



*University of Connecticut  
Department of Mathematics*

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MATH 1131

PRACTICE EXAM 2

FALL 2017

NAME: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

Instructor Name: \_\_\_\_\_ Lecture Section: \_\_\_\_\_

TA Name: \_\_\_\_\_ Discussion Section: \_\_\_\_\_

**Read This First!**

- Please read each question carefully. All questions are multiple choice. There is only one correct choice for each answer. Each question is one point.
- Indicate your answers on the answer sheet. The answer sheet is the **ONLY** place that counts as your official answers.
  - (1) When you're done, hand in **both** the exam booklet and the answer sheet.
  - (2) You will receive the exam booklet back after the exam is graded. The booklet is not graded, but you may circle answers there for your records.
- Calculators are allowed **below the level of TI-89**. In particular, the **TI-Nspire is not allowed**. No books or other references are permitted.

1. Determine  $f'(1)$  for the function  $f(x) = (x^3 - x^2 + 1)(x^4 - x + 2)$ .

(A) 3      (B) 0      (C) 4

(D) 2      (E) 5

2. Find the equation of the tangent line to the curve  $y = \frac{x}{x+1}$  at  $x = 1$ .

(A)  $y = \frac{1}{2}$       (B)  $y = -\frac{1}{2}x + 1$       (C)  $y = \frac{1}{2}x$

(D)  $y = -\frac{1}{4}x + \frac{3}{4}$       (E)  $y = \frac{1}{4}x + \frac{1}{4}$

3. If  $f(x) = \sin(x)$ , determine  $f^{(125)}(\pi)$ .

(A) 1      (B)  $-1$       (C) 0

(D)  $1/2$       (E)  $\sqrt{2}/2$

4. To compute the derivative of  $\sin^2 x$  with the chain rule by writing this function as a composition  $f(g(x))$ , what is the “inner” function  $g(x)$ ? [1]

(A)  $x$       (B)  $x^2$       (C)  $\sin x$

(D)  $\sin^2 x$       (E) None of the above

5. Let  $y = f(x)g(x)$ . Using the table of values below, determine the value of  $\frac{dy}{dx}$  when  $x = 2$ . [1]

$x$	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	5	2	4	4
2	3	4	1	3
3	2	3	2	2
4	4	1	5	5
5	1	5	3	1

- (A) 9      (B) 12      (C) 13  
(D) 15      (E) 23

6. For the function  $f(x) = 2 \sin x - 3 \cos x$  determine  $f'''(\pi/2)$ , its third derivative at  $x = \pi/2$ . [1]

- (A) 2      (B) -2      (C) 3  
(D) -3      (E) 1

7. If  $g(x) = \frac{ax + b}{cx + d}$ , where  $a, b, c$ , and  $d$  are constants, then  $g'(1)$  is which of the following? [1]

(A)  $\frac{a + b - c - d}{c + d}$       (B)  $\frac{ad - bc}{(c + d)^2}$       (C)  $\frac{a + b - c - d}{(c + d)^2}$

(D)  $\frac{ad + bc}{c + d}$       (E)  $\frac{ad + bc}{(c + d)^2}$

8. For the function  $f(x) = x^3 \arctan(x)$ , which of the following is  $f'(1)$ ?

(A)  $\frac{3\pi}{4}$       (B)  $\frac{3\pi}{4} + \frac{1}{2}$       (C)  $\frac{1}{2}$

(D)  $\frac{\pi}{4}$       (E)  $3 \tan(1) + \sec^2(1)$

9. On the curve  $x^y = y^x$  with  $x$  and  $y$  both positive,  $\frac{dy}{dx}$  is which of the following? [1]

(A)  $\frac{1 - \ln x}{1 - \ln y}$       (B)  $x^{y-x} \ln x$       (C)  $(1 - \ln x) \frac{y}{x}$

(D)  $(1 - \ln y) \frac{y}{x}$       (E)  $\left(\frac{y}{x}\right) \left(\frac{x \ln y - y}{y \ln x - x}\right)$

10. Find  $\frac{d}{dx} [x^{\ln x}]$ . [1]

(A)  $(\ln x)x^{\ln x}$       (B)  $2(\ln x)x^{(\ln x)+1}$       (C)  $x^{(\ln x)-1}$

(D)  $2(\ln x)x^{\ln x}$       (E)  $2(\ln x)x^{(\ln x)-1}$

11. On the curve  $xy^3 = x - y$ , which of the following is  $\frac{dy}{dx}$ ?

(A)  $\frac{1 - y^2}{1 + 2xy^2}$       (B)  $\frac{1 - y^3}{1 - 3xy^2}$       (C)  $\frac{1 + y^3}{1 + 3xy^2}$

(D)  $\frac{1 + y^2}{1 + 3xy^2}$       (E)  $\frac{1 - y^3}{1 + 3xy^2}$

12. The size of a colony of bacteria at time  $t$  hours is given by  $P(t) = 100e^{kt}$ , where  $P$  is measured in millions. If  $P(5) > P(0)$ , then determine which of the following is true. [1]

I.  $k > 0$

II.  $P'(5) < 0$

III.  $P'(10) = 100ke^{10k}$

(A) I and III only.      (B) I and II only.      (C) I only.

(D) II only.      (E) I, II, and III.

13. Suppose that the half-life of a certain substance is 20 days and there are initially 10 grams of it. The amount of the substance, in grams, remaining after  $t$  days is

[1]

(A)  $10e^{10k}$       (B)  $\ln(10)e^{kt/10}$       (C)  $\ln(10)e^{t/10}$   
(D)  $10e^{-t\ln(2)/20}$       (E)  $10e^{t\ln(2)/20}$

14. Atmospheric pressure (the pressure of air around you) goes down as your height above sea level goes up. It decreases exponentially by 12% for every 1000 meters of added height. The pressure at sea level is 101.3 kilopascals. The pressure in kilopascals at height  $h$  meters above sea level is given by

[1]

(A)  $1000e^{10h}$       (B)  $\ln(101.3)e^{kh/12}$       (C)  $101.3e^{\ln(0.88)/1000}$   
(D)  $1000e^{-h\ln(2)/20}$       (E)  $101.3e^{h\ln(0.88)/1000}$

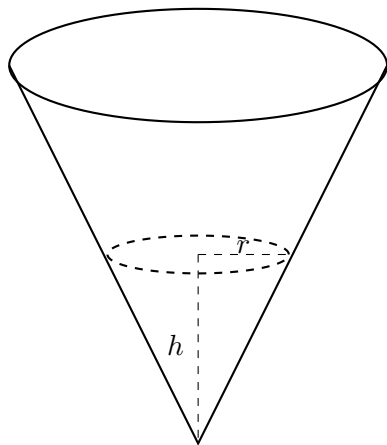


15. A particle moves along the curve  $y^3 = x^4 + 11$ . When it reaches the point  $(2, 3)$ , the  $y$ -coordinate is increasing at a rate of 32 cm/s. Which of the following represents the rate of increase of the  $x$ -coordinate at that instant?

(A) 27 cm/s      (B) 9 cm/s      (C) 13.5 cm/s  
(D) 6.75 cm/s      (E) None of the above

16. Water is withdrawn at a constant rate of  $2 \text{ ft}^3/\text{min}$  from an inverted cone-shaped tank (meaning the vertex is at the bottom). The diameter of the top of the tank is 4 ft, and the height of the tank is 8 ft. How fast is the water level falling when the height of the water in the tank is 2 ft? (**Note:** the volume of a cone of height  $h$  and base a circle of radius  $r$  is  $\frac{1}{3}\pi r^2 h$ .)

(A)  $\frac{2}{\pi}$  ft/min      (B)  $\frac{4}{\pi}$  ft/min      (C)  $\frac{6}{\pi}$  ft/min  
(D)  $\frac{8}{\pi}$  ft/min      (E)  $\frac{16}{\pi}$  ft/min



17. Use the linearization for the function  $f(x) = \sqrt{x^3 + 2x + 1}$  at  $x = 1$  to approximate the value of  $f(1.1)$ .

- (A) 2.0125      (B) 2.10      (C) 2.125  
(D) 0.5      (E) 1.925

18. Let  $f(x) = x^2 - 10$ . If  $x_1 = 3$  in Newton's method for solving  $f(x) = 0$ , determine  $x_2$ .

- (A)  $1/2$       (B)  $19/6$       (C)  $15/4$   
(D)  $12/7$       (E)  $17/6$