

**General Instructions:** Use black or blue pen only. Show neat, complete and organized solutions to earn full points. Box all final answers. The use of any electronic devices is not allowed during the exam. Cheating is punishable by a grade of **5.00** for the course.

For problems on limits involving indeterminate forms, write which type is it on the side of the limit. Also write “By L’Hopital’s Rule” or an equivalent statement every time you apply the aforementioned rule.

I. Evaluate the antiderivative  $\int \frac{3^x - 1}{5^x} dx$ .

II. Evaluate the antiderivative  $\int \frac{2x}{x^2 + 20x + 109} dx$

III. Do what is asked.

1. Show **using the definition** of  $\sinh x$  that  $D_x(\sinh x) = \cosh x$ .

2. Show that  $D_x(\sinh^{-1} x) = \frac{1}{\sqrt{1+x^2}}$ .

Hint: You will use the previous item along the way.

IV. **DO NOT SIMPLIFY.** Find  $\frac{dy}{dx}$  given

$$y = \frac{x^{\sin x} \cdot \sin^{-1}(3^x)}{\sinh(x \ln 3) \cdot \sinh^{-1}(\log_5(2x))}$$

V. Evaluate  $\lim_{x \rightarrow -4} \left( \frac{x+7}{3x+12} - \frac{1}{\ln(x+5)} \right)$ .

VI. Evaluate  $\lim_{x \rightarrow 1} (2-x)^{\tan(\pi x/2)}$ .

END OF EXAM  
**TOTAL: 12 POINTS**

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