

Name: _____

Please show all work and box the answers, where appropriate.

1. (20 pts.) Evaluate each of the following limits (∞ and $-\infty$ are legitimate answers) or state that the limit does not exist.

$$(a) \lim_{x \rightarrow -2} \frac{x^2 - 4}{x^3 + 8} \quad (b) \lim_{x \rightarrow 0^-} \frac{|x|}{x^2} \quad (c) \lim_{x \rightarrow 0} \frac{\tan\left(\frac{x}{2}\right)}{\sin(2x)} \quad (d) \lim_{x \rightarrow 0} \frac{\tan(x^3)}{\sin(x^2)}$$

2. (20 pts.) Let $f(x) = \frac{x^3 + 1}{x^2 - 1}$.

- (a) Find all vertical asymptotes or state that there are not any.
 (b) Find all oblique and horizontal asymptotes or state that there are not any.
 (c) Sketch the graph of $y = f(x)$.
 (d) Determine exactly at which x this function fails to be continuous.

3. (20 pts.) Let $f(x) = 1/x$.

- (a) Show that f is differentiable by computing $f'(x)$ from the definition of the derivative.
 (b) Check your answer by computing $f'(x)$ using the rules of differentiation.
 (c) Find an equation for the line tangent to $y = f(x)$ at $x = 2$.
 (d) Sketch both $y = f(x)$ and the tangent line.

4. (20 pts.) Find the derivatives of the following functions with respect to x .

$$(a) \sqrt{x^3 + 1} \quad (b) \tan^3(x^4 + 1) \quad (c) \frac{3x + 1}{x^2 + 4} \quad (d) (x^2 - 1)^4(3x - 1)^5$$

1	2	3	4	total (80)	%