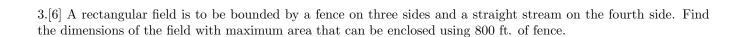
50 min. No books, no notes, no electronic devices. You must show your work to receive credit.

- 1.[18] For the function $f(x) = xe^{-x}$
 - (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 any local extrema for the graph of f.

2.[5] Use l'Hôpital's rule to compute $\lim_{x\to 1} \frac{\ln x}{\sin(x-1)}$. Indicate which case of l'H you're using.



4.[7] Find the general antiderivative (indefinite integral): $\int \left(2\sin x - \frac{1}{1+x^2} + e^{3x}\right) dx$

5.[5] Let f be integrable on [1,3]. If $\int_{1}^{3} f(x) dx = -8$ and $\int_{1}^{2} f(x) dx = 1$, what's $\int_{2}^{3} f(x) dx$?

6.[6] Use the Fundamental Theorem of Calculus to find the average value of $f(x) = x^2 - 1$ on [-1, 1].

7.[13] Use the Fundamental Theorem of Calculus to evaluate the following definite integrals. Simplify your final answers.

(a)
$$\int_{1}^{4} \left(\frac{1}{x} + \sqrt{x}\right) dx.$$

(b)
$$\int_0^{\ln 2} e^{-x} dx$$
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