

You Are the Rendering Engine

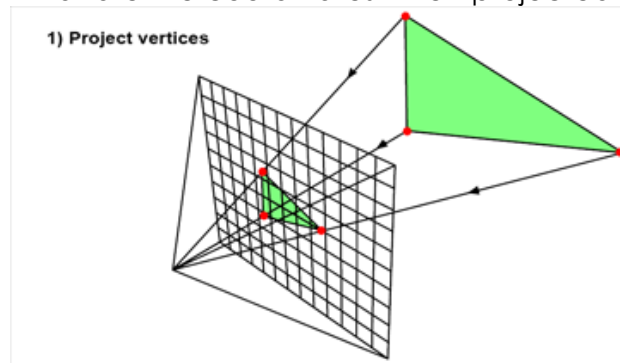
1. Projection

Imagine we construct a digital model of a scene with a single triangle. In our world coordinate system, the vertices of the triangle are at:

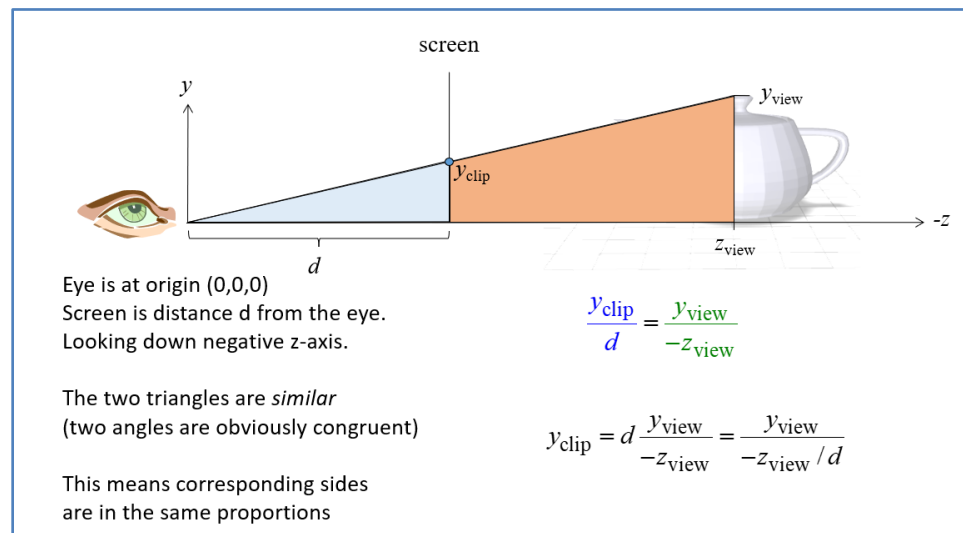
$v1=(-4, 4,-4)$, $v2=(4,4,-4)$, $v3=(4,-4,-8)$

We place the eyepoint at $(0,0,0)$ and will use perspective projection.

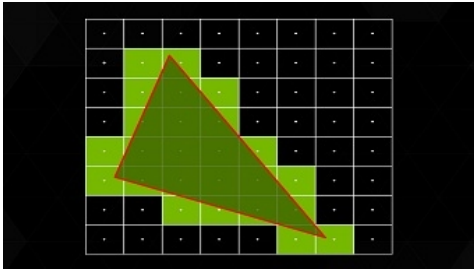
What are the coordinates when projected onto the image plane $z = -1$?



Below, you can see how to compute a perspective projection for the y coordinate of a vertex. Projecting an x coordinate is done similarly. The z coordinate in this case will project to $z=-1$, since that is the location of the image plane.



2. Rasterization



The raster (set of pixels) we are generating is an 8x8 grid of pixels centered on $(0,0,-1)$ with the bottom left corner at $(-2,-2,-1)$ and the top right corner at $(2,2,-1)$ in world coordinates.

We want to generate a list of pixels to light up that corresponds to projection of the triangle on the view plane. To refer to the pixels, we will use **viewport coordinates**. These are 2D coordinates where (m,n) indicates the pixel in row m and column n of the raster. The bottom left pixel has viewport coordinates $(0,0)$. Which pixels will be lit up for the triangle from question 1? You can find this by drawing on the grid below and coloring in any pixels the triangle crosses.

