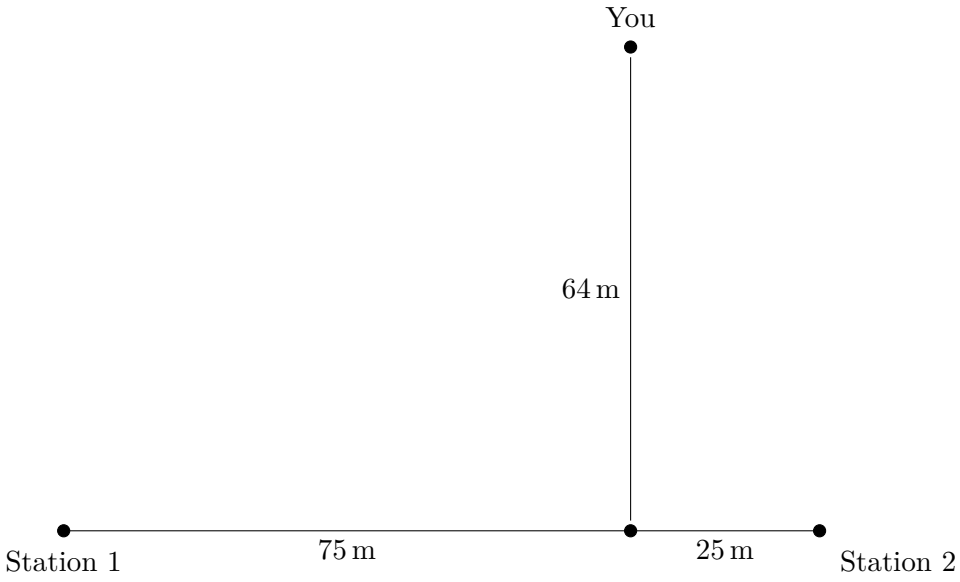
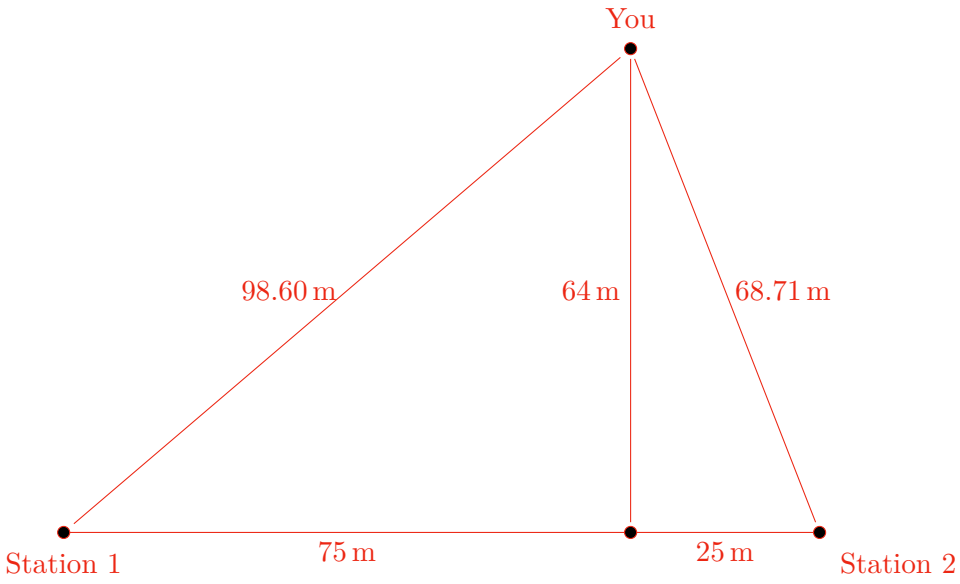
Physics 133 Physics IIb—Thermodynamics and Waves
Radio Tower Interference

Problem 1: (20 pts.) While hiking one day, you pass between two stations broadcasting identical radio waves. The stations are 100 m apart. When you are at a distance of 64 m from the line joining the two stations, you observe destructive interference between the signals from the two stations. What is the minimum possible frequency of the radio waves?



Problem 2: (20 pts.) While hiking one day, you pass between two stations broadcasting identical radio waves. The stations are 100 m apart. When you are at a distance of 64 m from the line joining the two stations, you observe destructive interference between the signals from the two stations. What is the minimum possible frequency of the radio waves?



$$\Delta r = 98.60\,\text{m} - 68.71\,\text{m} = 29.89\,\text{m}$$

For destructive interference, we want $\Delta r = \left(m + \frac{1}{2}\right)\lambda = \left(m + \frac{1}{2}\right)\frac{c}{f}$. Since Δr is fixed, a minimum f implies a maximum λ, which means $m = 0$.

$$\begin{aligned}
\Delta r &= \frac{1}{2}\lambda \\
\lambda &= 2\Delta r = \boxed{59.77\,\text{m}} \\
f &= \frac{c}{\lambda} = \frac{3 \times 10^8\,\text{m/s}}{59.77\,\text{m}} = \boxed{5.019\,\text{MHz}}
\end{aligned}$$