

- (1) (10 points) Solve the equation

$$e^{ax} = ce^{bx}$$

for x , where a, b and c are constants, $c > 0$ and $a \neq b$.

- (2) (20 points) Let $f(x) = \ln(\ln x)$. (The domain of $f(x)$ is wherever $\ln(\ln x)$ is defined.)

(a) (5 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) (5 points) Where are $f(x)$ and $f^{-1}(x)$ continuous?

- (3) (15 points) Find the tangent line of the curve $y^2 = x^3$ 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

$$f(x) = \begin{cases} cx - 1 & \text{if } x \geq 1 \\ 1 - cx^2 & \text{if } x < 1 \end{cases},$$

where c is a constant. For what values of c is $f(x)$ continuous on $(-\infty, \infty)$?

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

$$y = \frac{\sqrt{4x^2 + 1}}{x + 1}.$$

- (6) (30 points) Find the following limits if they exist.

(a) (10 points) $\lim_{x \rightarrow 0} \frac{x^3 - 1}{x^2 - 1}$.

(b) (10 points) $\lim_{t \rightarrow 9} \frac{9 - t}{3 - \sqrt{t}}$.

(c) (10 points) $\lim_{x \rightarrow \infty} (\sqrt{x + 1} - \sqrt{x})$.