12. (25 Points) A source emits sound with a frequency of 1000 Hz. It is moving at a 20 m/s toward a reflecting wall. If the speed of sound is 340 m/s an observer at rest directly behind the source hears a beat frequency of:

\[ f_{\text{beat}} = |f_2 - f_1| = f \left( \frac{v}{v+v_s} - \frac{v}{v-v_s} \right) = f \left( \frac{v}{v+v_s} - \frac{1}{v-v_s} \right) \]

\[ = (1000 \text{ Hz})(340 \text{ m/s}) \left| \frac{1}{360 \text{ m/s}} - \frac{1}{320 \text{ m/s}} \right| \]

\[ = 118 \text{ Hz} \]