November 18, 2014 Worksheet 19: Integration by Substitution (indefinite, definite, initial value)

1. Find

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

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 $\int \frac{x}{\left(x^{2}+1\right)^{2}} d x$
3. Find $\int_{1}^{4} \frac{e^{\sqrt{x}}}{\sqrt{x}} d x$. 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 $\int \frac{1}{5 x-1} d x$
6. Solve the initial value problem

$$
\frac{d y}{d x}=\frac{e^{x}}{5+e^{x}}, \quad y(\ln 5)=4+\ln 10 .
$$

