FOV
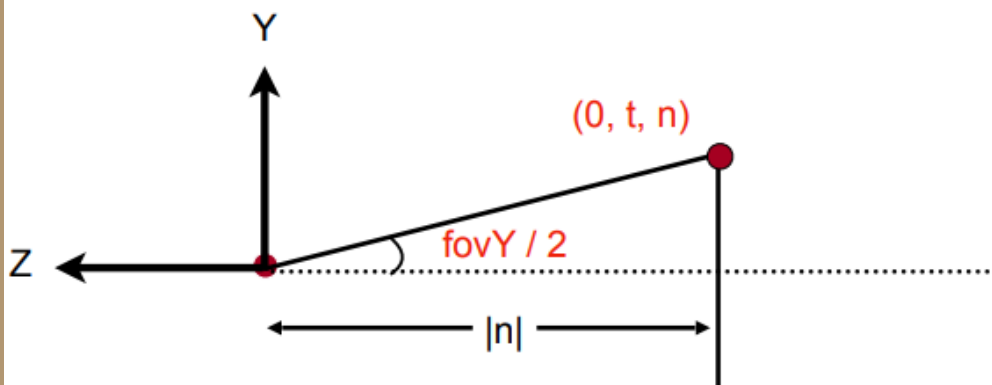
- ## How to convert from fovY and aspect to l, r, b, t?
  - Trivial

$$\tan \frac{fovY}{2} = \frac{t}{|n|}$$
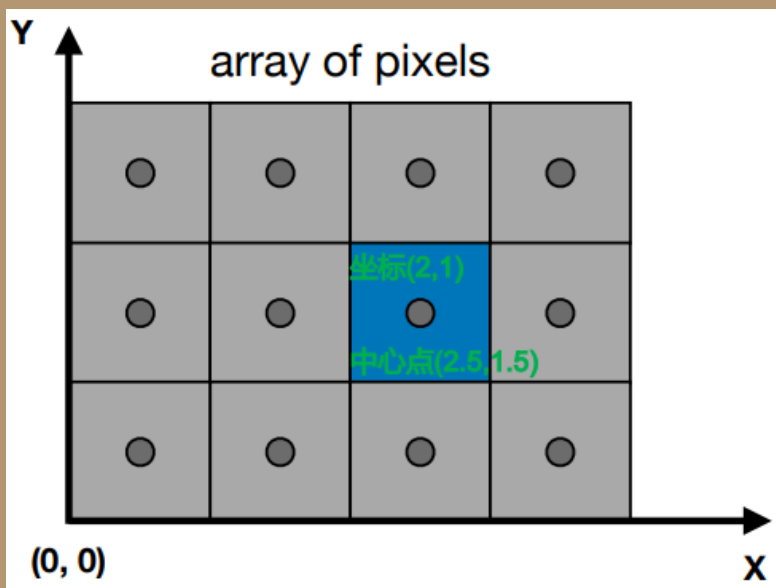
$$aspect = \frac{r}{t}$$

MVP

https://www.notion.so/MVP-8b56ec2e06b84af4af34b4bf28de4bab

Canonical Cube to Screen

光栅：把东西画在屏幕上，在德语中光栅表示屏幕

像素索引从(0,0)到
(width-1,height-1)

像素的中心在
(x+0.5,y+0.5)

屏幕覆盖(0,0)到
(width,height)

Transform in xy plane: $[-1, 1]^2$ to $[0, width] \times [0, height]$

Viewport transform matrix:

$$M_{viewport} = \begin{pmatrix} \frac{width}{2} & 0 & 0 & \frac{width}{2} \\ 0 & \frac{height}{2} & 0 & \frac{height}{2} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

从屏幕坐标看，相当于将屏幕的(0,0)点从左下角平移到屏幕中心
从Canonical Cube看，相当于将所有坐标点向右平移width/2，向上平移height/2

[-1,1]相当于[0,2]的范围，将其扩大width/2和height/2倍

将Canonical cube映射到屏幕坐标后，如果中心点在屏幕左下角，将有3/4画面看不到

Rasterization:Drawing to Raster Displays

Sampling a Function

给一个连续函数，在不同的地方问值是多少

采样：把一个函数离散化的过程，例如f(x)=sin(x),在x=1,2,3,...,100...的位置值是多少

Evaluating a function at a point is sampling.

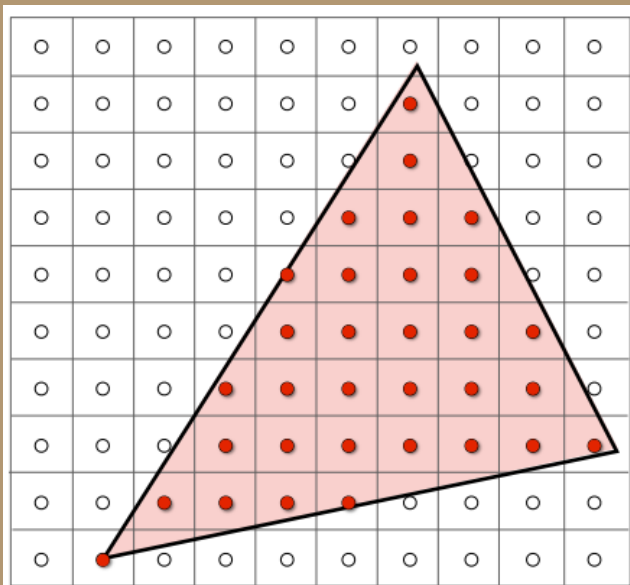We can discretize a function by sampling.

```
for (int x = 0; x < xmax; ++x)
    output[x] = f(x);
```
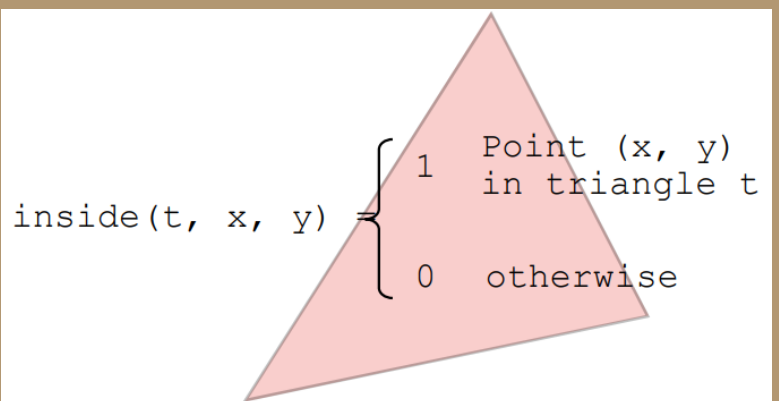
Sampling is a core idea in graphics.
We sample time (1D), area (2D), direction (2D), volume (3D) …

用像素中心对屏幕空间进行采样

采样判断一个像素中心是否在三角形内


```
for (int x = 0; x < xmax; ++x)
    for (int y = 0; y < ymax; ++y)
        image[x][y] = inside(tri,x + 0.5,y + 0.5);
```

$$\text{inside(t, x, y)} = \begin{cases} 1 & \text{Point (x, y) in triangle t} \\ 0 & \text{otherwise} \end{cases}$$

通过叉积判断一个点是否在三角形内