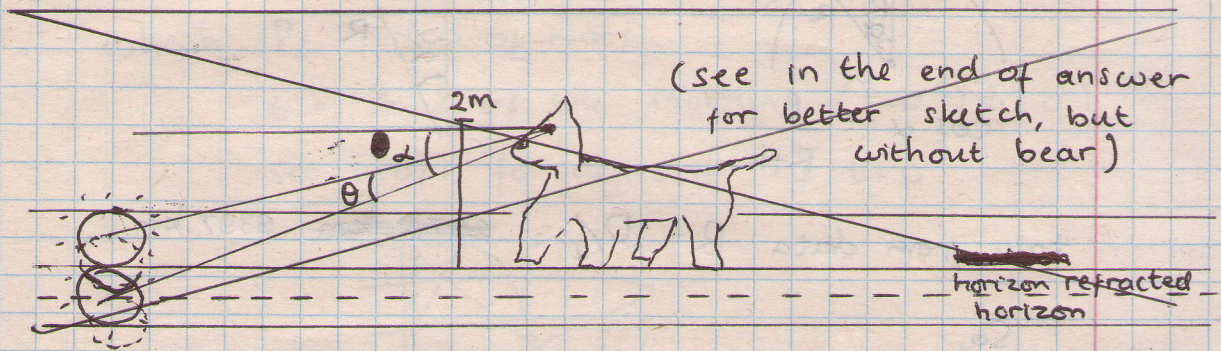


3. Define sunrise from the first touch until last touch for the sun with horizon (see picture after answer)



Actually, the bear have angle of dip and refraction due to atmosphere. It will start the sunrise faster but the sun will pass the horizon faster too (which means the sun isn't in "sunrise" condition again)

~~So, those effect will be neglected~~
It will make the δ of sunrise different

Answer

~~δ of sun~~

-) the sun will rise when

$$(-\delta) = \text{refraction } (r) + \text{angle of dip } (\alpha)$$

until

$$\delta' = (-\delta) + \theta$$