

Good afternoon: Warm up in notes

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1 \quad \lim_{x \rightarrow 0} \frac{1 - \cos x}{x} = 0$$

$$\lim_{x \rightarrow 0} x \csc x = \lim_{x \rightarrow 0} \frac{x}{\sin x} = 1$$

$$\lim_{x \rightarrow 0} \frac{\sin x}{2x} \Rightarrow \lim_{x \rightarrow 0} \frac{1}{2} \cdot \frac{\sin x}{x}$$

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

$$\lim_{x \rightarrow 0} \frac{\tan 2x}{x} \Rightarrow \lim_{x \rightarrow 0} \frac{\frac{\sin 2x}{\cos 2x}}{x}$$

$$\lim_{x \rightarrow 0} \frac{\sin 2x}{\cos 2x} \cdot \frac{1}{x}$$

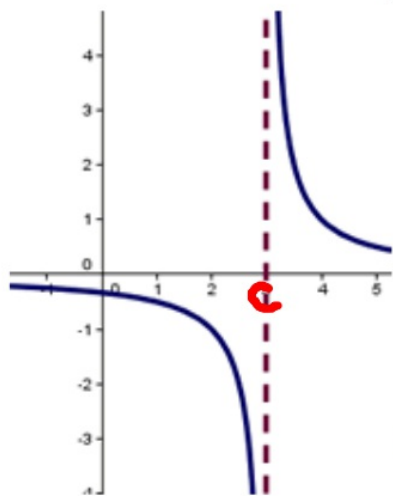
$$\lim_{x \rightarrow 0} \frac{\sin 2x}{x} \cdot \frac{1}{\cos 2x}$$

$$\lim_{x \rightarrow 0} \frac{2 \sin 2x}{2 \cdot x} \cdot \lim_{x \rightarrow 0} \frac{1}{\cos 2x}$$

See Friday

$$1 = 2$$

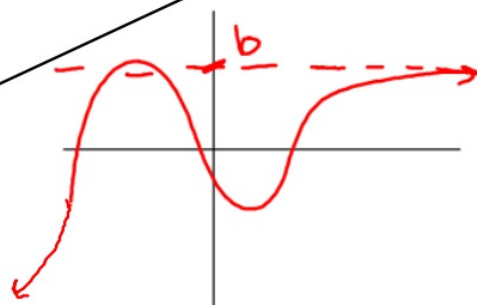
Definition of Vertical Asymptote



$x=c$ is a v.a. iff
any of the following is true:

• $\lim_{x \rightarrow c^+} f(x) = \pm \infty$

• $\lim_{x \rightarrow c^-} f(x) = \pm \infty$



Definition of Horizontal Asymptotes

$y=b$ is h.a. iff

$\lim_{x \rightarrow \infty} f(x) = b.$

or
 $\lim_{x \rightarrow -\infty} f(x) = b.$

H.A. "Rules" from Pre-cal

Degree on top bigger:

Degree on bottom bigger:

Degrees same:

no H.A.

H.A. is $y=0$

H.A. is $y = a/b$

where a and b are leading coefficients

ex/

$$\lim_{x \rightarrow \infty} \frac{x^4 + x^2 + x}{3x^5}$$

$\infty^4 + \infty^2 + \infty$

$3\infty^5$

$$\frac{\infty^4}{3\infty^5} \Rightarrow \frac{1}{3\infty} = 0$$

ex/

$$\frac{x^7 + 2x^6 + 3}{3x^2 + 5}$$

Huge
Rel. Small
 ∞ , or no
H.A.

ex/

$$\frac{5x^3 + 2x}{-2x^3 - x^2}$$

$5\infty^3 + \dots$

$-2\infty^3 - \dots$

$$\lim_{x \rightarrow -\infty} \frac{(2x^3 - 4x^2 + 2x + 9)}{(7x^3 + 2x^2 - 3x + 5)}$$

$$\frac{2(-\infty)^3}{7(-\infty)^3} = \frac{-}{-}$$

$$\left(+ \frac{2}{7} \right)$$

What will test questions on this look like?

Find any vertical asymptote(s). **Justify Your Answer** using limits

$$f(x) = (x+5)/(x^2+4x-5)$$

$$f(x) = \frac{x+5}{x^2+4x-5}$$
$$= \frac{x+5}{(x+5)(x-1)}$$

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


V.a. Candidate: $x=1$

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

therefore $x=1$ is a v.a.

Find any horizontal asymptote(s). ****Justify Your Answer**** using limits

$$f(x) = (x+5)/(x^2+4x-5)$$

$$\lim_{x \rightarrow \infty} \frac{x+5}{x^2+4x-5} = 0$$

So $y=0$ is a h.a.

Homework:

- backside of worksheet #13-24 (answers posted at mcalc.weebly.com)
- Finish practice assessment (solutions at mcalc.weebly.com)
- Assessment Wednesday