52. Drop a stone in the well...

\[ \text{time for rock to fall:} \]
\[ a_y = -\frac{1}{2} g t_r^2 \quad \text{so} \quad t_r = \sqrt{\frac{2 \Delta y_{\text{down}}}{-g}} \]

\[ \text{time for sound to travel:} \]
\[ a_y = v_s t_s \quad \text{so} \quad t_s = \frac{\Delta y_{\text{up}}}{v_s} \]

There are a few more things we know:

1. \( t_r + t_s = t_{\text{total}} = 3.20 \text{s} \)

\[ \sqrt{\frac{2 \Delta y_{\text{down}}}{-g}} + \frac{\Delta y_{\text{up}}}{v_s} = 3.20 \text{s} \]

\[ |\Delta y| = -\Delta y_{\text{down}} = \Delta y_{\text{up}}, \]
and then you can solve for \( \Delta y \) with a quadratic.

It’s not obvious, but

2. \( |\Delta y_{\text{down}}| = |\Delta y_{\text{up}}| \) \( \leftarrow \) That is, the well is the same distance down as it is up!

\[ \frac{1}{2} g t_r^2 = v_s t_s \quad \leftarrow \text{This looks nicer than (1) but there are two times we don’t know. But we know that} \]
\[ t_s + t_r = 3.20 \text{s}. \text{ So} \quad t_s = (3.20 \text{s} - t_r) \]

Now solve for \( t_r \)...

It’s a quadratic...

\[ \frac{1}{2} g (t_r^2) + v_s t_r - (3.20 \text{s}) v_s = 0 \]

\[ A = 4.90 \text{m/s}^2 \quad B = 343 \text{m/s} \quad C = -1097.6 \text{m} \]

\[ t_r = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A} = \frac{3.07 \text{s}}{2 \text{s}} \]

Not possible

Note: \( \Delta t_s = \frac{\Delta y}{v_s} = \frac{46.2 \text{m}}{343 \text{m/s}} = 1.35 \text{s} \)