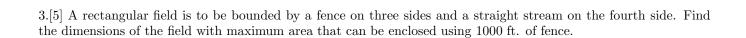
50 min. No books, no notes, no electronic devices. You must show your work to receive credit.

- 1.[17] For the function $f(x) = x^3 3x^2 + 3$
 - (a) Find the critical points of f.
 - (b) Find f''(x).
 - (c) Find the open intervals on which f is concave up and the open intervals on which f is concave down.
 - (d) Identify any inflection points for the graph of f. Give the actual points.
 - (e) Use the second derivative test to identify all local extrema for the graph of f.

2.[7] Use l'Hôpital's rule to calculate $\lim_{x\to 0} \frac{x\,e^{2x}}{e^{3x}-1}$. To get full credit, you must state which case of l'H you're using.



4.[11] Find the general antiderivative by integrating term-by-term: $\int \left(\cos x + x^7 + e^{4x} - \frac{3}{\sqrt{x}} + \frac{1}{x^2 + 1}\right) dx.$

Evaluate the following definite integrals using FTC (part 2). Some may also require u-substitution.

5.[9] Evaluate
$$\int_0^2 \frac{x^2}{\sqrt{x^3 + 1}} \, dx$$
.

6.[8] Evaluate
$$\int_{\frac{\pi}{2}}^{\pi} (x - \sin x) dx.$$

7.[8] Evaluate
$$\int_{e}^{5} \frac{\ln x}{x} dx$$
.