

SEQUENCES

Please do not write on the subject paper and don't forget to give back the examination paper at the end of the test.

Problem n°1

Ever since the time of the Greek astronomer Hipparchus, second century B.C., the brightness of stars has been measured in terms of magnitude.

The brightest stars, excluding the sun, are classed as magnitude 1, and the dimmest visible to the eye are classed as magnitude 6.

In 1856, the English astronomer N. R. Pogson showed that first-magnitude stars are 100 times brighter than sixth-magnitude stars. Assuming that the ratio of brightness between consecutive magnitudes is constant, find this common ratio. Round it to the 1/1000th.

Let's label b_n the brightness of an n^{th} -magnitude star and r the common ratio.

Vocabulary : *dimmest* : *la plus sombre*

Problem n°2

A plant is eaten by an insect, an insect by a trout, a trout by a salmon, a salmon by a bear, and the bear is eaten by you.

If only 20% of the energy is transformed from one stage to the next, how many calories must be supplied by plant food to provide you with 2,000 calories from the bear meat?

Let's label E_n the energy at stage n .

Stage 1 is for the plant, Stage 2 is for the insect, ...

Vocabulary : *trout* = *truite*