

A drug is injected intra-muscularly. It's assimilated by the blood through the muscles and then dispelled by the kidneys.

Let  $f(t)$  be the drug quantity (measured in milliliters) in the blood at the time  $t$  (measured in hours).

A medical study establishes :

$$f(t) = q(e^{-0.5t} - e^{-t})$$

where  $q$  is the initial quantity of the injected drug.

1. (a) Find the derivative of  $f$ .
- (b) Determine where  $f$  creases and where  $f$  decreases.
- (c) Find the absolute maximum value of  $f$ .
- (d) Evaluate  $\lim_{t \rightarrow +\infty} f(t)$ .

2. Supervision of the drug's effects.

The drug quantity in the blood must not exceed the toxicity threshold  $th_M = 2.6$  mL.

The drug is only efficient if the quantity is greater than or equal to  $th_m = 1.2$  mL.

- (a) Use the result from question 1(c) to determine which values of  $q$  could be injected without exceeding the toxicity threshold.
- (b) For the following questions  $q = 10$ .  
Find the equation of  $\Delta$  the tangent line to the curve  $\mathcal{C}_f$  at  $(0, 0)$  then sketch  $\mathcal{C}_f$  and  $\Delta$ .
- (c) Use the curve  $\mathcal{C}_f$  to determine at which interval of time the drug is efficient.

