15. From highest level to lowest level is twice the amplitude x_m of the motion. The period is related to the angular frequency by Eq. 16-5. Thus, $x_m = \frac{1}{2}d$ and $\omega = 0.503$ rad/h. The phase constant ϕ in Eq. 16-3 is zero since we start our clock when $x_o = x_m$ (at the highest point). We solve for t when x is one-fourth of the total distance from highest to lowest level, or (which is the same) half the distance from highest level to middle level (where we locate the origin of coordinates). Thus, we seek t when the ocean surface is at $x = \frac{1}{2}x_m = \frac{1}{4}d$.

$$\begin{aligned} x &= x_m \cos(\omega t + \phi) \\ \frac{1}{4}d &= \left(\frac{1}{2}d\right)\cos(0.503t + 0) \\ \frac{1}{2} &= \cos(0.503t) \end{aligned}$$

which has $t = 2.08$ h as the smallest positive root. The calculator is in radians mode during this calculation.