9. Find the distance from the nut to the second fret if the saddle is 40cm from the nut.

$f_{2nd\,fret} = f_{nut}\left(2^{3/12}\right)$ $\quad f_{2nd\,fret} = 1Hz\left(2^{3/12}\right)$

Step 1 — make something up (1 Hz)

$f_{2nd\,fret} = 1.1225\,Hz$

Step 2 — $V = \lambda f$ $\quad V = 80cm\,(1Hz)$ $\quad V = 80cm/s$

N A N

$\lambda = 2L$ (2N, 1A)

$2 \times (40cm) = 80cm$

Step 3 — $V = \lambda f$ $\quad 80\ cm/s = \lambda\,(1.1225\,Hz)$

$\lambda_{2nd\,fret} = 71.3\,cm$

Step 4 — $\lambda_{2nd\,fret} = 71.3cm \Rightarrow$ vibrating string length $= \frac{71.3cm}{2} = 35.6cm$

$L = \frac{\lambda}{2}$

Step 5 — Old vibrating string length − New vibrating string length = 2nd fret distance from nut

$40cm - 35.6cm = 4.4cm$