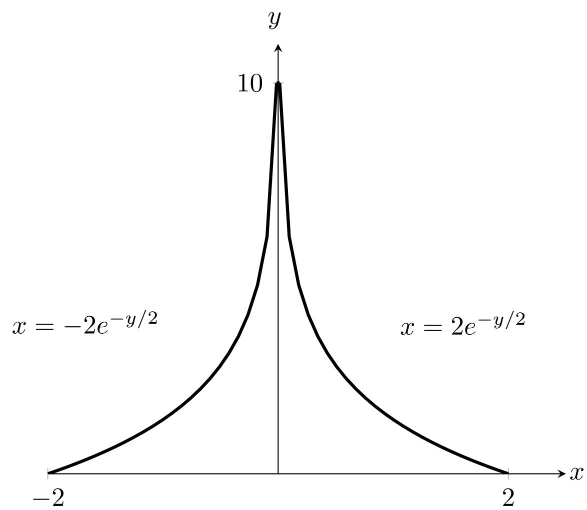
Name:____

Professors name:____

Due date: 11/20

1. Erected in 1889 for the World's Fair, the Eiffel Tower became the largest structure in the world at the time. Originally intended to be exactly 1000 feet tall (it actually surpassed that), its design needed to be able to withstand pressures from the wind and thus an exponential shape was created. In this problem, we consider a simplified model of the tower.

   Calculate the force due to wind pressure on the face of the Eiffel Tower, which is the region between the two curves $x = 2e^{-y/2}$ and $x = -2e^{-y/2}$ from $y = 0$ (the base) to $y = 10$ (the top). One unit of length = 100 feet.



   For the following pressure functions, find the force due to wind pressure on the face of our Eiffel Tower. Note that this is slightly different than for water pressure.

   (a) Assume the pressure is decreasing quadratically as you go up the atmosphere: $p(y) = 1 - \frac{y^2}{100}$.

   (b) Assume the pressure is sinusoidal: $p(y) = 1 - \sin\left(\frac{\pi y}{5}\right)$. There's some weird smog at different heights...

   Fun Fact: In 1893, the World's Fair came back to the US in Chicago. Look up what "structure" they came up with to compete with the Eiffel Tower.

2. Compute $\int_0^1 \arctan(x)\,dx$. Do not use power series.

3. Find the volume obtained by rotating the reigion R about the x-axis, where R is the region bounded by $f(x) = \sec^2(x)\tan^{\frac{3}{2}}(x)$, the x-axis, and the line $x = \frac{\pi}{4}$.