PRINT Your Name: _____

The quiz is worth 5 points. **Remove EVERYTHING from your desk except this quiz and a pen or pencil.** SHOW your work. Express your work in a neat and coherent manner.

Find the average y coordinate of the points on the semi-circle parameterized by $\overrightarrow{\boldsymbol{c}} : [0, \pi] \to \mathbb{R}^3$, where $\overrightarrow{\boldsymbol{c}}(\theta) = (0, a \sin \theta, a \cos \theta)$, for some positive number a.

Answer: The average of y is

$$\frac{\int_{\overrightarrow{\boldsymbol{c}}} y \, ds}{\int_{\overrightarrow{\boldsymbol{c}}} ds} = \frac{\int_0^\pi a \sin \theta || \overrightarrow{\boldsymbol{c}}\,'(\theta) || d\theta}{\int_0^\pi || \overrightarrow{\boldsymbol{c}}\,'(\theta) || d\theta} = \frac{\int_0^\pi a^2 \sin \theta \, d\theta}{\int_0^\pi a \, d\theta} = \frac{-a^2 \cos \theta |_0^\pi}{a \theta |_0^\pi} = \frac{2a^2}{a\pi} = \boxed{\frac{2a}{\pi}}$$