1. The half-life of the plutonium isotope is 24,360 years. If 10 grams of plutonium is released into the atmosphere by a nuclear accident, how many years will it take for 80% of the isotope to decay?

Solution. Since we are given half-life, we write

\[ A(t) = 10 \left( \frac{1}{2} \right)^{\frac{t}{24,360}}. \]

If 80% decays, 20% remains. Thus we solve for \( t \) in the equation

\[ 0.2 = \frac{1}{5} = \left[ \frac{1}{2} \right]^{\frac{t}{24,360}}, \]

We obtain,

\[ \ln \left( \frac{1}{5} \right) = \left( \frac{t}{24,360} \right) \ln \left( \frac{1}{2} \right), \]

or

\[ t = \frac{24,360 \ln 5}{\ln 2}. \]

2. Compute the derivative of

\[ y = \frac{1}{2} \sinh(2x + 1). \]

Solution.

\[ y' = \cosh (2x + 1). \]