

Math 125 D Autumn 2023  
Mid-Term Exam Number Two  
November 16, 2023

Name: \_\_\_\_\_

Student ID no. : \_\_\_\_\_

Signature: \_\_\_\_\_

Section: \_\_\_\_\_

1	20
2	20
3	20
4	10
5	10
6	10
Total	90

- 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!

1. Evaluate the following indefinite integrals.

(a)  $\int \frac{x}{x^2 + 4x + 3} dx$

(b)  $\int \sin^3 x \cos^4 x \tan x dx$

2. Evaluate the following indefinite integrals.

(a)  $\int x \cos x \sin x \, dx$

(b)  $\int \frac{x^5}{\sqrt{4-x^2}} \, dx$

3. Evaluate the following indefinite integrals.

(a)  $\int x^3(x^2 - 1)^{3/2} dx$

(b)  $\int x^2 \tan^{-1} x dx$

4. Consider the region  $R$  bounded by  $y = \frac{3}{4}x^2$ ,  $x = 2$ ,  $y = 5$  and the  $y$ -axis.

Find the volume of the solid of revolution created by revolving  $R$  about the  $y$ -axis.

5. Consider the region  $R$  bounded by  $y = \frac{3}{4}x^2$ ,  $x = 2$ ,  $y = 5$  and the  $y$ -axis. This is the same region as in problem 5.

Suppose a water tank is made in the shape of the solid of revolution you get by revolving  $R$  about the  $y$ -axis, with units in meters.

Suppose the tank is filled with water with density  $\rho$  kg/m<sup>3</sup>.

Suppose acceleration due to gravity is  $g$ .

Let  $W$  be the work done in pumping all the water out of the tank.

Express  $W$  using one or more integrals. Do not evaluate the integral(s).

6. Give an interval of length 3 on which the exponential function  $e^x$  has an average value of 5.