Please do not write in the boxes immediately below.

problem	1	2	3	4	5	6	total
points							

MATH 136 Fall 2023 Midterm Exam 2

November 16, 2023

Your name_____

The exam has 6 different printed sides of exam problems and 1 side workspace.

Duration of the Midterm Exam is 90 minutes. There are 6 problems, worth 10 points each. From Problems 1 – 6, only 5 problems will be graded. If you solve all Problems 1 – 6, you must cross out the problem in the box above that must not be graded. If you solve all Problems 1 – 6 and do not cross out a problem, only the first five problems will be graded. Show all your work for full credit. Books, notes etc. are prohibited. Calculators, cellphones, earphones, AirPods and cheat sheets are NOT permitted.

1. Determine whether the integral $\displaystyle\int_4^\infty \frac{dx}{x^2-5x+6}$ converges or diverges. You are not allowed to use the Comparison Test for Improper Integrals.

2. Find the value of C that makes $p(x) = Ce^{-x}e^{-e^{-x}}$ a probability density function, and compute the probability $P(-4 \leq X \leq 4)$.

3. Find the arc length of $y = \ln\left(\dfrac{e^x + 1}{e^x - 1}\right)$ for $1 \leq x \leq 3$.

4. (i) Find the area of the region bounded by the curves $y = \sin x$, $y = \cos x$, $x = 0$, and $x = \pi/2$.

(ii) **Set up** an integral to find the volume of the solid obtained by rotating the region in part (i) about the x-axis.

5. The half-life of cesium-137 is 30 years. Suppose we have a 100-mg sample.
(a) Find a formula for the mass of the sample that remains after t years.Your formula must be of the form $m(t) = c_1\, 2^{c_2 t}$, where c_1 and c_2 are constants.

(b) How much of the sample remains after 100 years? **Hint:** $2^{-10/3} \approx 0.1$.

(c) After how long will only 1 mg remain? **Hint:** $\ln(1/100) \approx -4.6$.

6. Determine whether the sequence converges or diverges, if it converges, find the limit.

(a) $a_n = \dfrac{3\sqrt{n}}{\sqrt{n}+2}$

(b) $\left\{\dfrac{(-1)^n}{2\sqrt{n}}\right\}$

(c) $a_n = \cos\left(\dfrac{n\pi}{n+1}\right)$

(d) $\left\{\dfrac{\ln n}{\ln 2n}\right\}$

(e) $a_n = \dfrac{\cos^2 n}{2^n}$

WORKSPACE