Math 125C Spring 2024
Mid-Term Exam Number Two
May 16, 2024

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	20
2	20
3	20
4	10
5	10
Total	80

- Show all work for full credit.
- All answers should be exact unless the problem asks for an estimate, approximation or decimal value.
- You may use a TI 30X-IIS calculator during this exam. **All other electronic devices are not allowed**, and should be turned off and put away for the duration of the exam.
- If you use a trial-and-error or guess-and-check method when an algebraic method is available, you will not receive full credit.
- You may use one hand-written 8.5 by 11 inch page of notes. Write your name on your notesheet and turn it in with your exam.
- No scratch or other paper is allowed during the exam other than the notesheet described above. If you need more space to work, use the back of the exam pages.
- You have 80 minutes to complete the exam.
- Good luck!

1. Evaluate the following integrals.

   (a) $\int x^2(\ln x)^2\,dx$

   (b) $\int \dfrac{4x^3+x^2+4}{x^2+x}\,dx$

2. Evaluate the following integrals.

(a) $\int \frac{x^3}{\sqrt{1-2x^2}}\,dx$

(b) $\int \frac{1}{\sqrt{x^2-6x+10}}\,dx$

3. Evaluate the following integrals.

(a) $\int \frac{\sqrt{x-1}}{x}\,dx$

(b) $\int_0^\infty xe^{-x^2}\,dx$

4. Let $\mathcal{R}$ be the region in the first quadrant bounded by $y = e^x$ and $y = 10$.

   Suppose $\mathcal{R}$ is rotated about the y-axis to create a solid of revolution.

   Suppose this solid of revolution is filled with a liquid of density ρ kg/m^3.

   Assume gravity is g m/s^2.

   (a) Use an integral expression to express the amount of work done in lifting all the liquid up to the top of the tank.
   Do not evaluate your integral.

   (b) Suppose we instead want to lift all the liquid to a point 2.6 meters above the top of the tank.
   Use an integral expression to express the amount of work done.
   Do not evaluate your integral.

5. Find $b > 0$ such that the average value of $f(x) = x^2$ on the interval $0 \leq x \leq b$ is b.