

Name _____

Math 140A - Practice Problems for Final Part II

Limits: Calculate each of the following limits. Only give the answer, “does not exist,” if ∞ and $-\infty$ are both incorrect answers.

1. $\lim_{x \rightarrow -2} \frac{5}{x+2} - \frac{2x-16}{x^2-4}$

2. $\lim_{t \rightarrow 3} \frac{1-t^2}{t(t-3)^2}$

3. $\lim_{x \rightarrow 0} \left(\frac{x+2}{1-x} \right)^3$

4. $\lim_{s \rightarrow 4} \frac{s-4}{s^2+s-2}$

5. $\lim_{t \rightarrow \infty} \frac{(2t+1)^2}{t(t^2-9)}$

6. $\lim_{y \rightarrow \infty} \frac{(y+3)(10-y)}{3y+4}$

$$7. \lim_{x \rightarrow 6^+} \frac{(x-8)(x+4)}{x(x-6)}$$

$$8. \lim_{t \rightarrow -1} \frac{2t^2}{t^2 - 1}$$

$$9. \lim_{r \rightarrow 2} \frac{r^2 + 3r - 10}{3r^2 - 5r - 2}$$

$$10. \lim_{x \rightarrow 5} \frac{\frac{1}{x+3} - \frac{1}{8}}{x-5}$$

Continuity (Part I): At $x = 1$, decide whether each of the following functions is continuous. If not, decide whether it is a removable discontinuity. If not, decide whether it is a jump discontinuity and whether it is at least left or right continuous.

$$1. f(x) = \begin{cases} 3x - 5, & \text{if } x < 1 \\ 7, & \text{if } x = 1 \\ \frac{10}{x+1} + 2, & \text{if } x > 1 \end{cases}$$

$$2. f(x) = \begin{cases} \frac{\sqrt{x+3}-2}{x-1}, & \text{if } x \neq 1 \\ -\frac{1}{4}, & \text{if } x = 1 \end{cases}$$

$$3. f(x) = \begin{cases} \frac{1}{(x-1)^2}, & \text{if } x < 1 \\ 4x + 1, & \text{if } x \geq 1 \end{cases}$$

$$4. f(x) = \begin{cases} \frac{2x-2}{x^2-3x+2}, & \text{if } x < 1 \\ -2, & \text{if } x = 1 \\ 1 - \sqrt{x+8}, & \text{if } x > 1 \end{cases}$$

Continuity (Part II): Determine the value(s) of the constant c which makes the given functions continuous. Hint: There is only one value of c for $f(x)$, but there are two values of c for $g(x)$.

$$f(x) = \begin{cases} 2cx - 9, & \text{if } x \leq 3 \\ x^2 + x - c, & \text{if } x > 3 \end{cases}$$

$$g(x) = \begin{cases} 3x + c^2 - 1, & \text{if } x < 0 \\ \frac{c}{x+2} + 2, & \text{if } x \geq 0 \end{cases}$$

Tangent Lines: Find the equation of the tangent line to the given function at the given point. Then graph the function and tangent line on the same set of axes.

1. $f(x) = x^2 - 6x + 5$ at the point $(5, 0)$.

2. $f(x) = \frac{6}{(x+2)}$ at the point $(-4, -3)$.

Derivative Functions: Calculate the derivatives of the following functions, not just at a fixed point but as a function defined for any x .

1. $f(x) = 5 + \sqrt{2x + 1}$

2. $f(x) = x - \frac{1}{x}$

Rational Function Graphs: Graph the following rational functions. Make sure to specify the roots, vertical asymptotes, and horizontal asymptote (if there is one).

1. $f(x) = \frac{(x-1)(2x+5)^2}{x(x^2-1)}$

2. $f(x) = \frac{(x-5)^3}{(x+2)^2(x^2+1)}$