1. Find

$$\int \left(x + \frac{1}{x} \right) \left(1 - \frac{1}{x^2} \right) \, dx$$

in two ways:

(a) by a substitution;

(b) by multiplying out and integrating term by term. Show that your two answers are the same.
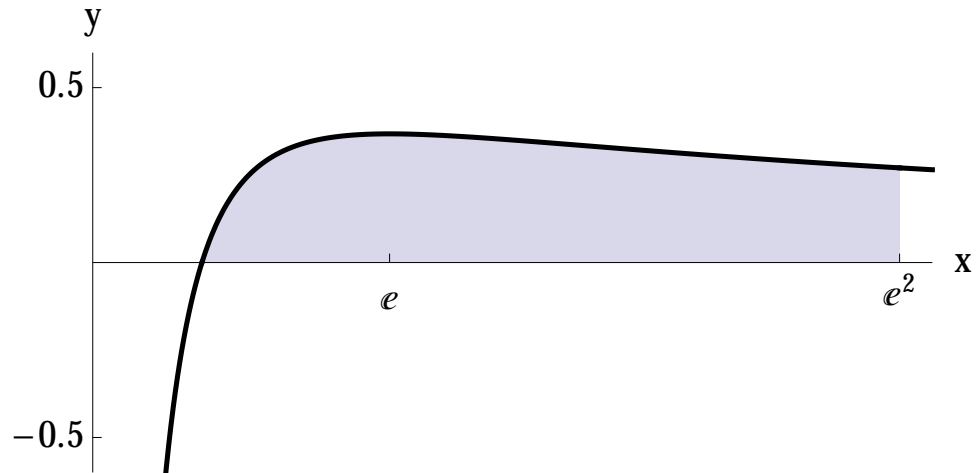
2. Find $\int \dfrac{x}{(x^2+1)^2}\,dx$

3. Find $\int_1^4 \dfrac{e^{\sqrt{x}}}{\sqrt{x}}\,dx$. Express your answer in terms of whole numbers and e.

4. Find the area under the graph of
$$y = \frac{\ln(x)}{x}$$
   from $x = 1$ to $x = e^2$. Express your answer as a whole number.

5. Find $\displaystyle\int \frac{1}{5x - 1}\, dx$

6. Solve the initial value problem

$$\frac{dy}{dx} = \frac{e^x}{5 + e^x}, \qquad y(\ln 5) = 4 + \ln 10.$$