MATH 1650 Student name: _____

Exam 3 – Ver A Recitation instructor: _____

Spring 2026 Section: _____

This exam is closed book and closed notes. No electronic devices, calculators, headphones, or smart watches are allowed.

There are two sections:

Section 1 – Multiple-Choice: *5-points each, No partial credit*

Section 2 – Work-Out: *10-points each, Partial credit possible*

SCORES

SECTION 1: Multiple-Choice

1–6 Total	

SECTION 2: Work-Out

7	
8	
9	
10	

DO NOT BEGIN THIS EXAM UNTIL INSTRUCTED TO START

Do not write in these boxes on the exam →

score

Section 1 – Multiple-Choice *Clearly circle one choice for each question. More than one circled answer will be considered incorrect. Space is provided for work, but no work will be graded. Each question is worth 5 points with no partial credit.*

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1. A function $f(x)$ and its derivative $f'(x)$ are partially described in the table below.

x	$f(x)$	$f'(x)$
1.0	2.4	3.0
1.5	0.8	2.0
2.0	-0.5	1.2
2.5	-1.1	0.6

A student wants to use **Newton's method** to approximate a zero of $f(x)$, starting with the initial guess $x_0 = 1.5$.
What is the next approximation, x_1?

A. 1.9

B. 1.1

C. 2.3

D. 2.7

E. All of the above

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2. Suppose f is a continuous function on $[a, b]$. Assume f has a maximum value of 5 and a minimum value of 1 on $[a, b]$. Which of the following **must** be true by the Mean Value Theorem for integrals?

A. $f(c) = 2$ for some c in $[a, b]$.

B. There is a unique value c such that $f(c) = \dfrac{1}{b-a}\displaystyle\int_a^b f(x)\,dx$.

C. $f(c) = \dfrac{4}{b-a}$ for some c in $[a, b]$.

D. $\displaystyle\int_a^b [f(x) - f(c)]\,dx = 0$ for some c in $[a, b]$.

E. The Mean Value Theorem does not apply as f is not differentiable.

score

3. Which of the following is the correct definite integral after applying the u-substitution method to $\int_1^2 \frac{2x}{1+x^4}\,dx$ with $u = x^2$?

A. $\int_1^4 \frac{1}{1+u^2}\,du$

B. $\int_1^4 \frac{2}{1+u^2}\,du$

C. $\int_1^2 \frac{1}{1+u^2}\,du$

D. $\int_1^2 \frac{2}{1+u^2}\,du$

E. $\int_1^2 \frac{2\sqrt{u}}{1+u^2}\,du$

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4. Compute:

$$\frac{d}{dx}\left[\int_x^{x^2} \sin(t^2)\,dt\right]$$

A. $\cos(x^4) - \cos(x^2)$

B. $2x^2\cos(x^4) - 2x\cos(x^2)$

C. $2x\sin(x^4) - \sin(x^2)$

D. $\sin(x^4) - \sin(x^2)$

E. $2x\sin(x^4) + \sin(x^2)$

score

5. Which of the following represent the area of the region bounded by the graphs of $y = x - 2$, $x = y^2$, $x = 0$, and $x = 4$?

1. $2\int_0^1 \sqrt{x}\ dx + \int_1^4 (\sqrt{x} - x + 2)\ dx$
2. $\int_0^4 [(x-2) - \sqrt{x}]\ dx$
3. $\int_0^4 [(y+2) - y^2]\ dy$
4. $\int_{-1}^2 [(y+2) - y^2] dy$

A. 1 only

B. 2 only

C. 3 only

D. 1 and 4

E. 2 and 3

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6. Consider the limit of a Riemann sum using right endpoints and equal subinterval widths

$$\lim_{n\to\infty} \sum_{k=1}^{n} \left(\frac{6k}{n}\right)^2 \cdot \frac{6}{n}$$

Which definite integral does this limit equal?

A. $\int_0^6 (6x)^2 dx$

B. $\int_0^6 (6x)^2 \cdot 6\, dx$

C. $\int_0^6 x^2 dx$

D. $\int_0^6 x^2 \cdot 6\, dx$

E. $\int_0^6 \left(\frac{6}{x}\right)^2 dx$

score

Section 2 – Work-Out *Answer each question completely using exact values. You do not need to simplify your answers unless otherwise indicated. Show all steps neatly and legibly. Include correct notation.* **Answers without work and/or justifications will not receive full credit**. *Clearly indicate your final answer for each problem. Each problem is worth* 10 *points. Partial credit is possible.*

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7. Evaluate the limit using L'Hospital's Rule:

$$\lim_{x \to 0^+} x \ln(x)$$

score

8.

(a) Evaluate the following definite integral $\int_1^3 2te^{t^2}\,dt$ via u-substitution.

(b) Evaluate the following indefinite integral: $\int x(x^2+1)^3\,dx$ via u-substitution.

score

9. Let $F(x) = \int_0^x (e^t + 2t)\, dt$.

(a) Find $F(4)$.

(b) Find $F'(4)$.

score

10. Consider the area under the line $y = \frac{x}{3}$ and above the x-axis from $x = 0$ to $x = 6$.

(a) (4 points) Approximate the area using a Riemann sum with three equally sized subintervals, using the left endpoint of each subinterval. Your answer should clearly label the interval size(s), the left endpoint(s) and value(s) used.

(b) (5 points) Approximate the area using a Riemann sum with right endpoints and n rectangles. Your answer should clearly label expressions for the interval size(s), the right endpoint(s) and value(s), and simplified area approximation without summations.

(c) (1 point) Find the exact area by taking the limit of the Riemann sum from part (b).

score