1. Two loose ends: Doppler for Light, Intensity vs. Amplitude
2. Interference/Superposition, Reflection of Waves on Strings
3. Standing Waves (on Strings)

1. Doppler for Light:
   \[ f' = f \sqrt{\frac{1 - \beta}{1 + \beta}} \]
   One relevant speed: \( \beta \)

2. "Proportional to"
   \[ I \propto A^2 \]
   \[ I = A^2(\ldots) \]

3. Superposition
   \[ y_{\text{tot}} = y_1 + y_2 \]
At distance \( D \) from an isotropic source, the wave amplitude is \( A \). What is the wave amplitude at distance \( 2D \)?

\[
\begin{align*}
I_f &= CA_f^2 \\
I_0 &= CA_0^2 \\
\frac{1}{A} &= \frac{A_f}{A_0} \\
\frac{1}{2} &= \frac{A_f}{A_0} \\
\end{align*}
\]

(A) \( A \)  
(B) \( \frac{1}{\sqrt{2}} A \)  
(C) \( \sqrt{2} A \)  
(D) \( \frac{1}{\sqrt{2}} A \)  
(E) None of the above

\[
A_f = \left( \frac{1}{2} A_0 \right)
\]

A symmetric pulse is approaching the right end of a string tied to two walls, as shown below on the right. Which of the following best represents the shape of the string after it has completely reflected off the wall on the right?

1. None of the above.
2. None of the above.
3. None of the above.
4. None of the above.
A symmetric pulse is approaching the right end of a string tied to two walls, as shown below on the right. At the precise moment when half of the wave has hit the wall, which of the following best represents the shape of the string?

1.  
2.  
3.  
4.  
5. None of the above.

Two identical pulses move in opposite directions toward opposite ends of a string tied to two walls, as shown on the right. Which of the following represents possible shape(s) for the string after both pulses have undergone reflections and meet somewhere in the middle.

1.  
2.  
3.  
4.  
5. 3 AND 4.
6. None of the above.
Standing Waves

\[ y(x,t) = A(x) \cos(\omega t) \]

- \( m = 1 \) special \( x \)'s (and therefore freq.) "fit nicely" to produce standing waves.

- \( m = 2 \) "mode" = # antinodes "harmonic"

- \( \lambda(m=1) = 2L = \frac{2L}{1} \)

- \( \lambda(m=2) = L = \frac{2L}{2} \)

- \( \lambda(m=3) = \frac{2}{3}L \)

- \( \lambda_m = \frac{2L}{m} \)
A string is vibrating at 300 Hz. Using a strobe light and an ultra fast camera you get a picture of the string as sketched below. The blue walls are separated by 1 meter. What is the speed of the wave?

\[
\lambda = \frac{2}{3} L = \frac{2}{3} (1 \text{ m})
\]

\[
V = \lambda f = \left(\frac{2}{3} \text{ m}\right)(300 \text{ Hz}) = 200 \frac{m}{s}
\]

1. 50 m/s
2. 100 m/s
3. 150 m/s
4. 200 m/s
5. 300 m/s
6. None of the above

A string is vibrating at 300 Hz. Using a strobe light and an ultra fast camera you get a picture of the string as sketched below. The blue walls are separated by 1 meter. As determined in the previous question, the speed of the wave vibrating as shown is 200 m/s. What would its speed be if it were vibrating in the lowest possible frequency?

1. 50 m/s
2. 100 m/s
3. 150 m/s
4. 200 m/s
5. 300 m/s
6. None of the above.

ANS: Ambiguous... is the tension fixed, or the frequency?