A train on one track moves in the same direction as a second train on the adjacent track. The first train, which is ahead of the second train and moves with a speed of 35.8 m/s, blows a horn whose frequency is 124 Hz. If the frequency heard on the second train is 133 Hz, what is its speed?

$$f' = \frac{\left(1 \pm \frac{V_o}{V}\right)}{\left(1 \mp \frac{V_s}{V}\right)} f$$

$V_s = 35.8\ m/s$

$f = 124\ Hz$

$f' = 133\ Hz$

$V_o = ?$

observer approaching + in numerator

Source receding from observer + in denominator

$$f' = \frac{\left(1 + \frac{v_o}{v}\right)}{\left(1 + \frac{v_s}{v}\right)} f$$

$$f'\left(1 + \frac{v_s}{v}\right) = \left(1 + \frac{v_o}{v}\right) f$$

$$f' + f'\left(\frac{v_s}{v}\right) = f + \left(\frac{f}{v}\right) v_o$$

$$\frac{f' - f + f'\left(\frac{v_s}{v}\right)}{\left(\frac{f}{v}\right)} = v_o = \frac{133\,Hz - 124\,Hz + 133\,Hz\left(\frac{35.8\,m/s}{343\,m/s}\right)}{\frac{124\,Hz}{343\,m/s}}$$

$$= 63.3\,m/s$$