Math 141, Exam 3
Spring 2025

Name: _____

Student ID: _____

Version: **A**

Instructions:

- Do NOT open exam booklet until instructed.
- Write your Name and Student ID Number on the lines above.
- Write your Name and Student ID Number on the answer sheet.
- Fill in version (A or B) on your answer sheet.
- No calculators, personal devices (phones, computers, tablets, etc.), or reference materials may be used during the exam.
- You may use any blank space on this exam booklet for your scratch work or ask for a blank sheet for scratch work. DO NOT USE YOUR OWN SCRATCH PAPER!
- Indicate your answer to each question on the answer sheet by fully filling in the appropriate bubble.
- The exam booklet and answer sheet will be collected at the end of the exam. Only the answer sheet will be graded.

Page intentionally left blank for scratch work.

1. Solve $e^{3x} = 2$ for x.

(a) $x = \frac{\ln 2}{\ln(3)}$

(b) $x = \frac{\ln 2}{3}$

(c) $x = \frac{2}{3e}$

(d) $x = \ln\left(\frac{2}{3}\right)$

2. Find $\frac{d}{dx} 3e^{8x}$.

(a) $3e^{8x}$

(b) $24e^{8x}$

(c) $8xe^{8x}$

(d) $24xe^{8x}$

3. Find the slope of the tangent line to $y = 6\ln(2x)$ at the point $(1, 6\ln(2))$.

(a) 2

(b) 3

(c) 6

(d) 12

4. What is the derivative of $2x^3e^x$?

(a) $2x^3e^x + 6x^2e^x$

(b) $6x^2e^x$

(c) $2x^3 + 6x^2e^x$

(d) $6x^2 + 2e^x$

5. Compute $\frac{d}{dx}\frac{x}{\ln(1+x^2)}$.

(a) $\frac{\frac{2x^2}{x^2+1}-\ln(1+x^2)}{(\ln(1+x^2))^2}$

(b) $\frac{\ln(1+x^2)-\frac{2x^2}{x^2+1}}{(\ln(1+x^2))^2}$

(c) $\frac{\ln(1+x^2)-\frac{2x}{x^2+1}}{(\ln(1+x^2))^2}$

(d) $\frac{\frac{x^2}{x^2+1}-\ln(1+x^2)}{(\ln(1+x^2))^2}$

6. Which of the following statements about $\ln(x)$ is **false**? (Choose one.)

(a) The natural logarithm is defined for positive values of x.

(b) The natural logarithm is the inverse of the natural exponential.

(c) $\ln(e) = 0$.

(d) The antiderivative of $1/x$ with respect to x is $\ln|x| + C$.

(e) For any $a, b > 0$, $\ln(ab) = \ln(a) + \ln(b)$.

7. If $P(t)$ is a function satisfying $\frac{d}{dt}P = 4P$ and $P(0) = 5$, find an equation for $P(t)$.

(a) $P(t) = 4e^t + 1$

(b) $P(t) = e^{4t} + 4$

(c) $P(t) = 5e^{4t}$

(d) $P(t) = 20e^t$

8. What is the purpose of a definite integral?

(a) To find the slope of a tangent line to a curve.

(b) To calculate the total change of a function over an interval.

(c) To determine the net area under a curve within a specified interval.

(d) To identify the rate of change of a function at a specific point.

9. If $\int_a^b f(x)dx = 0$, which of the following must be true?

(a) $f(x) = 0$ everywhere on the interval $[a, b]$.

(b) The areas above and below the x-axis cancel each other out.

(c) $f(x)$ is constant on $[a, b]$.

(d) $f(x)$ has no critical points on $[a, b]$.

10. Evaluate $\int e^{3x} - 7dx$

(a) $e^{3x} - 7x$

(b) $e^{3x} - 7x + C$

(c) $\frac{1}{3}e^{3x} - 7x$

(d) $\frac{1}{3}e^{3x} - 7x + C$

11. Find a function f with $\frac{d}{dx}f(x) = 6x^2 - 2x$ and $f(1) = 5$

(a) $2x^3 - x^2 + 4$

(b) $2x^3 - x^2 + 5$

(c) $x^3 - x^2 + 2$

(d) $x^3 - x^2 + 5$

12. Find the net area under the curve $f(x) = x - e^x$ over the interval $[0, 2]$.

(a) $1 - e^2$

(b) $2 - e^2$

(c) $3 - e^2$

(d) $4 - e^2$

13. If $f(x) < 0$ on the interval $[a, b]$, then $\int_a^b f(x)dx$ is

(a) positive

(b) negative

(c) there is not enough information to decide if the integral is positive, negative, or zero.

14. What is the total area bounded by the curves $y = 0$ and $y = x^3 - x$?

(a) $\int_{-1}^{1}(x^3 - x)dx$

(b) $\left|\int_{-1}^{1}(x^3 - x)dx\right|$

(c) $\left|\int_{-1}^{0}(x^3 - x)dx\right| + \left|\int_{0}^{1}(x^3 - x)dx\right|$

(d) $\int_{-1}^{0}(x^3 - x)dx + \int_{0}^{1}(x^3 - x)dx$

15. What is the average value of $4x^3$ over the interval $[1, 3]$?

(a) 10

(b) 20

(c) 40

(d) 80

16. Let $f(x)$ be a continuous function with continuous derivative. If $\int_2^6 f'(x)dx = 3$ and $f(6) = 1$, what is $f(2)$?

(a) 4

(b) -3

(c) -2

(d) There is not enough information to answer the question.

17. The integration technique substitution is used to undo which differentiation rule.

(a) The power rule

(b) The product rule

(c) The quotient rule

(d) The chain rule

18. Evaluate $\int \frac{\ln(x)}{x} dx$.

(a) $x \ln(x) + C$

(b) $\frac{1}{2}(\ln(x^2)) + C$

(c) $\frac{1}{x^2 \ln(x)} + C$

(d) $\frac{1}{2}(\ln(x))^2 + C$

19. If $u = 2x + 1$, then

(a) $du = 2$

(b) $du = dx$

(c) $du = 2dx$

(d) $du = 3$

20. Compute $\int_{-\frac{1}{2}}^{0} (2x + 1)^9 dx$

(a) $\frac{1}{20}$

(b) $-\frac{1}{20}(\frac{-1}{2})^{10}$

(c) $\frac{1}{20}(\frac{-1}{2})^{10}$

(d) $-\frac{1}{20}$