

Math 121 Midterm Exam #1 March 11-14, 2021
Due Sunday, March 14, in Gradescope by 11:59 pm ET

- This is an *Open Notes* Exam. You can use course materials, homeworks problems, lecture notes, etc. that you manually worked on.
- There is **NO** *Open Internet* allowed. You can only access our Main Course Webpage.
- You are **NOT** allowed to work on or discuss these problems with other people, including the Professor or Math Fellow TA.
- Submit your final work in Gradescope in the Exam 1 entry.
- Please *show* all of your work and *justify* all of your answers. No Calculators.

Limits [30 Points total, 10 points per each limit] Evaluate each of the following. Please justify/simplify. Be clear if the limit equals a value, $+\infty$ or $-\infty$, or Does Not Exist.

1. Show that $\lim_{x \rightarrow 1} \frac{\arctan(x-1) - \cos(\pi x) - x}{\sinh(x^2-1) - 2 \ln x} = \boxed{-\frac{\pi^2}{4}}$

2. Show that $\lim_{x \rightarrow 0^+} x^5 \ln x = \boxed{0}$

3. Show that $\lim_{x \rightarrow \infty} \left(1 - \arcsin\left(\frac{2}{x^4}\right)\right)^{x^4} = \boxed{e^{-2}}$

Integrals [70 Points total, 10 points per each integral]

4. Compute $\int_1^3 \frac{1}{\sqrt{x} \cdot \sqrt{4-x}} dx$ Simplify.

5. Compute $\int_e^{e^3} \frac{1}{x[3 + (\ln x)^2]} dx$ Simplify.

6. Show that $\int_{-2}^2 \sqrt{4-x^2} dx = \boxed{2\pi}$ using Trigonometric Substitution

7. Compute $\int \frac{x}{\sqrt{4+x^2}} dx$ using Trigonometric Substitution

8. Compute $\int x^2 \arcsin x dx$

9. Show that $\int_1^e [\ln(x^3)]^2 dx = \boxed{9e - 18}$

10. Compute $\int \frac{e^{2x}}{(4 + e^{4x})^{\frac{3}{2}}} dx$ Hint: $e^{4x} = (e^{2x})^2$