1. Show how to reduce \( y' + \frac{k}{y} + xy^2 = 0 \) to a linear differential equation. You do not need to solve the linear equation.

\[
\begin{align*}
\text{Let } & u = y^{-1} \\
\Rightarrow & u' = -y^{-2}y' = -y^{-2}\left(-\frac{k}{x} - x\gamma^2\right) \\
& = \frac{k}{xy} + \gamma \\
& = \gamma u + \gamma
\end{align*}
\]

So \( u' = \gamma u + \gamma \) or \( u' - \frac{\gamma}{\gamma} u = \gamma \)

2. The region bounded by \( y = x^2 \), the \( x \)-axis, and the vertical line \( x = 1 \) is rotated about the horizontal line \( y = 1 \). Find the resulting volume.

\[
\text{Volume } = \int_0^1 \pi \left( (1-x^2) - (1-y^2) \right) dy
\]

\[
\text{Volume } = \int_0^1 \pi \left( (1-x^2) - (1-x^2) \right) dy
\]

\[
\text{Volume } = \int_0^1 \pi \left( (1-x^2) - (1-x^2) \right) dy
\]

\[
\text{Volume } = \frac{7\pi}{15}
\]