21.9. **Model:** Reflections at the string boundaries cause a standing wave on the string.
Visualize: Please refer to Figure Ex21.9.
Solve: **(a)** When the frequency is doubled $\left(f' = 2f_0\right)$, the wavelength is halved $\left(\lambda' = \frac{1}{2}\lambda_0\right)$. This halving of the wavelength will increase the number of antinodes to six.
(b) Increasing the tension by a factor of 4 means

$$v = \sqrt{\frac{T}{\mu}} \Rightarrow v' = \sqrt{\frac{T'}{\mu}} = \sqrt{\frac{4T}{\mu}} = 2v$$

For the string to continue to oscillate as a standing wave with three antinodes means $\lambda' = \lambda_0$. Hence,

$$v' = 2v \Rightarrow f'\lambda' = 2f_0\lambda_0 \Rightarrow f'\lambda_0 = 2f_0\lambda_0 \Rightarrow f' = 2f_0$$

That is, the new frequency is twice the original frequency.