2. [11 points] Consider the function \( f(x) = e^{-2x} \), and the region \( R \) bounded by the \( x \)-axis, the \( y \)-axis, \( y = f(x) \) and \( x = q \), where \( q \) is a positive constant larger than 2.

a. [4 points] Give a formula for, but do not compute, the volume of the solid formed by rotating the region \( R \) around the \( y \)-axis. Your answer should depend on \( q \). (Hint: Use the shell method)

b. [4 points] Compute the integral you found in part a). Your final answer should be in terms of \( q \).
c. [3 points] Taking a limit of your answer in b), compute the volume of the infinitely long solid of revolution formed by rotating the region $\mathcal{R}$ around the $y$-axis. Be sure to show how you got the value of your limit.