43. (a) Since the standing wave has three loops, the string is three half-wavelengths long: $L = 3\lambda/2$, or $\lambda = 2L/3$. If v is the wave speed, then the frequency is

$$f = \frac{v}{\lambda} = \frac{3v}{2L} = \frac{3(100\,\mathrm{m/s})}{2(3.0\,\mathrm{m})} = 50\ \mathrm{Hz}\ .$$

(b) The waves have the same amplitude, the same angular frequency, and the same angular wave number, but they travel in opposite directions. We take them to be $y_1 = y_m \sin(kx - \omega t)$ and $y_2 = y_m \sin(kx + \omega t)$. The amplitude y_m is half the maximum displacement of the standing wave, or $5.0 \times 10^{-3}\,\mathrm{m}$. The angular frequency is the same as that of the standing wave, or $\omega = 2\pi f = 2\pi(50\,\mathrm{Hz}) = 314\,\mathrm{rad/s}$. The angular wave number is $k = 2\pi/\lambda = 2\pi/(2.0\,\mathrm{m}) = 3.14\,\mathrm{m}^{-1}$. Thus,

$$y_1 = (5.0 \times 10^{-3}\,\mathrm{m}) \sin\left[\left(3.14\,\mathrm{m}^{-1}\right) x - \left(314\,\mathrm{s}^{-1}\right) t\right]$$

and

$$y_2 = \left(5.0 \times 10^{-3}\,\mathrm{m}\right) \sin\left[\left(3.14\,\mathrm{m}^{-1}\right) x + \left(314\,\mathrm{s}^{-1}\right) t\right]\ .$$