$$
\begin{aligned}
L &= \int_a^b \sqrt{r^2 + (dr/d\theta)^2}\; d\theta = \int_0^\pi \sqrt{(e^{2\theta})^2 + (2e^{2\theta})^2}\; d\theta \\
&= \int_0^\pi \sqrt{e^{4\theta} + 4e^{4\theta}}\; d\theta = \int_0^\pi \sqrt{5e^{4\theta}}\; d\theta \\
&= \sqrt{5} \int_0^\pi e^{2\theta}\; d\theta = \tfrac{\sqrt{5}}{2} \left[e^{2\theta}\right]_0^\pi = \tfrac{\sqrt{5}}{2}(e^{2\pi} - 1)
\end{aligned}
$$