

# Math 19 Midterm 1

## Part 1: Limits

#1.  $\frac{0}{0}$  indeterminate  
(need to factor)

i.e.  $\lim_{x \rightarrow 3} \frac{x^2 - 2x - 3}{x - 3} = \frac{0}{0}$   
 $= \lim_{x \rightarrow 3} \frac{(x-3)(x+1)}{x-3} = \lim_{x \rightarrow 3} x+1 = \boxed{4}$

#2.  $\frac{\text{some } \#}{0}$  infinite limit  
(need to plug in numbers)

i.e.  $\lim_{x \rightarrow 2^+} \frac{x+5}{(x-2)^2} = \frac{7}{0}$

• which type of infinity?

$$\approx \frac{7}{(2.1-2)^2}$$
$$= \frac{7}{\text{small}^2}$$
$$= \text{big}^+ = \boxed{+\infty}$$

#3. Limit at infinity  
(3 cases)

$m < n, m > n, m = n \dots$

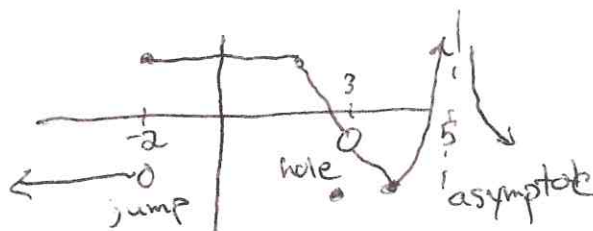
i.e.  $\lim_{x \rightarrow \infty} \frac{x^2 + x + 1}{5x^2 + 2x - 1} = \boxed{\frac{1}{5}}$

#4. one more of #1-3

## Part 2: Asymptotes + Continuity

#1. Discuss where the graph of a function is continuous/discontinuous?

Def of continuity  $\begin{cases} \bullet \lim_{x \rightarrow c} f(x) \text{ exists} \\ \bullet f(c) \text{ exists} \\ \bullet \lim_{x \rightarrow c} f(x) = f(c) \end{cases}$



#2. For a given function i.e.  $f(x) = \frac{x^2 + 2}{x^2 - 5x - 6}$

- find horizontal asymptotes (if any)  $\leftrightarrow$  limit at infinity
- Find vertical asymptotes (if any)  $\leftrightarrow$  infinite limit
- Find partition #s and make sign chart

## Part 3 The Derivative

#1. Use limit definition (four-step process) to find  $f'(x)$  for i.e.  $f(x) = x^2 + 3x - 1$ .

#2. Shortcuts:

a) power rule (i.e.  $f(x) = x^5 + 4x^3 - x + 1$ )

b)  $\frac{1}{x^n}$

c)  $\sqrt[n]{x}$

} these use power rule too

d)  $e^x$ ,  $\ln x$

#3. Find eqn of tangent line or

find where tangent line is horizontal ( $f'(x) = 0$ )

(point-slope form)

## Part 4 Continuous Compounded Interest

#1 Word problem (doubling time/half-life)  
• involves solving an equation by using log.  
i.e.  $4 = e^{0.1t}$