20.75. Solve: We will closely follow the details of section 20.7 in the textbook. Figure 20.29 shows that the wave crests are stretched out behind the source. The wavelength detected by Pablo is $\lambda_- = \frac{1}{3}d$, where d is the distance the wave has moved plus the distance the source has moved at time $t = 3T$. These distances are $\Delta x_{\text{wave}} = vt = 3vT$ and $\Delta x_{\text{source}} = v_S t = 3v_S T$. The wavelength of the wave emitted by a receding source is thus

$$\lambda_- = \frac{d}{3} = \frac{\Delta x_{\text{wave}} + \Delta x_{\text{source}}}{3} = \frac{3vT + 3v_S T}{3} = (v + v_S)T$$

The frequency detected in Pablo's direction is thus

$$f_- = \frac{v}{\lambda_-} = \frac{v}{(v + v_s)T} = \frac{f_0}{1 + v_S/v}$$