1. a. Draw a sketch of the set bounded by the curves \( y = x \), \( y = 3x \), and \( x = 2 \).

b. Find the volume of the region gotten by revolving the above set about the x axis.

\[
V = \int_{x=0}^{x=2} \left( \pi y^2 - \pi y_1^2 \right) dx = \int_0^2 \pi (3x)^2 - \pi (x)^2 \, dx = \int_0^2 9x^2 \pi - x^2 \pi \, dx
\]

\[
= \left. \int_0^2 8\pi x^3 \, dx \right| = \frac{8\pi x^4}{4} \bigg|_0^2 = \frac{64\pi}{3} - 0 = \frac{64\pi}{3}
\]

2. Let \( P(t) = 200 + t^4 \) denote the population of people (in millions) in the country of Manlu. Time \( t \) is measured in years with \( t = 0 \) corresponding to 1950.

a. What is the average population of Manlu over the time period 1950 to 2000?

\[
P_{\text{average}} = \frac{1}{50-0} \int_0^{50} 200 + t^4 \, dt = \left. \left( \frac{200t + t^5}{5} \right) \right|_0^{50} = 200 \cdot 50 + \frac{(50)^5}{5}
\]

\[
= 200 + \frac{(50)^4}{5} = 12,500 million people.
\]

b. Is there a time at which \( P(t) \) equals this average rate?

\[
200 + t^4 = 1,250,000
\]

\[
t^4 = 1,250,000 \quad t = \sqrt[4]{1,250,000} = 33.44 \text{ years}
\]

\[\approx 1983\]