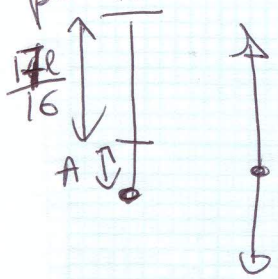
Amplitude is just be examining situation where particle was at rest.:



$T'' = \kappa\left(\frac{17\ell}{16} + A - \ell\right)$

$\Sigma F = m\,\text{accel}$ $\quad |\text{accel}| = \omega^2 x$ · at amplitude

$-T'' + 5mg = m\left[\omega^2 A\right]$

$-T'' + 5mg = m\left(4\sqrt{\frac{5}{\ell}}\right)^2 A$

$-\frac{48mg}{\ell}\left(\frac{\ell}{16} + A\right) + 5mg = \frac{4mg}{\ell} A$

$\Rightarrow \quad -3mg - \frac{48mg}{\ell} A + 5mg = \frac{4mg}{\ell} A.$

$\Rightarrow \quad 2 = \frac{48A}{\ell}$

$\Rightarrow \quad \frac{\ell}{24} = A.$