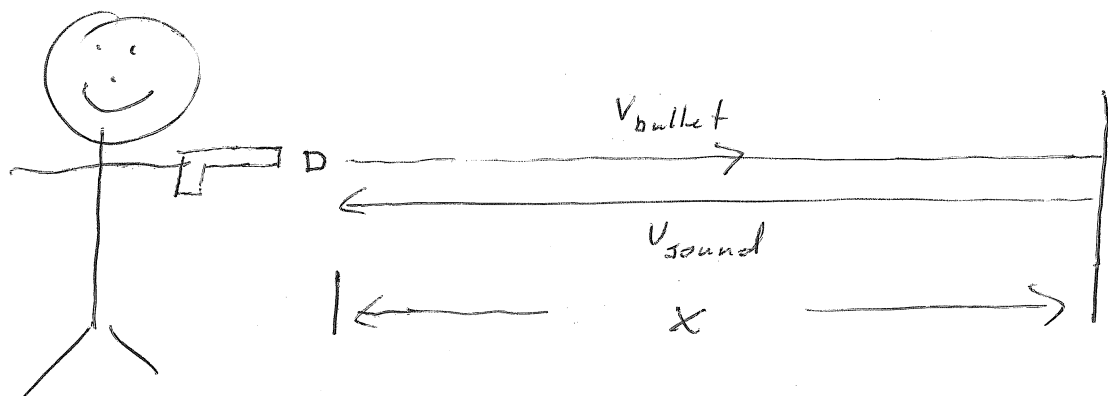


Example

①

James Bond fires a bullet at 130 m/s into a dark building. If he hears an impact report 2.15 later, how far is he from the impact point? ($v_{\text{sound}} \approx 343 \text{ m/s}$ ignore gravitational effects on the bullet.)



bullet

$$v = 130 \text{ m/s}$$

$$t = t_{\text{bullet}}$$

↑ Travels right

$$x = x$$

$$x_0 = 0 \text{ m}$$

$$x = 130 \text{ m/s } t_{\text{bullet}}$$

sound

$$v = -343 \text{ m/s}$$

$$t = t_{\text{sound}}$$

↖ Travels left

$$x_0 = x$$

$$x_0 = 0 \text{ m}$$

$$0 = x + (-343 \text{ m/s}) t_{\text{sound}}$$

$$t_{\text{bullet}} + t_{\text{sound}} = t_{\text{total}}$$

$$t_{\text{bullet}} + t_{\text{sound}} = 2.15$$

2

$$t_{\text{bullet}} = \frac{x}{130 \text{ m/s}}$$

$$t_{\text{sound}} = \frac{x}{343 \text{ m/s}}$$

$$\frac{x}{130 \text{ m/s}} + \frac{x}{343 \text{ m/s}} = 2.1 \text{ s}$$

$$x = \frac{2.1 \text{ s}}{\left(\frac{1}{130 \text{ m/s}} + \frac{1}{343 \text{ m/s}}\right)} = 197.97$$

198m