Answer on Question #66379, Physics / Electromagnetism

A chain hang over a nail with 2 m over one side & 6 m on another side. If the force of friction is equal to the wt. of 1.0 m of the chain, calculate the chain required for the chain to slide of the nail.

Solution:

Each part of the chain has the same displacement, speed and acceleration (magnitude).

Equation of motion:

Where, x(t) is length of the chain on the heavier side, L is the total length of the chain

$d^2x(t)/dt^2 = 2g/L * [x - (L+1)/2]$

$x(t) = (L+1)/2 + A \exp(\sqrt{(2g/L)}\, t)$

Given L = 8 m,

x(t=0sec) = 6 m

$x(0) = 9/2 + A \exp(\sqrt{2.5}\, t) = 6$ m

A = 3/2 m

$x(t) = 4.5 + 1.5 \exp(1.581\, t)$

Now to find time t

$x(t) = 4.5 + 1.5 \exp(1.581\, t) = 8$

t = 0.536 sec

Answer: 0.536 sec