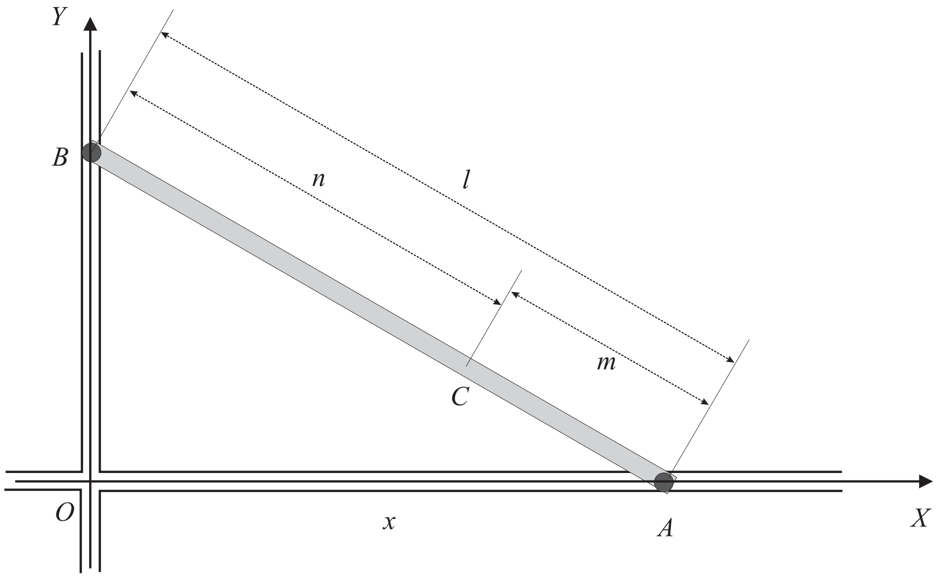
Kungl Tekniska Högskolan **2005 09 04**
Institutionen för Mekanik

Mekanik II M2, 5C1140

Hand in assignment 1, HT 2005

The sliding bar of an ellipsograph, $AB = l$, moves in slots along the axes X and Y. The end A of the sliding bar undergoes harmonic oscillations $x = a \sin \omega t$, where $a < l$. $CA = m$ and $CB = n$. Find the speed, $v_C(t)$, of C, for arbitrary values of the parameters.

Plot the speed from $t = 0\,\mathrm{s}$ to $t = 2\pi\,\mathrm{s}$, assuming $a = n = 3\,\mathrm{cm}$, $m = 2\,\mathrm{cm}$, $l = 5\,\mathrm{cm}$, and $\omega = 1\,\mathrm{rad/s}$.



Hints: You could use the formula connecting the velocities of different points in a rigid body directly. It is, however, simpler to use the fact that there is pure rotation about the instantaneous center of zero velocity. You then also need the cosine theorem to get the length to C.

Answer: $v_C = (a\omega/l) \cos \omega t \sqrt{n^2 + m^2 a^2 \sin^2 \omega t/(l^2 - a^2 \sin^2 \omega t)}$ is one possibility, but there are many algebraically equivalent forms. The plots should all look the same though.

The solutions, which must have explanative *text* in English, are intended to start from general laws and definitions. All essential steps in the calculations must be included.

Mark the solutions with your *name* and number as well as *my name* (Hanno Essén). They must be *tidy* and easy to read, as well as correct.

The last day for handing in this assignment is Wednesday, September 14.