Frequency beating of sound waves

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Solution: *a. The beat frequency is,*

$$\tfrac{1}{2}(\nu_{frk} - \nu_a) = \pm 1 \ Hz \ .$$

Since $\nu_a \propto \sqrt{F_T}$ *and noting that, by increasing the voltage, an increase in the beat frequency is observed, we conclude* $\nu_a > \nu_{frk}$*. Hence,* $\nu_a = 402 \ Hz$*.*
b. We know

$$\tfrac{1}{2}(3\nu_d - 2\nu_a) = \pm 1 \ Hz \ .$$

Since by decreasing the tension (and therefore the frequency) of the d-string the harmonic frequencies coincide, we deduce,

$$\nu_d = \tfrac{2}{3}\nu_a + \tfrac{2}{3} \ Hz = 294 \ Hz \ .$$

After tuning we have $\nu_d' = \tfrac{2}{3}\nu_a = 293.3 \ Hz$*. Hence,*

$$\frac{F_T/\mu}{F_T'/\mu} = \left(\frac{\nu_d}{\nu_d'}\right)^2 = \left(\frac{293.3}{294}\right)^2 = 99.6\% \ .$$