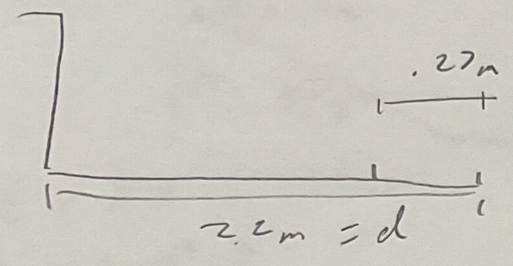
9)



$PE = \frac{1}{2}kx^2$ $\quad x = .011$

find x'

$KE = \frac{1}{2}mv^2 = \frac{1}{2}kx^2$

$\frac{1}{2}mv'^2 = \frac{1}{2}kx'^2$

$mv^2 = kx^2$

$v = \sqrt{\frac{kx^2}{m}} = \sqrt{\frac{k}{m}} \cdot x$

$\frac{1}{2}m\left(\frac{v'-.27}{d}\right)^2 = \frac{1}{2}kx^2$

$\frac{1}{2}m\left(\frac{vd}{d-.27}\right)^2 = \frac{1}{2}kx'^2$

$\sqrt{\frac{m}{k}\left(\frac{vd}{d-.27}\right)^2} = x'$

$= \sqrt{\frac{m}{k}}\left(\frac{vd}{d-.27}\right)$

$= \sqrt{\frac{m}{k}} \cdot \sqrt{\frac{k}{m}} \cdot \frac{xd}{d-.27}$

$= 1 \cdot \frac{xd}{d-.27} = \frac{.011 \cdot 2.2}{2.2 - .27}$ $\quad = .0125\,m$ $\quad = 1.25\,cm$

it takes t seconds to roll

$d = \frac{v'}{t}$ $\quad d - .27 = \frac{v}{t}$

$t = \frac{v'}{d}$ $\quad t = \frac{v}{d-.27}$

$\frac{v'}{d} = \frac{v}{d-.27}$

$v' = \frac{vd}{d-.27}$

$v = \frac{v'(d-.27)}{d} = v' - \frac{.27}{d}$

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