2. [9 points] Consider the graph of $y = e^{-14x}$ for $x \geq 0$.

a. [3 points] Let $\mathcal{R}$ be the region in the first quadrant between the graph of $y = e^{-14x}$ and the x-axis. Which of the following improper integrals best expresses the volume of the solid that is obtained by rotating $\mathcal{R}$ around the x-axis?

Circle one:

$$\int_0^\infty \pi e^{-14x}\,dx \qquad \int_0^\infty x e^{-14x}\,dx \qquad \int_0^\infty x e^{-28x}\,dx \qquad \int_0^\infty \pi e^{-28x}\,dx$$

$$\frac{\pi}{7}\int_0^1 \ln(y)\,dy \qquad \frac{\pi}{14}\int_0^1 y\ln(y)\,dy \qquad \frac{1}{14}\int_0^1 y\ln(y^2)\,dy$$

b. [6 points] Determine whether the improper integral you circled in part **a** converges or diverges.

- If the integral converges, circle "converges", find its exact value (i.e. no decimal approximations), and write the exact value on the answer blank provided.
- If the integral diverges, circle "diverges" and justify your answer.

In either case, **you must show all your work carefully using correct notation**. Any direct evaluation of integrals must be done **without using a calculator.**

Converges to _____ **Diverges**