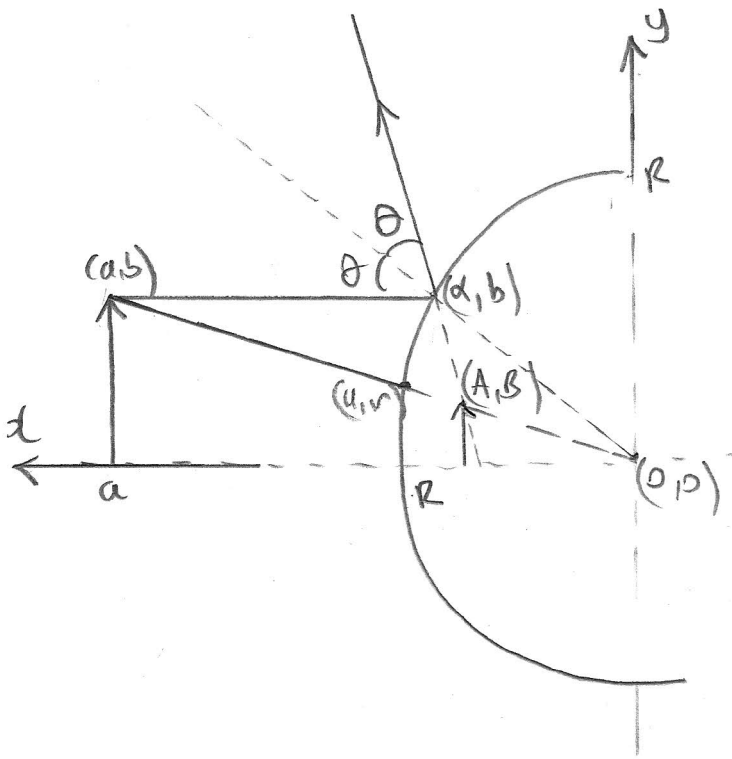
Virtual image in a convex mirror



Object at (a,b)

Virtual image at (A,B)

$\alpha^2+b^2=R^2$

$\therefore \boxed{\alpha=\sqrt{R^2-b^2}}$

$\tan\theta=\frac{b}{\alpha}$

$\therefore \boxed{\theta=\tan^{-1}\left(\frac{b}{\sqrt{R^2-b^2}}\right)}$

(A,B) is intersection of lines $y=\frac{b}{a}x$ and $\frac{y-b}{x-\alpha}=\tan 2\theta$

i.e. $y=\left(x-\sqrt{R^2-b^2}\right)\tan 2\theta+b$

$\therefore \frac{bx}{a}=\left(x-\sqrt{R^2-b^2}\right)\tan 2\theta+b$

$\tan 2\theta\sqrt{R^2-b^2}-b=\left(\tan 2\theta-\frac{b}{a}\right)x$

$\therefore \boxed{A=\dfrac{\tan 2\theta\sqrt{R^2-b^2}-b}{\tan 2\theta-\frac{b}{a}}}$

$\boxed{B=\frac{b}{a}A}$

$u^2+v^2=R^2$

$\frac{v}{u}=\frac{b}{a}$

$\therefore \boxed{v=\frac{b}{a}u}$

$u^2+\frac{b^2}{a^2}u^2=R^2$

$\boxed{u=\dfrac{R}{\sqrt{1+\frac{b^2}{a^2}}}}$