Midterm: Monday (10am).

- Quiz 3 and HW6
  - returned in Office Hours.

Office Hours Today: 2-5 in MATX 1118.

Math Annex.

BEDMAS.

$$5\sqrt[4]{x} + (x \cdot x) + e^{\pi}$$

$$\neq$$

$$(5\sqrt[4]{x} + x) \cdot (x + e^{\pi}).$$

①

Limits: What strategy to use for each?

1) $\lim_{x\to 2} \frac{x^2-6x+8}{x-1}$ Substitution.

2) $\lim_{x\to 2} \frac{x^2-6x+8}{x-2}$ Factor / Cancel / Sub.

3) $\lim_{x\to 3} \frac{1/x - 1/3}{x-3}$ Common Denominator / fractions / Cancel.

4) $\lim_{x\to 1} \frac{\sqrt{2-x}-1}{x-1}$ Conjugate. $\cdot \frac{\sqrt{2-x}+1}{\sqrt{2-x}+1}$.

5) $\lim_{x\to 4} \frac{|x-4|}{x-4}$ Take both one sided limits. piecewise.

6) $\lim_{x\to 1} f(x)$ where $f(x) = \begin{cases} x^2-2x+1, & x\le 1 \\ \ln x, & x>1 \end{cases}$

take one sided limits

(2)

$$\lim_{x\to 4} \frac{|x-4|}{x-4}.$$

$$|x-4| = \begin{cases} x-4, & x\geq 4 \\ -(x-4), & x<4 \end{cases}$$

One sided limits.

$$\lim_{x\to 4^+} \frac{\cancel{(x-4)}}{\cancel{(x-4)}} = \lim_{x\to 4^+} 1 = 1.$$

$$\lim_{x\to 4^-} \frac{-\cancel{(x-4)}}{\cancel{(x-4)}} = \lim_{x\to 4^-} -1 = -1.$$

$$\Rightarrow \lim_{x\to 4} \frac{|x-4|}{x-4} \text{ D.N.E.}$$

the two one sided limits are different.

(3)

Definitions:

Definition of the Derivative.

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Def. of Vertical Asymptote

- $\lim\limits_{x \to a^+} f(x) = \pm\infty$ as one of the one sided limits approaches a, the limit goes to $\pm\infty$

$\lim\limits_{x \to a^-} f(x) = \pm\infty$ OR / • $\lim\limits_{x \to a^-} f(x) = \pm\infty$.

← either or both

$\Rightarrow$ V.A at $x = a$.

Def. of Horizontal Asymptote.

- $\lim\limits_{x \to \infty} f(x) = L$
- $\lim\limits_{x \to -\infty} f(x) = L$

$\Rightarrow$ H.A at $y = L$.

④

How to find V.A.:

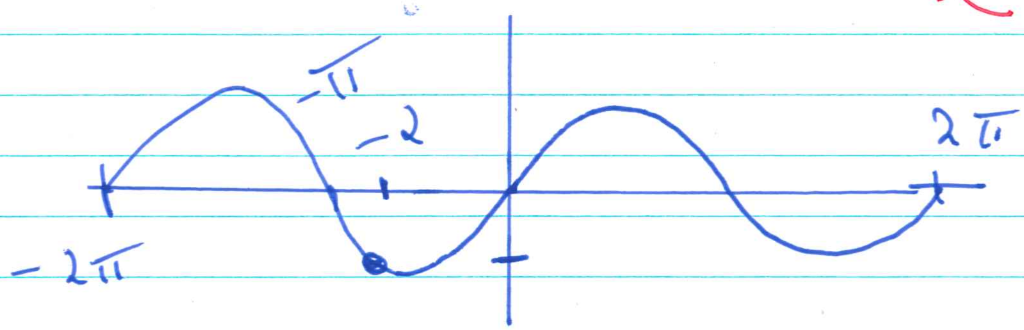
1) identify candidates.

2) compute one sided limits

<u>Ex:</u> $\frac{\sin x}{x+2}$. ← Find V.A.

1) Candidates? $x = -2$.

2) Compute: $\lim\limits_{x \to -2^-} \frac{\sin x}{x+2}$ ← top, normal negative number. ← small, negative number.



$\left(\frac{-}{-}\right)$.

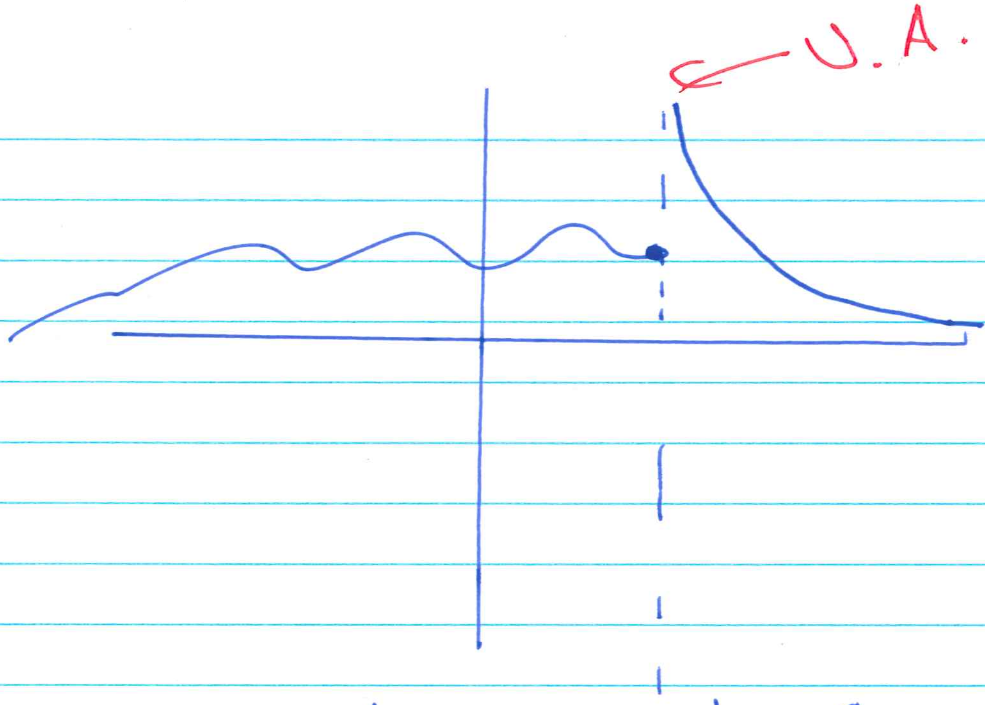
$$\lim_{x \to -2^-} \frac{\sin x}{x+2} = +\infty.$$

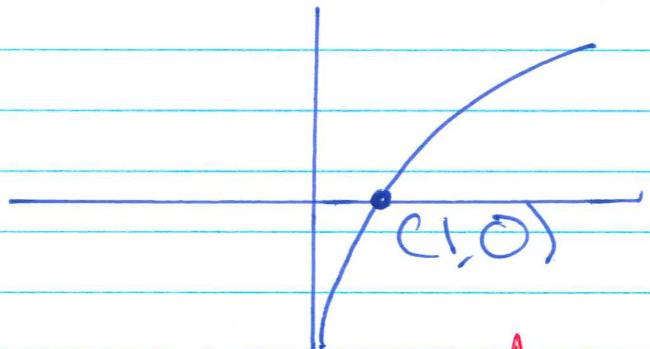
$\lim\limits_{x \to -2^+} \frac{\sin x}{x+2}$ ← normal, negative. ← Small positive. $\left(\frac{-}{+}\right)$.

$= -\infty$.

$\Longrightarrow$ V.A. at $x = -2$.
at least one of the above limits is $\pm\infty$.

5





Domain: $\{x \in \mathbb{R} : x > 0\}$.

U.A. at $x = 0$.

- $\lim_{x \to 0^+} \ln x = -\infty$.

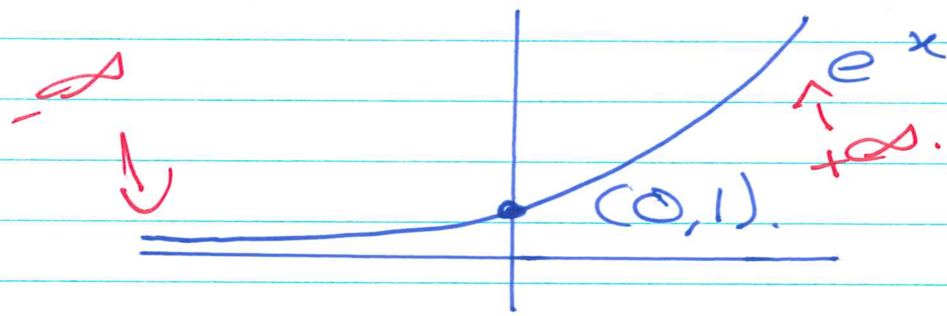
Find H.A.?

take $\lim_{x \to \infty} f(x)$, $\lim_{x \to -\infty} f(x)$.

Example: $\dfrac{7}{3e^{x}+2}$.

- $\lim_{x \to \infty} \dfrac{7}{3e^{x}+2} = 0.$

$e^{x} \to \infty$ as $x \to \infty$.



$\dfrac{7}{\text{"}\infty\text{"}+2}$

$\text{"}\dfrac{7}{\infty}\text{"}$.

$\Rightarrow$ H.A at $y = 0$

- $\lim_{x \to -\infty} \dfrac{7}{3e^{+x}+2} = \dfrac{7}{0+2} = \dfrac{7}{2}$ //.

$e^{x} \to 0$ as $x \to -\infty$.

$\Rightarrow$ H.A. at $y = 7/2$.