# Calculus 1, Handwritten Homework 10 — Spring 2022

NAME _____ STUDENT NUMBER _____

Write in complete sentences and use correct notation (such as equal signs). Give justifications for your claims using the definitions and theorems in the notes and book (quote them by name or number, as is done in the examples in the notes and videos, and in the solutions posted online). Give precise values, not numerical (calculator) approximations. If provided, put your final answer in the box. Each numbered problem is worth 5 points. Print out this document, work the problem, scan your solutions, and submit the scan of (in PDF) to the D2L DropBox by the deadline. See the online syllabus for deadlines. **Do not copy work from others or from the internet! This will result in you being charged with academic misconduct.**

**1.** Consider $y = f(x) = \cos x + \sqrt{3}\sin x$, $x \in [0, 2\pi]$. Find the open intervals on which $f$ is increasing and decreasing. Use the critical points of $f$ to make a table of the sign of $f'$ using test values from the intervals on which $f'$ has the same sign. Find extrema of $f$. Find the intervals on which $f$ is concave up and concave down. Use the potential points of inflection to make a table of the sign of $f''$. Find the points of inflection. This is Exercise 28 in Section 4.4.

**2.** Use l'Hôpital's Rule (Theorem 4.6) to evaluate the limits. Write the indeterminate form over the equal sign when you use l'Hôpital's Rule. These are Exercises 20 and 48 from Section 4.5.

**(a)** $\lim_{x \to 1} \dfrac{x - 1}{\ln x - \sin \pi x}$.

**(b)** $\lim_{x \to 0} \dfrac{(e^x - 1)^2}{x \sin x}$.

**3.** You are planning to close off a corner of the first quadrant with a line segment 20 units long running from $(a, 0)$ to $(0, b)$. Show that the area of the triangle enclosed by the segment is largest when $a = b$. Find the area $A$ of the triangle as a function and maximize $A$ over an appropriate closed and bounded interval. Follow the steps of Section 4.6. This is Exercise 6 in Section 4.6.