MAT 17A Fall 2023
Homework 8
Due before 1:10 PM on Friday, December 8

Please write the homework solutions in connected sentences and explain your work. Mark the answers to each question. Scan or take pictures of your homework and upload it to Gradescope before due time.

1. Use L'Hospital Rule to compute the limit

$$\lim_{x \to 0} \frac{e^x + e^{-x} - 2}{x^2}.$$

2. For a fish swimming at a speed v relative to the water, the energy expenditure per unit time is proportional to v^3. It is believed that migrating fish try to minimize the total energy required to swim a fixed distance. If the fish are swimming against a current u $(u < v)$, then the time required to swim a distance L is $L/(v - u)$ and the total energy E required to swim the distance is given by

$$E(v) = av^3 \cdot \frac{L}{v - u}.$$

where a is the proportionality constant. Determine the value of v that minimizes $E(v)$.

3. A box with a square base and open top must have a volume of $32,000 \text{cm}^3$. Find the dimensions of the box that minimize the amount of material used.