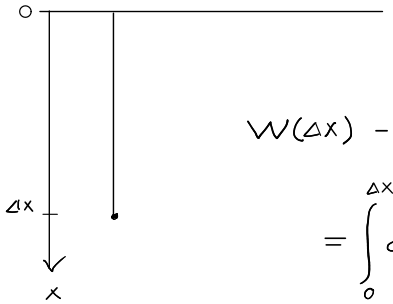
1-07-40

Force of a bungee cord is $\bar{F}(x) = k_1 x + k_2 x^3$, $k_1 = 204 \frac{N}{m}$, $k_2 = -0{,}233 \frac{N}{m^3}$

How much work is needed to strech it to $\Delta x = 16{,}7$ m



$$dW = \bar{F} \cdot d\bar{r}$$

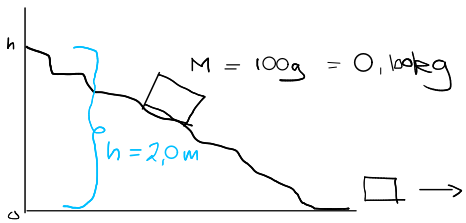
$$W(\Delta x) - W(0) = \int_0^{\Delta x} F(x)\,dx$$

$$= \int_0^{\Delta x} dx \left\{ k_1 x + k_2 x^3 \right\} = \left[k_1 \frac{x^2}{2} + k_2 \frac{x^4}{4} \right]_0^{\Delta x}$$

$$= k_1 \frac{(\Delta x)^2}{2} + k_2 \frac{(\Delta x)^4}{4}$$

$$W(16{,}7) = 204 \cdot \frac{(16{,}7)^2}{2} - 0{,}233 \cdot \frac{(16{,}7)^4}{4} = 2{,}39 \cdot 10^4 \text{ Nm} = \underline{23{,}9 \text{ kNm}}$$

1-07-64



How much work does the work of friction do?

$\square \rightarrow v = 4{,}0$ m/s

Total energy is conseved. Note initial with "i" and final with "f"

$E^i_{pot} = Mgh$, $E^f_{pot} = 0$, $\rightarrow \Delta E_{pot} = E^f_{pot} - E^i_{pot} = -Mgh$

$E^i_{kin} = 0$, $E^f_{kin} = \frac{1}{2} M v^2$, $\rightarrow \Delta E_{kin} = \frac{1}{2} M v^2$

If there was no resistance, then

$$\Delta E_{Total} = 0 = \Delta E_{kin} + \Delta E_{pot} = \frac{1}{2} M v^2 - Mgh$$

but we get $\Delta E_{Total} = -1{,}16$ Nm $\rightarrow \underline{-1{,}16 \text{ Nm}}$ is the work done by the friction

1-08-26

$$U(x) = -\frac{a}{x} + \frac{b}{x^2}$$

$$F = -\frac{dU(x)}{dx} = -\frac{a}{x^2} + \frac{2b}{x^3}$$

hvaða kraftur gæti þetta verið?

1-08-36 Tarsan jumps onto a vine with v = 9.0 m/s

a) how high can he swing?

$E^i_k = \frac{1}{2} M v^2$

the highest he could get is if all the kinetic energy is changed into potential energy

$$E_{pot} = Mgh = \frac{1}{2} M v^2 \rightarrow gh = \frac{1}{2} v^2 \rightarrow h = \frac{v^2}{2g}$$

$$= \frac{9^2}{2 \cdot 9{,}81} \text{ m}$$

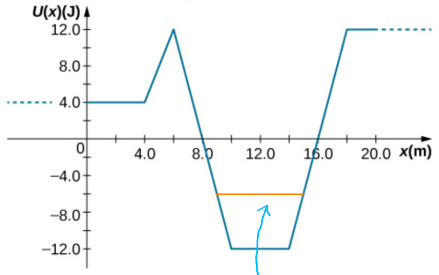
$$= 4{,}13 \text{ m}$$

b) Does the length of the vine influence h?

Not if L > h, otherwise Tarsan could be in trouble.

Independent of M

1-08-50



$$F(x) = -\frac{dU}{dx}$$

a) Find F(x) for some values of x

$F(2) = 0$

$F(5) = -\frac{12-4}{6-4} N = -4$ N

$F(8) = -\frac{(-12-12)}{10-6} = +6$ N

$F(12) = 0$

b) If the total energy of a particle is -6.0 J, find min and max x for the motion of the particle

$\underline{x_{min} = 9 \text{ m}, \; x_{max} = 15 \text{ m}}$ bound motion

c) if $E_T = 2{,}0$ J, bit more difficult, find the slope in the region ± 6 J/m

$\rightarrow x_{min} = (8 - \frac{1}{3})$ m, $x_{max} = (16 + \frac{1}{3})$ m

d) If the total energy is 16 J, what is the velocity of the partice at $x = 2, 5, 8, 12$?

$E_T = 16\,J, \quad E_{pot} = U(x), \quad E_k = \frac{1}{2} m v^2$

$E_T = \frac{1}{2} m v^2 + U(x) \rightarrow \frac{1}{2} m v^2 = E_T - U(x)$

$\rightarrow v(x) = \sqrt{\frac{2}{m}\{E_T - U(x)\}}$

$m = 0{,}50\ kg$

$v(2) = \sqrt{\frac{2}{0{,}50}\{16 - 4\}}\ m/s = 6{,}9\ m/s$