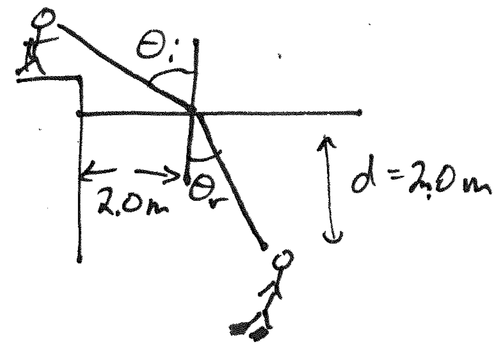
Ch.1 Prob. 45

From Problem 44



$\theta_r = 25.0°$

$n_{H_2O} = 1.333$

$n_{air} = 1.000$

and $n_1 \sin\theta_1 = n_2 \sin\theta_2 \rightarrow n_{air} \sin\theta_i = n_{H_2O} \sin\theta_r$

$$\sin\theta_i = \frac{n_{H_2O}}{n_{air}} \sin\theta_r$$

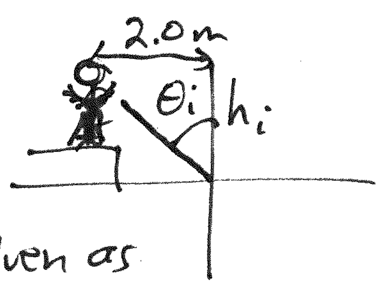
$$= \frac{1.333}{1.000} \sin 25.0°$$

$$\sin\theta_i = 0.563$$

$$\theta_i = 34.3°$$

Now for This problem

a) Find The height of The instructors head above The water



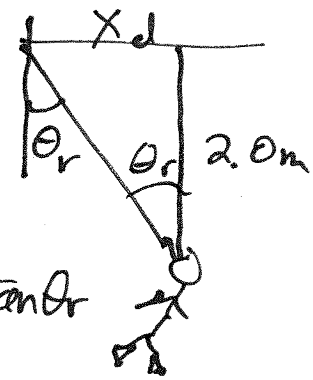
Using trigonometry height of The instructor h_i, is adjacent to The calculated angle. since The opposite side is given as 2.0m, Then The Trig function gives

$$\tan\theta_i = \frac{2.0\,m}{h_i} \rightarrow h_i = \frac{2.0\,m}{\tan\theta_i}$$

$$h_i = \frac{2.0\,m}{\tan 34.3°} = \boxed{2.93\,m}$$

b) Find the apparent depth of the diver below the water.

First find the distance the diver is from where the light from the diver intersects the surface of the water



Again, use trig.

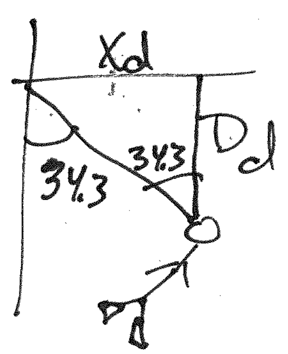
$$\tan\theta_r = \frac{X_d}{2.0m} \rightarrow X_d = 2.0\tan\theta_r$$

$$X_d = 2.0\tan(25.0°)$$

$$\underline{X_d = 0.933\,m}$$

As far as the instructor's concerned, the angle is 34.3° not 25.0°. Therefore, using this new angle gives a depth of

$$\tan 34.3° = \frac{X_d}{D_d}$$



$$D_d = \frac{X_d}{\tan 34.3°}$$

$$= \frac{0.933m}{\tan 34.3°} = \boxed{1.37\,m}$$