Math 151H
Sections 201 and 202
Third Test

25 November 2008
Instructor: F. Sottile

Full credit is given only for complete and correct answers.
No aids allowed on the exam. Please write your answers in blue books.
Do persevere; partial credit will be given, and you are all good students.
Point totals are in brackets next to each problem.

---

1. [10] State one version of the Fundamental Theorem of the Calculus.

2. [5] Using the Fundamental Theorem of the Calculus, give a formula for a function $F(\lambda)$ whose derivative with respect to λ is $\lambda + \sin\left(a^2 + e^{2\lambda}\sqrt{\lambda^2+3}\right)$.

3. [10] Find the area between the x-axis and an arc of the curve $y = \sin x$ between two consecutive zeroes of $\sin x$.

4. [15] Compute derivatives of the following functions
$$f(x) = \arctan(\sqrt{x}), \qquad f(x) = \operatorname{csch}(x^x), \quad \text{and} \quad f(x) = \sinh^{-1}(\arcsin(x)).$$

5. [20] For the function $f(x) = x^{1/3}(x+3)^{2/3}$, find its local extrema, the intervals on which it is increasng or decreasing, its inflexion points, as well as its intervals of constant concavity.

6. [15] Of all the circular cylinders inscribed in a sphere of radius r, find the one of maximum volume.

7. [25] Evaluate (give a number or find an antiderivative, or both) the integrals
$$\int_1^4 \left(\sqrt{\mu} - \tfrac{2}{\sqrt{\mu}}\right) d\mu\,, \qquad \int \tfrac{(\ln\alpha)^3}{\alpha} d\alpha\,, \qquad \int_0^{1/2} \tfrac{\arcsin(x)}{\sqrt{1-x^2}} dx\,, \quad \text{and} \quad \int \sqrt[3]{\gamma^3+1}\;\gamma^5 d\gamma\ .$$

Ω. [5 pts extra credit] State the *other* version of the Fundamental Theorem of the Calculus.