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Name (print): _____

Signature: _____

ID Number: _____

MATH 138, Calculus 2

Midterm Test, Fall Term, 2024

University of Waterloo

Instructor: Stephen New

Date: Monday, October 21, 2024

Time: 7:00-8:50 pm

Room: DWE 1501

Instructions:

1. Place your name, signature and ID number in the spaces provided at the top of this page.

2. This test contains 6 pages, including this cover page and a page at the end for extra space, if needed.

3. No calculators or any other electronic devices are allowed.

4. Answer all 4 questions; all questions will be given equal value.

5. Provide full explanations with all your solutions. If you run out of space then continue on the last pages.

Question	Mark
1	/10
2	/10
3	/10
4	/10
Total	/40

[10] **1:** (a) Recall that $\sum_{k=1}^{n} 1 = n$, $\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$, $\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$ and $\sum_{k=1}^{n} k^3 = \frac{n^2(n+1)^2}{4}$.
Find $\int_{-1}^{2} x^2 + 2x \, dx$ by finding the limit off a sequence of Riemann sums for $f(x) = x^2 + 2x$.

(b) Approximate $\int_{-1}^{1} \frac{dx}{2x^2 + x + 3}$ using the Trapezoid Rule T_4 (on 4 sub-intervals).

[10] **2:** (a) Find $\displaystyle\int_0^4 \frac{x\,dx}{\sqrt{2x+1}}$.

(b) Find $\displaystyle\int_1^4 \frac{\ln x}{x^{3/2}}\,dx$.

(c) Find $\displaystyle\int_0^{\pi/2} \frac{\cos^3 x}{2+\sin x}\,dx$.

[10] **3:** (a) Find $\displaystyle\int_0^\infty (2x+3)\,e^{-2x}\,dx\,.$

(b) Find $\displaystyle\int_0^3 \frac{dx}{\sqrt{x}\sqrt{3-x}}\,.$

(c) Find $\displaystyle\int_0^\infty \frac{2x-1}{(x+1)(x^2+2x+2)}\,dx\,.$

[10] **4:** (a) Find $h'(1)$ when $h(x) = \displaystyle\int_{t=\sqrt{x}}^{\ln(x^3)} 4^{t^2}\, dt\,.$

(b) Find $\displaystyle\int e^x \sin^2 x\; dx\,.$

Use this page to continue solutions if you require additional space.
If you do, then clearly indicate which questions you are continuing.