

Subject n°14

Please don't write on the exam paper.

We let a magic ball fall from a height of 2 meters. This ball always bounces five quarters of the height from which it comes. Let h_0 be 2 and, for any natural integer n , let h_n be the height reached after n rebounds, expressed in meters.

- 1- Do you have any idea about the reason why this ball was named magic?
- 2- Prove that $h_1 = 2,5$. Compute h_2 .
- 3- What is the nature of the sequence (h_n) ? Justify your answer.
- 4- Give the expression of h_n in terms of n . What is the height (rounded to the nearest centimeter) reached after the twentieth rebound?
- 5- How many rebounds are needed for the ball to bounce higher than the Eiffel tower? Explain your answer.
- 6- What is the total distance (rounded to the nearest meter) travelled by the ball since the beginning till the 25th impact on the floor? Explain.

Notes

To bounce : rebondir.

Hint: The Eiffel Tower, in Paris, is 324 meters high.

Formula :

Sum of the consecutive terms of a geometric sequence (common ratio is q):

$$S = u_0 + u_1 + \dots + u_n = u_0 \times \frac{1 - q^{n+1}}{1 - q}$$