

The concentration C of a medication in the bloodstream t hours after being administered is modeled by the function¹

$$C(t) = -0.002t^4 + 0.039t^3 - 0.285t^2 + 0.766t + 0.085$$

- a. After how many hours will the concentration be highest?

Let's discuss the domain of $C(t)$ before we graph. Since the input is time, in hours, after the medication is administered, we know that $t \geq 0$. Also, it is reasonable to assume that the concentration will start at a low value, then increase, and finally decrease as the body metabolizes the medication. So we'll start with a preliminary domain of $0 \leq t \leq 12$, *i.e.*, half-a-day. After we graph the function, we can adjust this if necessary. Whether we use a graphing calculator, a computer program, or an online graphing utility, the graph of the equation on the interval $[0,12]$ is as shown in Figure 1.

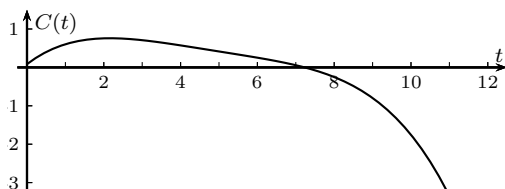


Figure 1

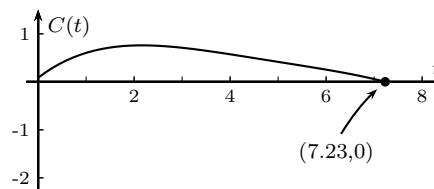


Figure 2

Using the `calc:maximum` function on the TI-84 (or whatever graphing calculator is available), we find the local maximum of ≈ 0.76 occurs when $t \approx 2.16$. Thus, the maximum concentration occurs about 2.16 hrs after the medication is administered.

We initially set a domain of $0 \leq t \leq 12$ for $C(t)$, however the graph of the function slips below the t -axis at a value of t a little larger than 7. Since the concentration of the medication cannot be negative, the domain of $C(t)$ will be from $t = 0$ to that value of t . Using the `calc:zero` function on the TI-84, we find the t -intercept to be $t \approx 7.23$, and thus the domain of the function is $[0,7.23]$. See Figure 2.

- b. A woman nursing a child must wait until the concentration is below 0.5 before she can feed him. After taking the medication, how long must she wait before feeding her child?

Here, we want to know the values of t for which $C(t) < 0.5$. We will graph the line $C(t) = 0.5$ and then use the `calc:intersect` function on the graphing calculator to find the values of t . See Figure 3.

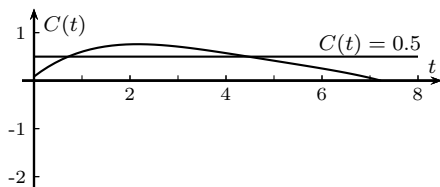


Figure 3

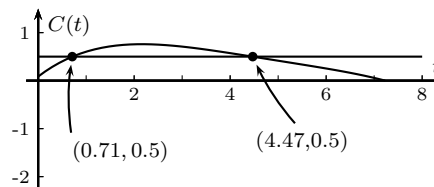


Figure 4

From our TI-84, the intersection on the left is $(\approx 0.71, 0.5)$ and the intersection on the right is $(\approx 4.47, 0.5)$. See Figure 4.

Thus, the woman can nurse the child for the first 0.71 hrs after the medication is administered, or following 4.47 hrs after the medication is administered.

¹Sullivan, *Precalculus: Enhanced with Graphing Utilities*, p. 91, #76.