

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

STUDENT ID NUMBER: \_\_\_\_\_

- (1) No books and notes are allowed.
- (2) You may use a calculator and a notecard.
- (3) Show your work in details.

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(1) (10 points) Solve the equation

$$\ln x + \ln(x - 2) = 1$$

for  $x$ .

- (2) (30 points) Let  $f(x) = \frac{x-1}{x+1}$ . (The domain of  $f(x)$  is wherever  $\frac{x-1}{x+1}$  is defined.)
- (a) (10 points) Find the inverse function  $f^{-1}(x)$  of  $f(x)$ .

(b) (10 points) What are the domains and ranges of  $f(x)$  and  $f^{-1}(x)$ ?

(c) (10 points) Find all horizontal asymptotes of  $y = f(x)$  and  $y = f^{-1}(x)$ .

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- (3) (15 points) Find the tangent line of the curve  $y = 1/x$  at the point  $(1, 1)$ . (Do not use the laws of derivative to find the slope. Compute it using its definition.)

(4) (10 points) Let

$$f(x) = \begin{cases} \sin x & \text{if } x \geq \pi/4 \\ \cos x & \text{if } x < \pi/4 \end{cases}.$$

Is  $f(x)$  continuous everywhere on  $(-\infty, \infty)$ ? You must justify your answer.

6

(5) (15 points) Find all the horizontal asymptotes of the curve

$$y = \sqrt{x^2 + x + 2} - x.$$

(6) (20 points) Find the following limits if they exist.

(a) (10 points)  $\lim_{x \rightarrow 1} \frac{x^2 - 3x + 2}{x^2 - 4x + 3}$ .

(b) (10 points)  $\lim_{x \rightarrow 0^+} e^{-1/x}$ .