Math 125 D Winter 2024
Mid-Term Exam Number Two
February 22, 2024

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	20
2	20
3	10
4	10
5	10
Total	70

- Show all work for full credit.
- All answers should be exact unless the problem asks for an estimate or approximation.
- 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!

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1. Evaluate the following indefinite integrals.

(a) $\displaystyle\int \frac{\sqrt{3x-10}}{3x+6}\,dx$

(b) $\displaystyle\int \frac{x+1}{x^2+5x+6}\,dx$

2. Evaluate the following indefinite integrals.

(a) $\displaystyle\int \frac{1}{x^4\sqrt{x^2-9}}\,dx$

(b) $\displaystyle\int \sec^6 x \tan^8 x\,dx$

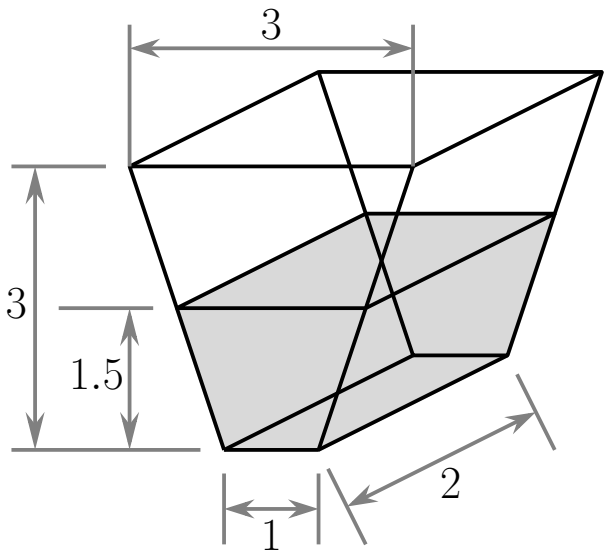
3. Let R be the region in the first quadrant bounded by $y = -6x^2 + 18x - 12$ and the x-axis.
   Find the volume of the solid obtained by rotating R about the line $x = -1$.
   Express your final answer as a simple decimal with at least four digits of accuracy.

4. A tank is shaped as shown in the figure, with trapezoidal ends and trapezoidal vertical cross-sections. All dimensions are in meters. The tank is filled with water to a depth of 1.5 meters.

   Use $\rho = 1000$ kg/m^3 for the density of water and $g = 9.8$ m/s^2 for acceleration due to gravity.

   Use an integral to express the amount of work required to pump all of the water to the top of the tank.

   Do not evaluate the integral.



5. Give two positive (i.e., greater than zero) values of b for which the function

$$f(x) = \sin x + x \cos x$$

has an average value of $\frac{1}{2}$ on the interval $[0, b]$.