Math 121, Section 01, Spring 2022

Homework #4

Due **SUNDAY, February 20th** 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. $\lim_{x\to 3^+} e^{\frac{2}{x-3}}$

13. $\lim_{x\to 3^-} e^{\frac{2}{x-3}}$

14. $\lim_{x\to\infty} \ln\left(1 - \arctan\left(\frac{5}{x^4}\right)\right)$

15. $\lim_{x\to\infty} \ln\left(\frac{\pi}{2} - \arctan x\right)$

16. $\lim_{x\to 4^-} \ln|\ln|x-4||$

17. $\lim_{x\to 0^+} \arctan\left(\frac{\ln x}{5}\right)$

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

Sunday: 6–7:30 pm TA Nico, SMUDD 207

Monday: 1:00–3:00 pm

6–7:30 pm TA Daksha, SMUDD 207

7:30–9:00 pm TA Karime, SMUDD 207

Tuesday: 12:00–4:00 pm

6–7:30 pm TA Ian, SMUDD 207

7:30–9:00 pm TA Nico, SMUDD 207

Wednesday: 1:00-3:00 pm

9–10:30 pm TA Daksha, SMUDD 207

Thursday: none for Professor

6–7:30 pm TA Ian, SMUDD 207

7:30–9:00 pm TA Karime, SMUDD 207

Friday: 12:00–2:00 pm

• 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 (Nico, Ian, Karime or Daksha) sessions.