Problem 8.1

a)

$$f_B = B\cos\phi\sin(kx-\omega t) + B\sin\phi\cos(kx-\omega t)$$

b)

$$f_A + f_B = (A + B\cos\phi)\sin(kx-\omega t) + B\sin\phi\cos(kx-\omega t)$$

c)

$$D_1^2 + D_2^2 = A^2 + B^2\cos^2\phi + 2AB\cos\phi + B^2\sin^2\phi = A^2 + 2AB\cos\phi + B^2$$

$$\tan\phi = \frac{D_2}{D_1} = \frac{B\sin\phi}{A + B\cos\phi}$$

$$f_A + f_B = \sqrt{A^2 + 2AB\cos\phi + B^2}\sin\left(kx - \omega t + \arctan\left(\frac{B\sin\phi}{A + B\cos\phi}\right)\right)$$

d)

$$\text{Amplitude} = \sqrt{A^2 + 2AB\cos\phi + B^2}$$
$$\text{Speed} = \frac{\omega}{k}$$
$$\text{Phase } \psi = \arctan\frac{B\sin\phi}{A + B\cos\phi}$$

The wave form is still sinusoidal

$$\begin{aligned}\phi = 0 \Rightarrow f_A + f_B &= \sqrt{A^2 + 2AB + B^2}\sin(kx - \omega t + \arctan 0)\\ &= (A + B)\sin(kx - \omega t)\\ &= A\sin(kx - \omega t) + B\sin(kx - \omega t)\end{aligned}$$

e)

$$\begin{aligned}f_- + f_+ &= (A\sin kx\cos\omega t - \cos kx\sin\omega t) + (A\sin kx\cos\omega t + \cos kx\sin\omega t)\\ &= 2A\sin kx\cos\omega t\end{aligned}$$

f)

$$\text{Amplitude} = 2A$$

It is sinusoidal and it is not a traveling wave.