US Population

Census figures for the US population (in millions) are listed in Table 2.17. Let f be the function such that $P = f(t)$ is the population (in millions) in year t.

TABLE 2.17 *US population (in millions), 1790–1990*

Year	Population	Year	Population	Year	Population	Year	Population
1790	3.9	1850	23.1	1910	92.0	1970	205.0
1800	5.3	1860	31.4	1920	105.7	1980	226.5
1810	7.2	1870	38.6	1930	122.8	1990	248.7
1820	9.6	1880	50.2	1940	131.7		
1830	12.9	1890	62.9	1950	150.7		
1840	17.1	1900	76.0	1960	179.0		

(a) (i) Estimate the rate of change of the population for the years 1900, 1945, and 1990.
(ii) When, approximately, was the rate of change of the population greatest?
(iii) Estimate the US population in 1956.
(iv) Based on the data from the table, what would you predict for the census in the year 2000?

(b) Assume that f is increasing (as the values in the table suggest). Then f is invertible.
(i) What is the meaning of $f^{-1}(100)$?
(ii) What does the derivative of $f^{-1}(P)$ at $P = 100$ represent? What are its units?
(iii) Estimate $f^{-1}(100)$.
(iv) Estimate the derivative of $f^{-1}(P)$ at $P = 100$.