Lab 3 solutions

1) Increasing the tension F increases v and f.

   Increasing the mass of the string (for fixed L) decreases v and f.

   A denser material for the string decreases v and f.

   Increasing the diameter of the string (for fixed L and mass density) decreases v and f.

   Increasing the length of the string L (for fixed mass density) leaves v unchanged but decreases f.

Part I
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1) Increasing the weight attached to the end of the string increases the tension, which increases both v and f.

Part II
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1) f1 = 165 Hz (approx)
   fN = N*f1 -> f2 = 330 Hz, f3 = 495 Hz, f4 = 660 Hz
   The harmonic frequencies are integer multiples of the fundamental.

2) f1 = v/2L -> v = f1*2L = 226 m/s

3) v = sqrt(F/mu) -> F = mu v^2 = 76.9 N

Part III
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1) ~25 harmonics. The amplitude of the 3rd harmonic is largest.

2) ~15 harmonics. The amplitudes of the harmonics are much less for the plucked string than the bowed string, especially for the higher harmonics.

3) Bowing excites the higher harmonics, while plucking excites only the lower harmonics. Bowing transfers more energy to the strings.