

# Problemen

| Problem Section

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## Problem 1

The first problem in the new millenium is an old one, solved by H.A. Lorentz in the first issue of Nieuw Archief in 1875:

Op een horizontaal vlak ligt een massieve cirkelvormige cylinder. Zoo nu het zwaartepunt van dien cylinder zich ergens buiten de as van het lichaam, en ook op eenig oogenblik niet verticaal onder die as bevindt, moet door de werking der zwaartekracht de cylinder eene rollende schommelende beweging aannemen. Bijaldien ondersteld wordt, dat deze schommelingen oneindig klein zijn, en dat er geen rollende wrijving bestaat, is de vraag: den tijd te bepalen waarin elke schommeling volbracht wordt.

[A solid cylinder is placed on a horizontal plane. Suppose that the barycentre is not on the central axis, nor vertically below this axis, so that gravity forces the cylinder into oscillation. Moreover, suppose that the oscillations are infinitesimal and that rolling is frictionless. Then what is the period of the oscillation?]

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## Problem 2

One quickly verifies that the plane cannot be partitioned in two sets, such that points of distance 1 are in opposite sets. A point in the plane is called *rational* if both its coordinates are rational. Is it possible to partition the rational points in two sets, such that points of distance 1 are in opposite sets?

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## Problem 3

The sequence  $a_1, a_2, \dots$  is defined by  $\sum_{d|n} a_d = 2^n$  for all  $n \geq 1$ . Show that  $n|a_n$  for all  $n$ .

Solutions to the problems in this section can be sent to the editor — preferably by e-mail. The most elegant solutions will be published in a later issue. Readers are invited to submit general mathematical problems. Unless the problem is still open, a valid solution should be included.

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