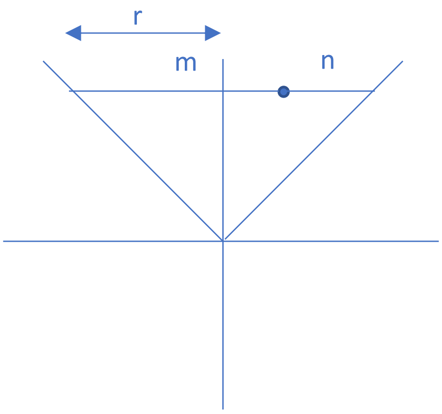
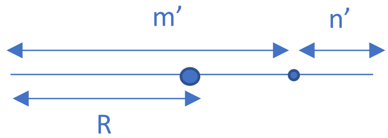
Pixel Range Formula:



(x, y)

GAME



(x’, y’)

SCREEN

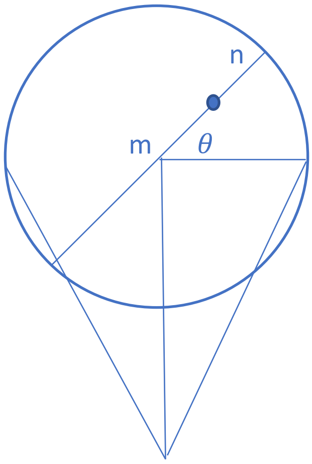
$$\frac{r-x}{r+x} = \frac{R-x'}{R+x'}$$

$$\tan\left(\frac{\theta}{2}\right) = \frac{r}{y}$$

$$y\tan\left(\frac{\theta}{2}\right) = r$$

$$\frac{y\tan(\frac{\theta}{2}) - x}{y\tan\left(\frac{\theta}{2}\right) + x} = \frac{R-x'}{R+x'}$$

$$x' = \frac{x}{y} R\cot\left(\frac{\theta}{2}\right)$$

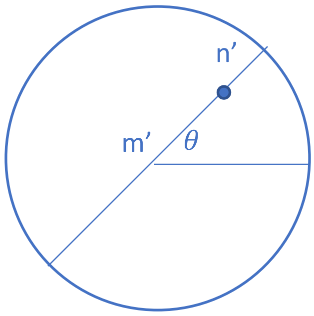


(x, y, z)

GAME

(x', y')

SCREEN



$$\sqrt{x'^2 + y'^2} = \frac{\sqrt{x^2 + y^2}}{z} R \cot\left(\frac{\theta}{2}\right)$$

$$\frac{y}{x} x' = y'$$

$$\sqrt{\frac{x'^2 y^2}{x^2} + x'^2} = \frac{x' \sqrt{x^2 + y^2}}{x} = \frac{\sqrt{x^2 + y^2}}{z} R \cot\left(\frac{\theta}{2}\right)$$

$$x' = \frac{x}{z} R \cot\left(\frac{\theta}{2}\right)$$

$$y' = \frac{y}{z} R \cot\left(\frac{\theta}{2}\right)$$

Inside Triangle Formula:

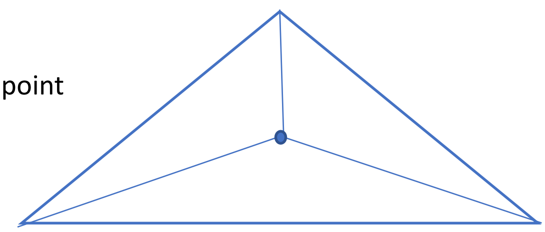
$$(\vec{q} - \vec{p}) \times (\vec{r} - \vec{p}) = \vec{n} = a\hat{\imath} + b\hat{\jmath} + c\hat{k}$$

If p, q, r are position vectors of a triangle

$$\frac{\sqrt{a^2 + b^2 + c^2}}{2} = area\ of\ triangle$$

If this is triangle ABC with a point

O inside it



ar(ABC) = ar(AOC)+ar(AOB)+ar(BOC)

Z Buffer:

For all triangle

For all pixels in range by projection if z is in range

Find plane of triangle

Find intersection point of ray and plane

If point inside triangle

Fill texture or simple colour in the frame buffer

Finding intersection point formula:

$ax + by + cz = \vec{n} \cdot \vec{p}$

Because of the plane equation of the triangle this equation is satisfied as n and p are defined above

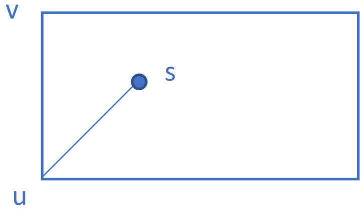
If we use projection formula to find ray and intersect in the plane we get

$$z = \frac{\vec{n} \cdot \vec{p}}{\frac{ax' + by'}{k} + c}$$

$$y = \frac{\vec{n} \cdot \vec{p}}{\frac{ax' + ck}{y'} + b}$$

$$x = \frac{\vec{n} \cdot \vec{p}}{\frac{ck + by'}{x'} + a}$$

Texture:



$\frac{(\vec{v}-\vec{u})\cdot(\vec{s}-\vec{u})}{|\vec{v}-\vec{u}|\,|\vec{s}-\vec{u}|} = \cos\theta$

$|\vec{s} - \vec{u}| \cos\theta = x'$

$|\vec{s} - \vec{u}| \sin\theta = y'$

Rotation:

$x' = x\cos\theta - y\sin\theta$

$y' = x\sin\theta + y\cos\theta$