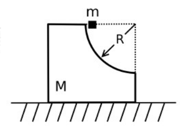
METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH 1 leto21 – Príklady 3

Cvičenie 1.4.2021

Príklad 1

A mass m slides down a circularly curved surface on an object with mass M as shown in the diagram below. Mass M is free to slide on a frictionless surface.

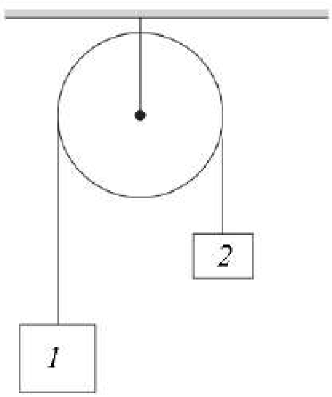
What are the final speeds of the two masses after m separates from M?



Príklad 2

V nasledujúcom je vždy práve jedno riešenie úlohy správne. Nájdite ktoré to je bez toho, aby ste úlohu počítali.

Cez nehmotnú kladku je prevesene lano, na koncoch ktorého sú telesa s hmotnosťou m_1 a m_2. Aké je zrýchlenie týchto telies. Smer nadol zoberme ako kladný.



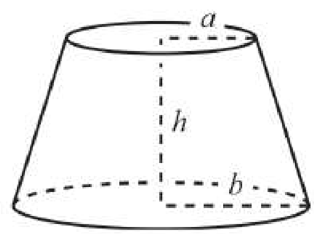
a. $a_1 = \frac{m_2}{m_1+m_2}g$, $a_2 = -\frac{m_2}{m_1+m_2}g$

b. $a_1 = \frac{m_2}{m_1+m_2}g$, $a_2 = \frac{m_1}{m_1+m_2}g$

c. $a_1 = \frac{m_1-m_2}{m_1+3m_2}g$, $a_2 = \frac{2m_2-2m_1}{m_1+m_2}g$

d. $a_1 = \frac{m_1-m_2}{m_1+m_2}g$, $a_2 = \frac{m_2-m_1}{m_1+m_2}g$

Aký je objem zrezaného kužeľa, ktorého horná podstava ma polomer a a spodná polomer b?



a. $V = \frac{\pi h}{3}(a^2+b^2)$

b. $V = \frac{\pi h}{2}(a^2+b^2)$

c. $V = \frac{\pi h}{3}(a^2+ab+b^2)$

d. $V = \frac{\pi h}{2}\frac{a^4+b^4}{a^2+b^2}$

e. $V = \pi hab$

Obežná doba Merkúra okolo Slnka je t_1, obežná doba Venuše okolo Slnka je t_2. S akou periódou dochádza k maximálnemu priblíženiu týchto dvoch planét?

a. $T = \frac{t_1^2}{t_2-t_1}$

b. $T = \frac{t_1 t_2}{t_2+t_1}$

c. $T = \frac{t_1 t_2}{t_2-t_1}$

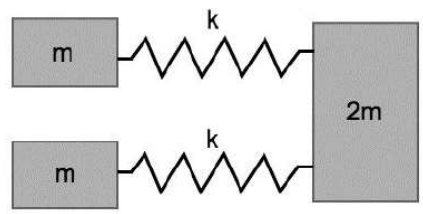
d. $T = \frac{t_1^2 t_2^2}{t_2^3+t_1^3}$

e. $T = \frac{t_1^2+t_2^2}{t_2-t_1}$

f. $T = \frac{t_1^2-t_2^2}{t_2^2+t_1^2}$

Príklad 3

For the masses shown on the right, find the frequencies of all the normal modes and sketch the motions in these normal modes. Make sure to indicate the relative amplitudes of each mass for all the normal modes. Assume that the masses are constrained to move only along the springs and friction can be ignored. *Hint:* This problem can be done without lengthy calculations.

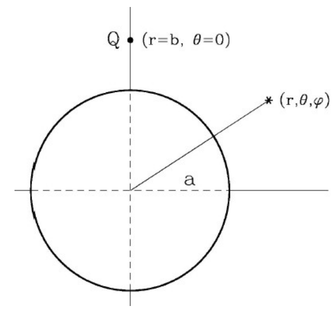


Príklad 4

An LC circuit consists of a capacitor and a coil with a large number of turns. Suppose all the linear dimensions of all elements of the circuit are changed by a factor γ while keeping the number of turns on the coil constant. How much does the resonant frequency of the circuit change? (Give simple arguments to justify your answer).

Príklad 5

PROBLEM: A point charge Q lies a distance b above the center of a grounded conducting sphere of radius a.



(a) Find the potential $\phi(r, \theta, \varphi)$ at an arbitrary point located outside the sphere. (Take θ to be the polar angle, with $\theta = 0$ being along $\hat{z}$.) *Hint: Use the method of images.*

(b) How much work is required to move the point charge Q from $r = b$ to $r = \infty$?

Príklad 6

A stick of length L is placed vertically by the wall. At its lower end sits a bug. The end B of the stick starts moving to the right with speed v, and at the same moment the bug starts crawling along the stick with speed u relative to the stick. What is the maximal height above the floor that the bug reaches while it crawls along the stick? End A of the stick does not lose contact with the wall.