

Subject n°12

Please, don't write on the exam paper.

A capacitor is an electronic device whose major particularity is to be able to store energy when submitted to an electric potential difference.

We assume that the charge q (expressed in Coulombs) of a capacitor can be expressed in terms of time t (expressed in seconds) with the following function : $q(t) = 6(1 - e^{-2t})$.

- 1- Study the variations of q over $(0; +\infty)$. How can you analyze these variations for the capacitor?
- 2- Compute the limit Q of q as t approaches $+\infty$. Physicists call it the maximal charge of the capacitor. Is the word "maximal" relevant from a mathematical point of view ?
- 3- Compute the instant t_0 over which $q(t) \geq 5,7$. Round the result to the first greatest integer. Give your analysis of the result.
- 4- What percent of the maximal charge Q does $q(t_0)$ represent?
- 5- Compute $q'(0)$. Can you give an interpretation of this result for the capacitor?
- 6- Using all the previous results, draw the graph of q over $(0; +\infty)$.