Indianapolis 500 (From Thompson & Ashbrook, 2019, Section 3.11)

Al Unser won the Indianapolis 500-mile race in 1987. Juan Pablo Montoya won the Indianapolis 500-mile race in 2015. Unser completed his race in 3.083089 hours. Montoya completed his race in 3.099033 hours. Imagine they drove their exact races against each other and the race ended when the winner crossed the finish line. Let t represent the number of hours since their imaginary race started.

1. Use function notation to represent the distance each driver traveled in relation to the number of hours since the race began. Be sure to say what every letter you use means. State the domain of your independent variable.
   $u(t)$ = number of miles Unser has driven t hours after race began
   $m(t)$ = number of miles Unser has driven t hours after race began
   The domain for u is $0 \leq t \leq 3.083089$ and for m is $0 \leq t \leq 3.099033$.
   You could use letters other than u and m as long as you use them consistently in questions 2 - 7.
2. Represent each of the following using function notation. Explain how what you wrote represents what you claim.
   a. The distance Unser traveled in the first 0.09 hours of the race. $u(0.09)$
   b. The distance Montoya travel in the first 97 minutes of the race. $m\left(97/60\right)$
   c. The distance Unser traveled from t=1.192 to t=2.013 hours. $u(2.013) - u(1.192)$
   d. The distance Montoya traveled in every one-minute time period. $m(t + 1/60) - m(t)$
3. Represent the distance between Unser and Montoya when Unser crossed the finish line. Explain how what you wrote represents what you claim.
   $u(3.083089) - m(3.083089)$
   Unser crossed the finish line 3.083089 hours after the race started. The difference above gives the number miles between Unser and Montoya at the moment in the race Unser crossed the finish line.
4. Represent the distance between Montoya and Unser at every moment from when the race began to when it ended. Explain how what you wrote represents what you claim.
   $m(t) - u(t)$
   This difference will be positive when Montoya was ahead of Unser and negative when Unser was ahead of Montoya.
5. Represent those times when Unser was ahead of Montoya. Explain how what you wrote represents what you claim.
   t such that $u(t) - m(t) > 0$
6. Represent the fact Unser was ahead of Montoya when Unser finished the race.
   $u(3.083089) > m(3.083089)$, or $u(3.083089) - m(3.083089) > 0$
7. Represent the moment(s) in time when Unser was 0.23 miles ahead of Montoya. Explain how what you wrote represents what you claim. Is it possible your equation has more than one solution? Why?
   t such that $u(t) - m(t) = 0.23$
   It is possible Unser was 0.23 miles ahead of Montaya many times during the race as the distance between them waxed and waned.