(8.) (12 pts) From Exam I, we have that the population of Michigan can be approximated by 
\[ P = f(t) = 7.8(1.0058)^t, \]
where \( t \) is the number of years since the beginning of 1960 and \( P \) is in millions.

(a) Determine the average rate of change in the population of Michigan between 1960 and 1980. [Be certain to include units and express your answer as a complete sentence.]
\[
\frac{f(20) - f(0)}{20} = 7.8 \left(1.0058\right)^{20} - 7.8 = 0.4782
\]
Over the 20-year period from 1960 to 1980, the population increased on average \( 0.4782 \) people per year.

(b) Determine the (instantaneous) rate of change of the population of Michigan at the beginning of 1980. [Again, use units and a sentence. Show your work.]
The instantaneous rate of change in 1980 is 
\[
f'(20) = 7.8 \left(1.0058\right)^{20}. \ln(1.0058) = 0.05064
\]
Thus, in the population was increasing at the rate of \( 0.05064 \) million people per year, or \( 50,640 \) people per year.

(c) Which is greater—the average rate of change between 1960 and 1980 or the instantaneous change in 1980? Use a graph or tables to give a convincing argument that the rate that you found to be greater should indeed be greater.

(d) Is there some time, \( t \), such that the instantaneous rate of change of \( P \) is equal to the average rate of change from 1960 to 1980? If so, approximate \( t \). If not, explain why not.