1. Consider $f(x) = \dfrac{x^2}{1-x^2}$. Find all horizontal and vertical asymptotes, and label them on the graph using appropriate limit notation.

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$N = 2$

$D = 2$

H.A $= \frac{1}{-1} = -1$

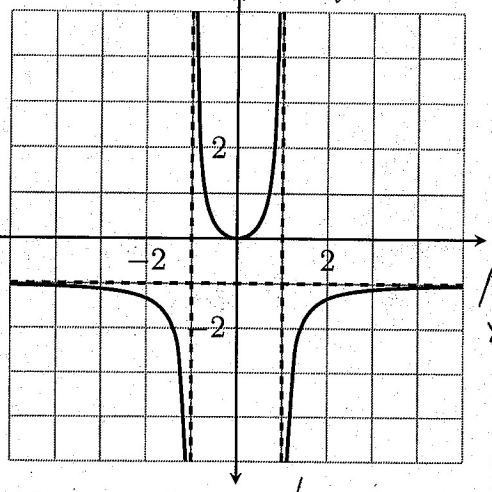
$1 - x^2 = 0$

$1 = x^2$

$x = \pm 1$

V.A.

$\lim_{x \to -1^+} f(x)$ DNE $(+\infty)$ $\lim_{x \to -1^-} f(x)$ DNE $(+\infty)$



$\lim_{x \to -\infty} f(x) = -1$ $\lim_{x \to \infty} f(x) = -1$

$\lim_{x \to -1^-} f(x)$ DNE $(-\infty)$ $\lim_{x \to -1^+} f(x)$ DNE $(-\infty)$

2. For each of the following, circle YES if L'Hôpital's Rule can be applied, and NO if it cannot.

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(a) YES (NO) $\lim_{x \to \infty} \dfrac{\ln(x)}{e^{-x}}$

(b) YES (NO) $\lim_{x \to -\infty} \dfrac{x}{2^x}$

(c) (YES) NO $\lim_{x \to 0} \dfrac{\sin(x)}{1 - \cos(x)}$

(d) (YES) NO $\lim_{x \to \infty} \dfrac{e^x}{1 + x^2}$

3. Use L'Hôpital's Rule to evaluate.

(a) $\lim_{x \to 1} \dfrac{x^2 - 1}{x^3 - 1}$ $\overset{LR}{=} \lim_{x \to 1} \dfrac{2x}{3x^2} = \lim_{x \to 1} \dfrac{2}{3x} = \dfrac{2}{3}$

+5

(b) $\lim_{x\to-\infty} \frac{e^{-x}}{x^2+1} \overset{LR}{=} \lim_{x\to-\infty} \frac{-e^{-x}}{2x} \overset{LR}{=} \lim_{x\to-\infty} \frac{e^{-x}}{2}$

+5 DNE $(+\infty)$

(c) $\lim_{x\to\infty} \frac{x}{2^x} \overset{LR}{=} \lim_{x\to\infty} \frac{1}{2^x \ln 2} = 0$

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4. Find $\lim_{x\to\infty} x^2 e^{-2x}$. $= \lim_{x\to\infty} \frac{x^2}{e^{2x}} \overset{LR}{=} \lim_{x\to\infty} \frac{2x}{2e^{2x}}$

+5 $= \lim_{x\to\infty} \frac{x}{e^{2x}} \overset{LR}{=} \lim_{x\to\infty} \frac{1}{2e^{2x}} = 0$

5. Find $\frac{d}{dx} 3^{1-2x}$. Chain Rule

+5 $f(x) = 3^x \quad f'(x) = 3^x \ln 3$

$g(x) = 1-2x \quad g'(x) = -2$

$f'(g(x))\, g'(x)$

$3^{g(x)} \ln 3\, (-2)$

$-2 \cdot 3^{1-2x} \ln 3$