p 349 49 – 53 odd (Assume speed of sound 343 ms^{-1} in air)

(49) (a) $f' = f\left(\frac{v + u_o}{v}\right) = 1550\,Hz\left(\frac{343\,ms^{-1} + 30\,ms^{-1}}{343\,ms^{-1}}\right)$

$= \underline{1690\,Hz}$

(b) $f' = f\left(\frac{v - u_o}{v}\right) = 1550\,Hz\left(\frac{343\,ms^{-1} - 30\,ms^{-1}}{343\,ms^{-1}}\right)$

$= \underline{1410\,Hz}$

(51) (a) Source Moving $f' = f\left(\frac{v}{v - u_s}\right) = 2000\,Hz\left(\frac{343\,ms^{-1}}{343\,ms^{-1} - 15\,ms^{-1}}\right)$

$= 2091\,Hz$

Observer Moving $f' = f\left(\frac{v + u_o}{v}\right) = 2000\,Hz\left(\frac{343\,ms^{-1} + 15\,ms^{-1}}{343\,ms^{-1}}\right)$

$= 2087\,Hz$

They are close but not the same: difference 4 Hz

(b) Source Moving $f' = 2000\,Hz\left(\frac{343\,ms^{-1}}{343\,ms^{-1} - 150\,ms^{-1}}\right) = 3554\,Hz$

Observer Moving $f' = 2000\,Hz\left(\frac{343\,ms^{-1} + 150\,ms^{-1}}{343\,ms^{-1}}\right) = 2875\,Hz$

NOT very close: difference 679 Hz

(c) Source moving $f' = 2000\,Hz\left(\frac{343\,ms^{-1}}{343\,ms^{-1} - 300\,ms^{-1}}\right) = 15954\,Hz$

Observer moving $f' = 2000\,Hz\left(\frac{343\,ms^{-1} + 300\,ms^{-1}}{343\,ms^{-1}}\right) = 3749\,Hz$

Why ~~sss~~

∴ The Doppler formulas are symmetrical at low speeds only.

(53) bat to object
(stationary) (moving)

$$f' = f\left(\frac{v - u_o}{v}\right)$$

$$= 50 \times 10^3 \text{ Hz}\left(\frac{343 \text{ ms}^{-1} - 25 \text{ ms}^{-1}}{343 \text{ ms}^{-1}}\right)$$

$$= 46\,356 \text{ Hz}$$

object to bat
(moving) (stationary)

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

$$= 46\,356\left(\frac{343 \text{ ms}^{-1}}{343 \text{ ms}^{-1} + 25 \text{ ms}^{-1}}\right)$$

$$= \underline{4.32 \times 10^4 \text{ Hz}} = \underline{43.2 \text{ kHz}}$$