, 0.00, 0.00)

Question 3)

$$z'(z) = n + f - \frac{nf}{z}$$

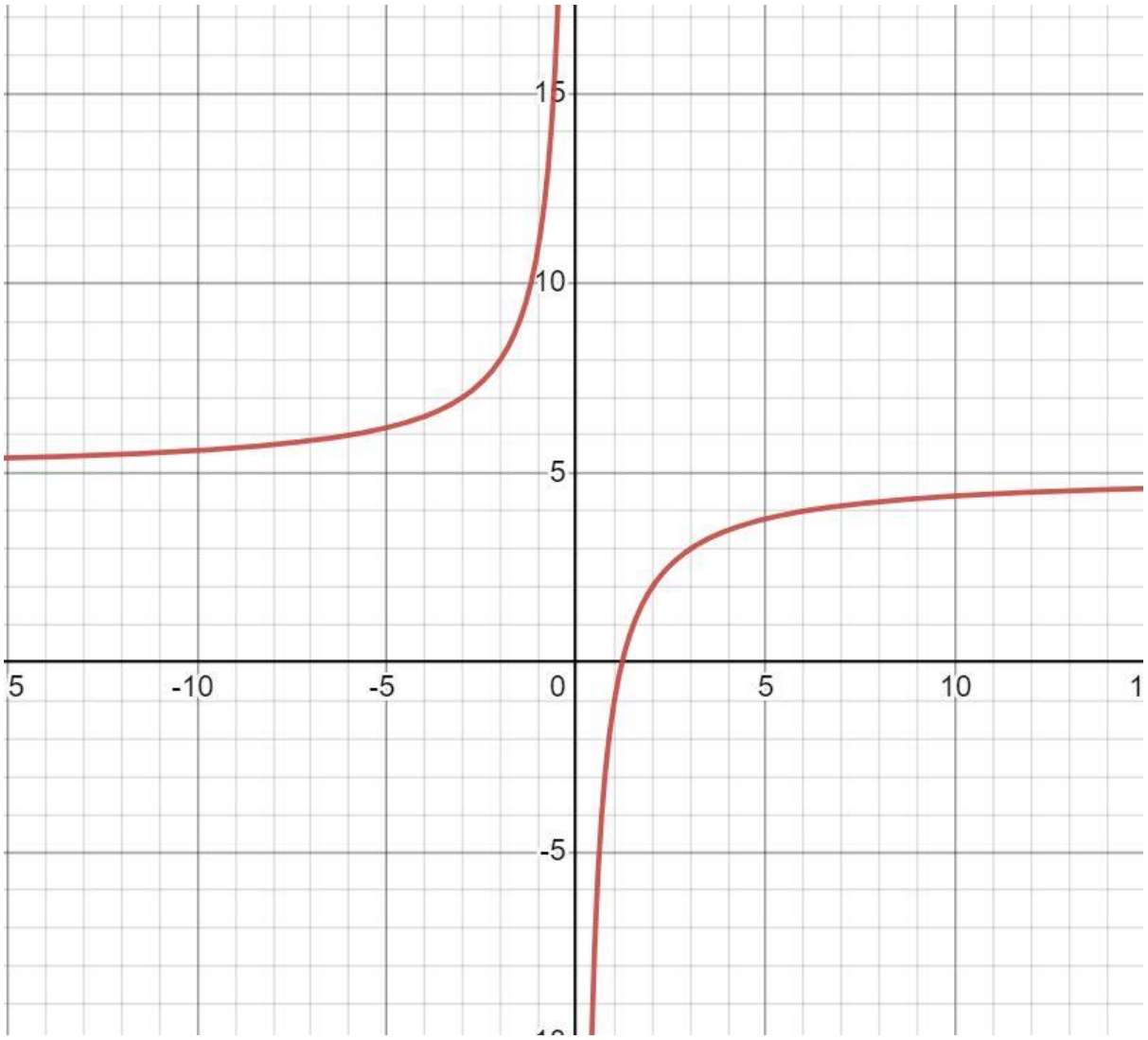
Differentiating with respect to z (n and f are constant with respect to z)

$$\frac{dz'}{dz} = 0 + 0 - \frac{nf}{z^{-2}}$$

$$\frac{dz'}{dz} = \frac{nf}{z^2}$$

We can clearly see that the derivative is positive for positive z. This means this function is monotonic. This means mapping z' leaves the order of z values intact post projection.

Graph of Z’(z) vs z.



Y axis -> Z’(z)

X axis -> z