15. The water is medium 1, so $n_1 = n_w$ which we simply write as n. The air is medium 2, for which $n_2 \approx 1$. We refer points where the light rays strike the water surface as A (on the left side of Fig. 35-32) and B (on the right side of the picture). The point midway between A and B (the center point in the picture) is C. The penny P is directly below C, and the location of the "apparent" or Virtual penny is V. We note that the angle $\angle CVB$ (the same as $\angle CVA$) is equal to θ_2, and the angle $\angle CPB$ (the same as $\angle CPA$) is equal to θ_1. The triangles CVB and CPB share a common side, the horizontal distance from C to B (which we refer to as x). Therefore,

$$\tan\theta_2 = \frac{x}{d_\mathrm{a}} \qquad \text{and} \qquad \tan\theta_1 = \frac{x}{d} \quad .$$

Using the small angle approximation (so a ratio of tangents is nearly equal to a ratio of sines) and the law of refraction, we obtain

$$\begin{aligned} \frac{\tan\theta_2}{\tan\theta_1} &\approx \frac{\sin\theta_2}{\sin\theta_1} \\ \frac{\frac{x}{d_\mathrm{a}}}{\frac{x}{d}} &\approx \frac{n_1}{n_2} \\ \frac{d}{d_\mathrm{a}} &\approx n \end{aligned}$$

which yields the desired relation: $d_\mathrm{a} = d/n$.