

MATH 30, SPRING 2026, PRACTICE TEST II

**Disclaimer:** This practice test DOES NOT serve as an indication of the contents of the actual test. It only suggests a possible format.

Please print your name clearly!

Name: \_\_\_\_\_

*Please show all your work, that is explain every step of your solution - it is your work, not the answer, that is being evaluated. When asked to prove a statement, make sure to provide reasoning behind each claim you are making in the process of the proof. The use of calculators or any other electronic devices is prohibited during the test. You are also not allowed to use any study materials except for those provided to you during the test. Cheating is strictly prohibited, and will be prosecuted. Good luck!*

**Problem 1 (30 points).** Find derivatives of the following functions.

a) - (10 points)  $f(x) = e^x(x^3 - x^2 + x)$

b) - (10 points)  $g(x) = \frac{e^x}{x^3 - x^2 + x}$

c) - (10 points)  $h(x) = \sin\left(\frac{1}{\ln x}\right)$

**Problem 2 (40 points).** Find  $dy/dx$  in the following equations.

a) - (10 points)  $\sqrt{x+y} = 1 + x^2y^2$

b) - (10 points)  $y = \cos^{-1}(\sin^{-1}x)$

c) - (10 points)  $x^y = y^x$

d) - (10 points)  $y = (\tan x)^{1/x}$

**Problem 3 (10 points).** Let  $f(x)$  be an odd differentiable function on the entire real line. Prove that for every real number  $b > 0$  there exists a number  $-b \leq c \leq b$  such that

$$f'(c) = \frac{f(b)}{b}.$$

**Problem 4 (10 points).** Compute the limit

$$\lim_{x \rightarrow 0} (x + 1)^{1/x} .$$

**Problem 5 (40 points).** Let  $f(x) = e^{\tan^{-1} x}$ .

- a) - (10 points) Find vertical and horizontal asymptotes of  $f(x)$ .
- b) - (10 points) Find intervals of increase / decrease and local maxima / minima of  $f(x)$ .
- c) - (10 points) Find intervals of concavity and inflection points of  $f(x)$ .
- d) - (10 points) Use the above information to sketch the graph of  $f(x)$ .