2. (4 points) Compute
\[ \int_{0}^{\frac{1}{2}} \frac{1}{1 + 4x^2} \, dx \]

3. (2 points) The definition of \( a^x \) for \( a > 0 \) is
\[ a^x = \underline{\phantom{00000000}} \]
4. (3 points) Show that
\[ \sinh x + \cosh x = e^x \]

5. (5 points) Find the general solution of the differential equation
\[ \frac{dy}{dx} = \frac{2y}{x} + \frac{1}{x}. \]

6. (4 points) A tank contains 50 gallons of water and 2 pounds of salt. The solution is flowing out of the tank at a speed of 1 gallon per minute, while salt is poured into the solution at a speed of 0.1 pounds per minute.

Find the differential equation for \( y(t) \), the amount of salt in the tank after \( t \) minutes.

You don’t need to solve the differential equation!