Assignment 6

Exercise 4

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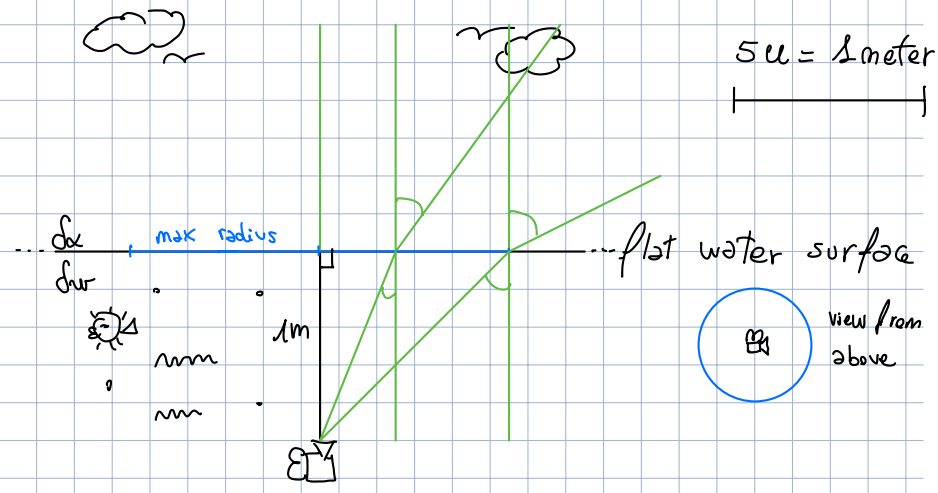
camera

1 meter = camera location below water

0.1 = δ_{air} air index refraction

$\sqrt{2}$ = δ_{wat} water index refraction

? max radius of circle on water surface through which camera capture objects above



Find critical angle: $\frac{\delta_1}{\delta_2} \cdot \sin\theta_1 = 1$ where δ_1, δ_2 = index of refraction, δ_1 of material where camera is

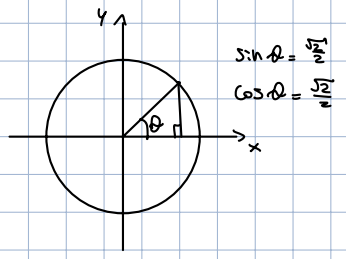
θ_1 = angle at surface between camera and normal of surface from δ_1

Then,

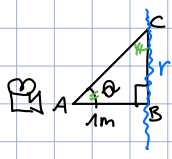
$$\frac{\delta_{wat}}{\delta_{air}} \cdot \sin\theta = 1 \rightarrow \frac{\sqrt{2}}{1} \cdot \sin\theta = 1 \rightarrow \sin\theta = \frac{1}{\sqrt{2}} \rightarrow \sin\theta = \frac{\sqrt{2}}{2} \rightarrow \arcsin\frac{\sqrt{2}}{2} = \theta$$

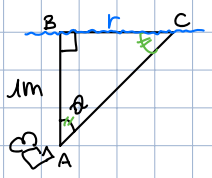
From:

$\theta = \frac{\pi}{4}$



$\theta = \frac{\pi}{4} = 45°$





$tg\,\theta = \frac{\overline{BC}}{\overline{AB}} = \frac{r}{1m}$

$$r = \overline{BC} = \overline{AB} \cdot tg\,\theta = 1m \cdot tg\,\frac{\pi}{4} = 1m \cdot 1 = 1m$$

Maximum circle radius on the water surface through which the camera can capture objects above surface is $\sqrt{2}m \approx 1,414\ m$