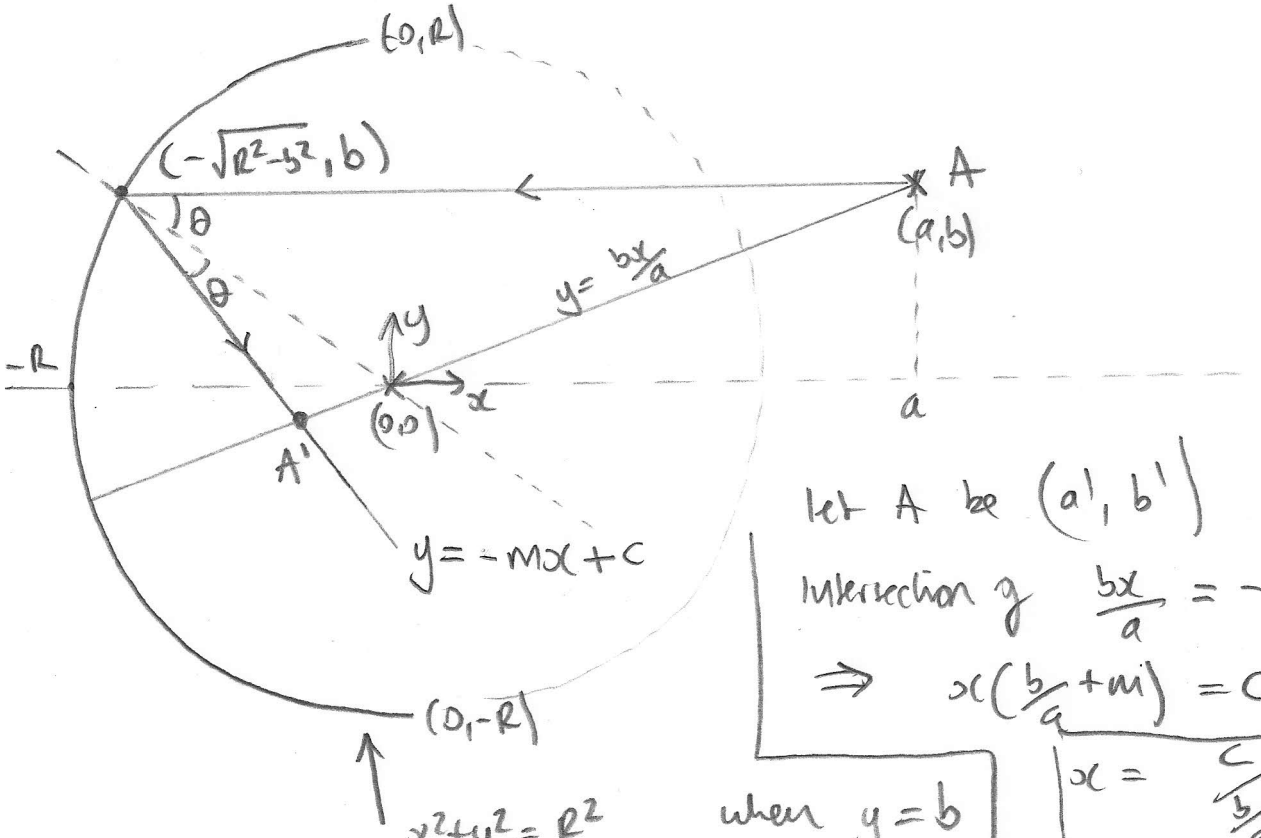
Reflection in a concave spherical mirror



let A be (a', b')

intersection of $\frac{bx}{a} = -mx + c$

$\Rightarrow x\left(\frac{b}{a} + m\right) = c$

$$x = \frac{c}{\frac{b}{a} + m}$$

when $y = b$

$x^2 = R^2 - b^2$

$x = -\sqrt{R^2-b^2}$ (assume C behind centre of curvature)

$$\tan\theta = \frac{b}{\sqrt{R^2-b^2}}$$

$m = \tan 2\theta$

$b = -\tan 2\theta\left(-\sqrt{R^2-b^2}\right) + c$

$\therefore \quad c = b - \sqrt{R^2-b^2}\tan 2\theta$

$$c = b - \frac{2b(R^2-b^2)}{R^2-2b^2}$$

So $y = \frac{-2b}{R^2-2b^2}\sqrt{R^2-b^2}\,x + c$

$$\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta} = \frac{2b}{\sqrt{R^2-b^2}} \frac{1}{1-\frac{b^2}{R^2-b^2}} = \frac{2b(R^2-b^2}{\sqrt{R^2-b^2}\ R^2-2b^2}$$

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