

# CALCULUS

## FINAL B

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

ID: \_\_\_\_\_

SCORE: \_\_\_\_\_/ 100

### RULES:

- You have 80 minutes to complete the exam.
- There are 5 questions and 100 points in total.
- You can use a non-graphing calculator.
- If you need to go to the restroom, please turn in your cellphone before.
- If you need hints, 1 hint is worth 3 points.

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*Date:* December 11, 2024.

*Problem 1* (20 points). (1) How many kinds of discontinuity are there? Draw graphs to demonstrate.

(2) State one out of two parts of the fundamental theorem of calculus? Just pick one.

(3) State the L'Hospital rule.

(4) Define the left-end Riemann sum for a continuous function  $f(x)$  on the interval  $[a, b]$ .

*Problem 2* (20 points). Compute the following:

(1)

$$\lim_{x \rightarrow 1^+} \frac{e^{\sin(x-1)-1} - 1}{\ln(x-1)}$$

(2)

$$\frac{d}{dx} \left( \sin(e^x) e^{\cos(x)} \right)$$

(3)

$$\int_0^\pi \sin(2x)e^x dx$$

(4)

$$\int x\sqrt{x^2-1} dx$$

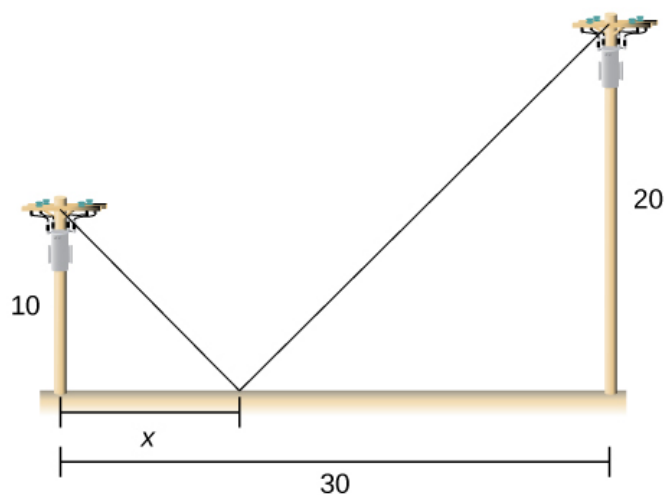
*Problem 3* (20 points). (1) What is the chain rule?

(2) Find  $y'(\pi)$  where

$$\tan(xy) = y,$$

and  $y(\pi) = 1$ .

*Problem 4* (20 points). Two poles are connected by a wire that is also connected to the ground. The first pole is 20 ft tall, and the second pole is 10 ft tall. There is a distance of 30 ft between the two poles. Where should the wire be anchored to the ground to minimize the amount of wire needed?



*Problem 5* (20 points). Use the method of shells to find the volume of a cone with radius  $r$  and height  $h$ .

