

1. The rule: if you divide the time (in seconds) by 3, then you get (approximately) the straight-line distance d . We note that the speed of sound we are to use is given at the beginning of the problem section in the textbook, and that the speed of light is very much larger than the speed of sound. The proof of our rule is as follows:

$$t = t_{\text{sound}} - t_{\text{light}} \approx t_{\text{sound}} = \frac{d}{v_{\text{sound}}} = \frac{d}{343 \text{ m/s}} = \frac{d}{0.343 \text{ km/s}} .$$

Cross-multiplying yields (approximately) $(0.3 \text{ km/s})t = d$ which (since $1/3 \approx 0.3$) demonstrates why the rule works fairly well.