

MATH 165
Exam 3
Spring 2024

Student name: _____
Recitation instructor: _____
Section: _____

*This exam is closed book and closed notes. No electronic devices, including calculators and headphones, are allowed. Drawing pictures to help understand and solve the questions is encouraged. Answer each question completely using exact values; you do not need to simplify your answers unless otherwise indicated. Show your work neatly. Include correct notation. Show the steps in your work. Write legibly. **Answers without work and/or justifications will not receive credit.** Circle your final answer for each problem. Each problem is worth 10 points.*

1	
2	
3	
4	
5	
6	

DO NOT BEGIN THIS EXAM UNTIL INSTRUCTED TO START

Do not write
in these boxes →
on the exam

score

1. The graph of $y = x^3 + 2$ crosses the line $y = -2x$ at one point. Estimate the x -coordinate of this point by finding x_2 using Newton's Method with $x_0 = 0$.
Give your answer as an integer or a fully reduced fraction.

score

2. Find the area of the region enclosed by the curves $y = \frac{1}{2}\sqrt{x}$ and $y = \frac{1}{2}x^2$.

score

3. Compute the following limits:

(a) (5 points)

$$\lim_{x \rightarrow 0} \left(\frac{e^x - x - 1}{\cos(3x) - 1} \right)$$

(b) (5 points)

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

score

4. Find the function $f(x)$ satisfying all the following properties:

(i) $\frac{d^2}{dx^2}f(x) = 3\sqrt{x}$

(ii) $f(x)$ has a horizontal tangent line at $x = 4$

(iii) the graph of $f(x)$ passes through the point $(0, 1)$

score

5. Find the equation of the tangent line of

$$F(x) = \int_{2x}^{x^2} \frac{\ln(t)}{t} dt$$

at $x = 2$.

score

6. Consider the area under the line $y = 2x$ and above the x -axis from $x = 0$ to $x = 3$.

(a) (2 points) Find the area by using geometry.

(b) (6 points) Approximate the area under the line using a Riemann sum with right endpoints and n rectangles. Your answer should be in terms of n only. Simplify.

(c) (2 points) Find the exact area under the line by taking a limit of the Riemann sum from part (b).

score
