

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

Key

## NON-GRAPHING CALCULATORS ALLOWED

1. [20 points] Find the derivatives of the functions below.

a.  $(e^{\tan x^2})'$

$$e^{\tan(x^2)} (\tan(x^2))' = e^{\tan(x^2)} \sec^2(x^2) (x^2)'$$

$$= 2x \sec^2(x^2) e^{\tan(x^2)}$$

b.  $(\csc \ln x)'$

$$= -\csc(\ln x) \cot(\ln x) \cdot (\ln x)'$$

$$= \frac{-1}{x \sin(\ln x) \tan(\ln x)}$$

c.  $\left(\frac{2^x + x^2}{\log_3 x}\right)'$

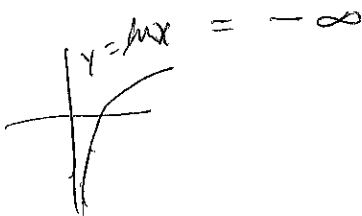
$$= \frac{(2^x + x^2)' \log_3 x - (2^x + x^2) (\log_3 x)'}{(\log_3 x)^2}$$

$$= \frac{(2^x \ln 2 + 2x) \log_3 x - \frac{2^x + x^2}{x \ln 3}}{(\log_3 x)^2}$$

d.  $\ln e^{x^3} = x^3$   $(x^3)' = 3x^2$

2. [20 points] Find the limits below.

a.  $\lim_{x \rightarrow 0^+} \ln x$



c.  $\lim_{x \rightarrow \infty} \frac{e^x - e^{-x}}{e^x + e^{-x}}$

$$= \lim_{x \rightarrow \infty} \frac{1 - e^{-2x}}{1 + e^{-2x}} = \frac{1 - 0}{1 + 0} = 1$$

b.  $\lim_{x \rightarrow \infty} \tan^{-1} e^x$  Let  $y = e^x$ . As  $x \rightarrow \infty$ ,  $y \rightarrow \infty$ .

$$= \lim_{y \rightarrow \infty} \tan^{-1} y = \frac{\pi}{2}$$

d.  $\lim_{x \rightarrow 0} \frac{x}{x + \tan x}$

$$= \lim_{x \rightarrow 0} \frac{\frac{1}{x}}{1 + \frac{\tan x}{x}} = \frac{1}{1 + 1 \cdot \frac{1}{x}} = \frac{1}{2}$$

