

Math 141 Exam 3 Fall 2019

Make sure you fill in your answers clearly on the scantron answer sheet provided. Fill in your name, student ID number, and exam version on the answer sheet. You may use this exam to work out the problems. You must hand in this exam as well as the scantron answer sheet. When you hand in your exam, be prepared to show your picture ID. No notes or formula sheets are allowed for this exam. Approved calculators such as TI-83 or TI-84 calculators are permitted for this exam, however TI-89 calculators and any CAS calculators are prohibited. No cell phones are permitted outside your bag at any time during the exam.

Name, and section: _____

ID#: _____

Exam version: B

[1] Use implicit differentiation to find $\frac{dy}{dx}$ if $x^3 + 2y^2 = 6$.

A. $\frac{6 + 3x^2}{4y}$

B. $\frac{6 - 3x^2}{4y}$

C. $-\frac{3x^2}{4y}$

D. $\frac{3x^2}{4y}$

[2] Use implicit differentiation to find $\frac{dy}{dx}$ if $x^3y^2 + x^5y^3 = -19$.

A. $\frac{3x^2y^2 + 5x^4y^3}{2x^3y + 3x^5y^2}$

B. $\frac{2x^3y + 3x^5y^2}{3x^2y^2 + 5x^4y^3}$

C. $\frac{2x^3y + 3x^5y^2}{-3x^2y^2 - 5x^4y^3}$

D. $\frac{-3x^2y^2 - 5x^4y^3}{2x^3y + 3x^5y^2}$

[3] What is the slope of the curve $x^2 - y^2 = 9$ at the point $(5, 4)$?

A. 5

B. 4

C. $\frac{5}{4}$

D. $-\frac{5}{4}$

[4] A 10 foot long ladder leans against a vertical wall. If the lower end of the ladder is being moved away from the wall at a rate of 3 feet per second, how fast is the height of the top changing (this will be a negative rate) when the lower end is 6 feet from the wall?

- A. $-\frac{63}{8}$ feet per second
- B. $-\frac{8}{63}$ feet per second
- C. $-\frac{9}{4}$ feet per second
- D. $-\frac{4}{9}$ feet per second

[5] Suppose that the revenue and cost of producing and selling x units of a certain item are given by $R(x) = 45x - 0.5x^2$ and $C(x) = 4x + 5$. Find the rate of change of the profit with respect to time when $x = 30$ units and $\frac{dx}{dt} = 15$ units per day.

- A. \$775 per day
- B. \$165 per day
- C. \$26 per day
- D. \$11 per day

[6] For $f(x) = e^x$, which of the following is **false**?

- A. f has no asymptotes.
- B. f has no relative extrema.
- C. $f(x)$ is positive for all x .
- D. $f'(x)$ is positive for all x .

[7] Which of the following is **false**?

- A. $\log_B(A) = \frac{\ln(A)}{\ln(B)}$
- B. $\ln(A \cdot B) = \ln(A) + \ln(B)$
- C. $\ln(A + B) = \ln(A) \cdot \ln(B)$
- D. $\ln\left(\frac{A}{B}\right) = \ln(A) - \ln(B)$

[8] For $f(x) = \ln(x)$, which of the following is **false**?

- A. f is increasing.
- B. f has a vertical asymptote.
- C. The range of f is $(-\infty, \infty)$.
- D. f has an inflection point at $(1, 0)$.

[9] Find the derivative of $y = \frac{e^x}{x^5}$.

- A. $\frac{e^x}{5x^4}$
- B. $\frac{xe^{x-1}}{5x^4}$
- C. $\frac{xe^x - 5e^x}{x^6}$
- D. $\frac{x^2e^{x-1} - 5e^x}{x^6}$

[10] Find the derivative of $y = x^4e^{3x}$.

- A. $4x^3e^{3x} + 3x^4e^{3x}$
- B. $4x^3e^{3x} + x^4e^{3x}$
- C. $4x^3e^{3x} + 3x^5e^{3x-1}$
- D. $12x^3e^{3x}$

[11] Find the derivative of $y = e^{-x^2+7x}$

- A. e^{-x^2+7x}
- B. $(-2x + 7)e^{-x^2+7x}$
- C. $(-x^2 + 7x)e^{-x^2+7x-1}$
- D. $(-2x + 7)e^{-x^2+7x-1}$

[12] Find the derivative of $y = x^4 \ln(7x)$.

- A. $\frac{4x^2}{7}$
- B. $4x^3 \ln(7x) + x^3$
- C. $4x^3 \ln(7x) + 7x^3$
- D. $4x^3 \ln(7x) + \frac{x^3}{7}$

[13] Find the derivative of $y = \ln\left(\frac{x^3}{x^2 + 2}\right)$.

- A. $\frac{x^2 + 2}{x^3}$
- B. $\frac{2}{3x^2}$
- C. $\frac{1}{x} - \frac{1}{x^2 + 2}$
- D. $\frac{3}{x} - \frac{2x}{x^2 + 2}$

[14] Find the derivative of $y = \ln(e^x + 2) + (\ln x)^3$.

- A. $1 + \frac{3(\ln x)^2}{x}$
- B. $\frac{e^x}{e^x + 2} + \frac{3(\ln x)^2}{x}$
- C. $1 + 3\left(\frac{1}{x}\right)^2$
- D. $\frac{e^x}{e^x + 2} + 3\left(\frac{1}{x}\right)^2$

[15] Find the derivative of $y = 2^x + \log_3(x)$.

- A. $2^x \cdot \ln(2) + \frac{1}{x \cdot \ln(3)}$
- B. $\frac{2^x}{\ln(2)} + \frac{\ln(3)}{x}$
- C. $2^x + \frac{3}{x}$
- D. $2^x + \frac{1}{x}$

[16] Find the general form of the function that satisfies $\frac{dA}{dt} = 5A$.

- A. $A(t) = 5Ce^t$
- B. $A(t) = 5Ce^{-t}$
- C. $A(t) = Ce^{5t}$
- D. $A(t) = Ce^{-5t}$

Use the following information for problems 17 and 18.

Timmy invests \$1000 in an account with an annual interest rate of 4% compounded continuously.

[17] What will the balance of Timmy's account be in 5 years?

- A. \$1064.03
- B. \$1134.91
- C. \$1221.40
- D. \$1376.79

[18] About how long will it take for Timmy's investment to double?

- A. 17.3 years
- B. 20.1 years
- C. 24.2 years
- D. 27.6 years

Use the following information for problems 19 and 20.

Lead-210 has a decay rate of 3.15% per year. The rate of change of an amount N of lead-210 is given by

$$\frac{dN}{dt} = -0.0315N.$$

[19] About how long is the half-life of lead-210?

- A. 315 years
- B. 220 years
- C. 32 years
- D. 22 years

[20] If there is initially 500g of lead-210, how much will be left in 10 years?

- A. 472g
- B. 365g
- C. 308g
- D. 254g