

Homework #3Due **Wednesday, September 8th** in Gradescope by 11:59 pm ET**Goal:** Solidifying Calculus for Inverse Sine and Inverse Tangent.

Differentiate the following functions. Simplify.

$$1. f(x) = \tan^{-1}(x^2) \quad 2. f(x) = (\tan^{-1}(x))^2$$

$$3. y = x \sin^{-1} x + \sqrt{1-x^2} \quad 4. f(x) = \ln\left(1 - \arcsin\left(\frac{2}{x^4}\right)\right)$$

5. Find the value of the expression $\tan\left(\sin^{-1}\left(\frac{2}{3}\right)\right)$

6. Simplify the expression $\sin(\tan^{-1} x)$

7. Compute the Second Derivative for $f(x) = \arctan(2x)$

8. Compute the Second Derivative for $f(x) = \arcsin(6x)$

9. **Prove** that $\frac{d}{dx} \sin^{-1}(3x) = \frac{3}{\sqrt{1-9x^2}}$

10. **Prove** that $\frac{d}{dx} \tan^{-1}(5x) = \frac{5}{1+25x^2}$

11. Use Integration to **Justify** that $\int \frac{1}{3+x^2} dx = \frac{1}{\sqrt{3}} \arctan\left(\frac{x}{\sqrt{3}}\right) + C$

Compute each of the following Integrals. Simplify.

12. $\int \frac{x^2}{x^2+1} dx$

13. $\int \frac{x+1}{x^2+1} dx$

14. $\int_{\frac{1}{\sqrt{3}}}^{\sqrt{3}} \frac{8}{1+x^2} dx$

15. $\int_0^{\frac{1}{2}} \frac{\arcsin x}{\sqrt{1-x^2}} dx$

16. $\int \frac{1}{\sqrt{1-x^2} \cdot \sin^{-1} x} dx$

17. $\int_1^3 \frac{1}{\sqrt{x}(1+x)} dx$

18. $\int_0^{\ln 3} \frac{e^x}{1+e^x} dx$

19. $\int_0^{\frac{1}{2} \ln 3} \frac{e^x}{1+e^{2x}} dx$

20. $\int \frac{e^{2x}}{\sqrt{1-e^{4x}}} dx$

21. $\int_3^{3\sqrt{3}} \frac{1}{\sqrt{36-x^2}} + \frac{1}{9+x^2} dx$

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 do not wait until the last night to start.
- Please stop by for help! Please try the homework before you come by though. Final Answer keys are posted on the webpage. Please do **not** look at them unless you have completed the problems. **They are not a replacement for my help or your understanding.**
- You can also find help at the Math Fellow (Mia, Ian, Karime or Daksha) sessions.