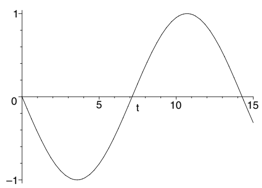
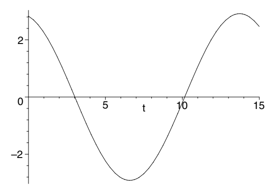
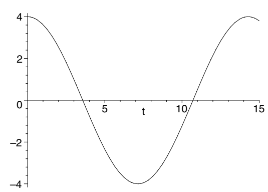
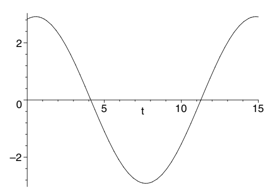
72. (a) The wave number for each wave is $k = 25.1/\mathrm{m}$, which means $\lambda = 2\pi/k = 250$ mm. The angular frequency is $\omega = 440/\mathrm{s}$; therefore, the period is $T = 2\pi/\omega = 14.3$ ms. We plot the superposition of the two waves $y = y_1 + y_2$ over the time interval $0 \le t \le 15$ ms. The first two graphs below show the oscillatory behavior at $x = 0$ (the graph on the left) and at $x = \lambda/8 \approx 31$ mm. The time unit is understood to be the millisecond and vertical axis (y) is in millimeters.

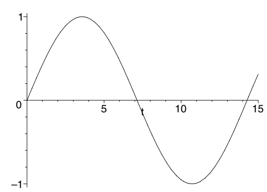




The following three graphs show the oscillation at $x = \lambda/4 \approx 63$ mm (graph on the left), at $x = 3\lambda/8 \approx 94$ mm (middle graph), and at $x = \lambda/2 \approx 125$ mm.







(b) If we think of wave y_1 as being made of two smaller waves going in the same direction, a wave y_{1a} of amplitude 1.50 mm (the same as y_2) and a wave y_{1b} of amplitude 1.00 mm. It is made clear in §17-11 that two equal-magnitude oppositely-moving waves form a standing wave pattern. Thus, waves y_{1a} and y_2 form a standing wave, which leaves y_{1b} as the remaining traveling wave. Since the argument of y_{1b} involves the subtraction $kx - \omega t$, then y_{1b} travels in the $+x$ direction.

(c) If y_2 (which travels in the $-x$ direction, which for simplicity will be called "leftward") had the larger amplitude, then the system would consist of a standing wave plus a leftward moving wave. A simple way to obtain such a situation would be to interchange the amplitudes of the given waves.

(d) Examining carefully the vertical axes, the graphs above certainly suggest that the largest amplitude of oscillation is $y_{\max} = 4.0$ mm and occurs at $x = \lambda/4$, and the smallest amplitude of oscillation is $y_{\min} = 1.0$ mm and occurs at $x = 0$ (and at $x = \lambda/2$).

(e) The largest and smallest amplitudes can be related to the amplitudes of y_1 and y_2 in a simple way: $y_{\max} = y_{1m} + y_{2m}$ and $y_{\min} = y_{1m} - y_{2m}$, where $y_{1m} = 2.5$ mm and $y_{2m} = 1.5$ mm are the amplitudes of the original traveling waves.