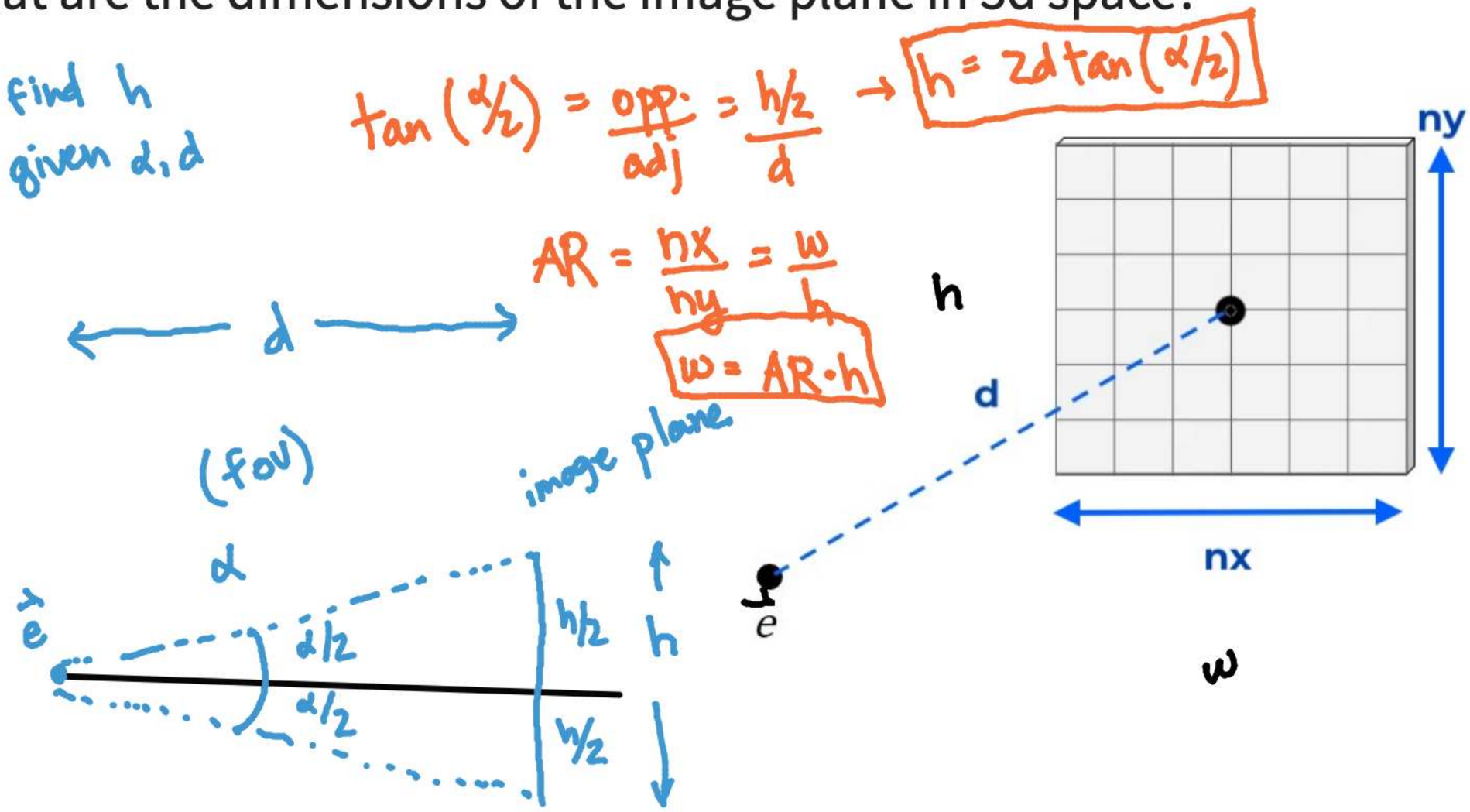
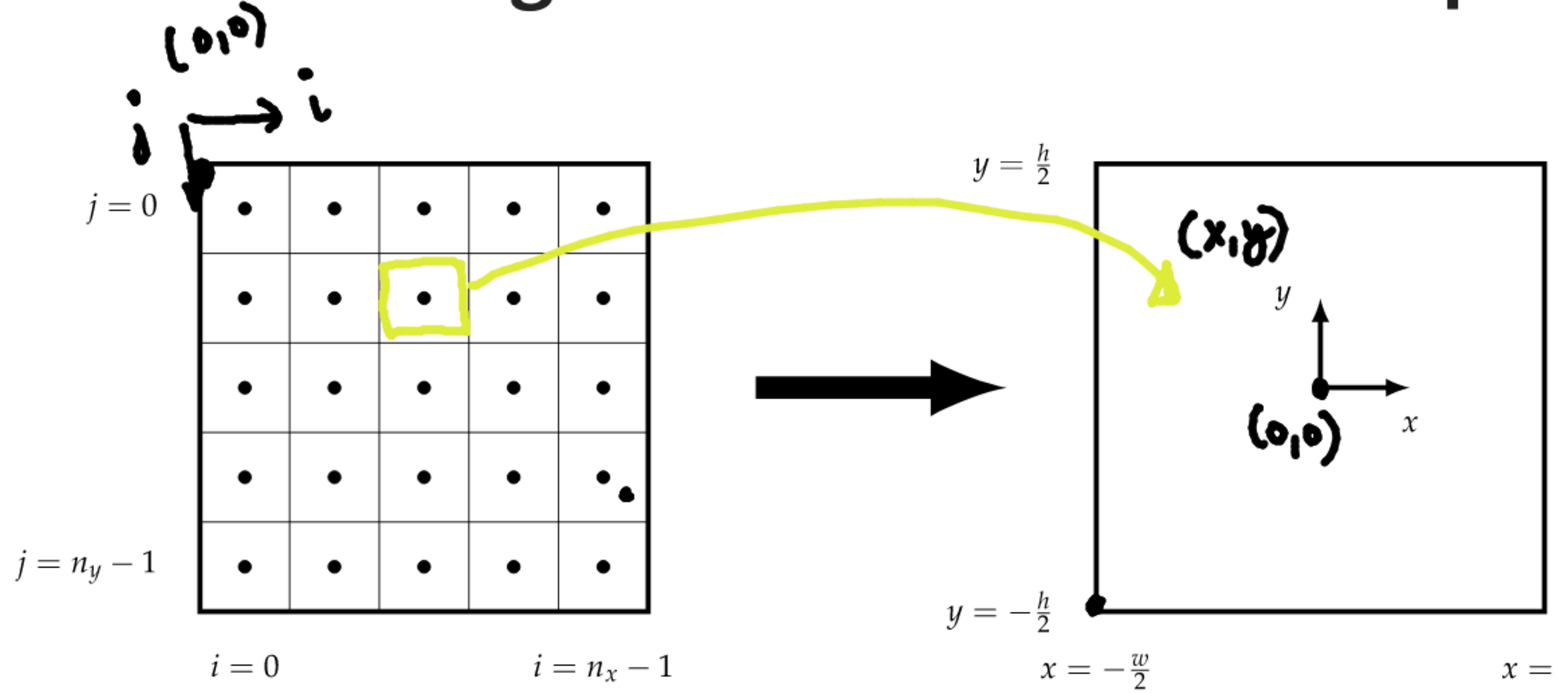
Step 1: setting up a camera and image plane.

What are the dimensions of the image plane in 3d space?



Step 2a: Calculating the 3d coordinates of a pixel.

spp
"samples per pixel"



$$x = -\frac{w}{2} + \frac{w}{nx}(i + 0.5)$$

$$y = \frac{-h}{2} + \frac{h}{ny}(ny - 0.5 - j)$$

Calculating the intersection of a ray with a sphere.

$$At^2 + 2tB + C = 0$$

quadratic eq'n.

$A = 1$ (assume $\|\vec{r}\| = 1$)

$t = -B \pm \sqrt{B^2 - C}$

$A = \|\vec{r}\|^2$

$B = \vec{r} \cdot (\vec{e} - \vec{c})$

$C = \|\vec{e} - \vec{c}\|^2 - R^2$

always normalize $\vec{r}$ (ray direction).

what happens $B^2 - C < 0$?

no intersection!

$= 0$? one intersection

> 0 two intersections