

**Homework #4**Due **Friday, September 10th** in Gradescope by 11:59 pm ET

**Goal:** Exploring Hyperbolic Functions and Reviewing Inverse Trigonometric Functions and Limits (no L'Hopital's Rule yet)

1. Prove that  $\frac{d}{dx} \cosh x = \sinh x$
2. Prove the Fundamental Identity for Hyperbolic Functions:  $\cosh^2 x - \sinh^2 x = 1$
3. Prove that  $\frac{d}{dx} \sinh^{-1} x = \frac{1}{\sqrt{1+x^2}}$ . Hint: "L.I.D.S" method and finish by using the Fundamental Identity in 2 above

Compute each of the following Integrals. Simplify.

4.  $\int \sinh x \cdot \cosh^2 x \, dx$
5.  $\int \frac{\sinh \sqrt{x}}{\sqrt{x}} \, dx$
6.  $\int \tanh x \, dx$
7.  $\int_4^{4\sqrt{3}} \frac{1}{16+x^2} \, dx$
8.  $\int \frac{x}{\sqrt{1-x^4}} \, dx$
9.  $\int \frac{x^2}{x^2+4} \, dx$
10.  $\int \frac{2x^2+5}{x^2+1} \, dx$
11.  $\int \frac{1}{(1+x^2)(5+(\arctan x)^2)} \, dx$

Compute each of the following Limits. Simplify.

12.  $\lim_{x \rightarrow 3^+} e^{\frac{2}{x-3}}$
13.  $\lim_{x \rightarrow 3^-} e^{\frac{2}{x-3}}$
14.  $\lim_{x \rightarrow \infty} \ln \left( 1 - \arctan \left( \frac{5}{x^4} \right) \right)$
15.  $\lim_{x \rightarrow \infty} \ln \left( \frac{\pi}{2} - \arctan x \right)$
16.  $\lim_{x \rightarrow 4^-} \ln |\ln |x - 4||$
17.  $\lim_{x \rightarrow 0^+} \arctan \left( \frac{\ln x}{5} \right)$
18. Present two different methods to Prove that  $\int \frac{1}{4+x^2} \, dx = \frac{1}{2} \arctan \left( \frac{x}{2} \right) + C$

# REGULAR OFFICE HOURS

**Monday: 1:00–3:00 pm**

9–10:30 pm TA Mia, SMUDD 207

**Tuesday: 12:00–4:00 pm**

6–7:30 pm TA Ian, SMUDD 207

7:30–9:00 pm TA Karime, SMUDD 207

**Wednesday: 1:00–3:00 pm**

6–7:30 pm TA Ian, SMUDD 207

7:30–9:00 pm TA Daksha, SMUDD 207

**Thursday: none for Professor**

1–2:30 pm TA Mia, SMUDD 207

7:30–9:00 pm TA Daksha, SMUDD 207

**Friday: 12:00–2:00 pm**

2:30–4:00 pm TA Karime, SMUDD 014\*\*

- Please stop by for help! Try to attend at least one office hour for me and at least one for the Math Fellows each week.
- You can also find help at the Math Fellow (Mia, Ian, Karime or Daksha) sessions.