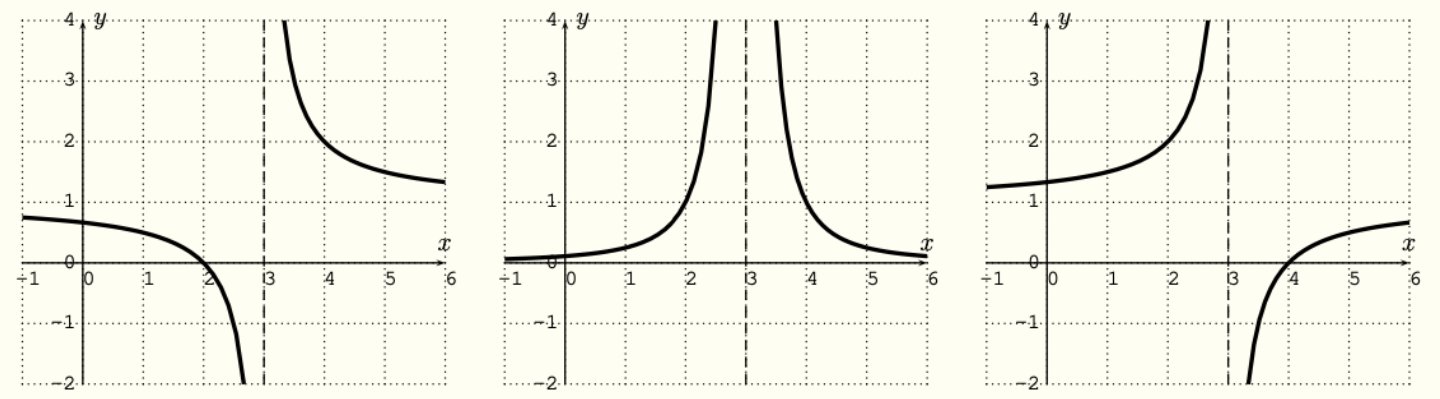
MAT 1375, Classwork9, Fall2024

ID:_____ Name:_____

1. The definition of a **Vertical Asymptote**:

The line $\boldsymbol{x = a}$ is a _____ of the graph of a function f if $f(x)$ **increases or decreases without bound** as $\boldsymbol{x}$ **approaches** $\boldsymbol{a}$.



As $x \to$___, $f(x) \to$___; _____ _____

As $x \to$___, $f(x) \to$___. _____ _____

2. How to locate Vertical Asymptotes: Let $f(x) = \frac{p(x)}{q(x)}$ be a rational function.

If $p(x)$ and $q(x)$ have no _____,

and $\boldsymbol{a}$ is a **zero** of $q(x)$ which makes $f(x)$ _____,

then _____ is a vertical asymptote of the graph of $f(x)$.

If $\boldsymbol{a}$ is a **zero** of both $p(x)$ and $q(x)$ ($p(a) =$_____, $q(a) =$ _____.) which means _____

is the common factor of $p(x)$ and $q(x)$, then there is a _____

at $x = a$.

3. Find the vertical asymptotes of the graph of each rational function:

a) $f(x) = \frac{x}{x^2-1}$ b) $g(x) = \frac{x-1}{x^2-1}$ c) $h(x) = \frac{x-1}{x^2+1}$

4. The definition of a **Horizontal Asymptote**:

The line $\boldsymbol{y = b}$ is a _____ the graph of a function f if $f(x)$ approaches $\boldsymbol{b}$ as $\boldsymbol{x}$ **increases** or **decreases without bound**.

5. What is the difference of Vertical Asymptote and Horizontal Asymptote?

6. How to locate Horizontal Asymptotes: Let $f(x) = \frac{p(x)}{q(x)}$ be a rational function given by

$$f(x) = \frac{p_n x^n + p_{n-1}x^{n-1} + \cdots + p_1 x + p_0}{q_m x^m + q_{m-1}x^{m-1} + \cdots + q_1 x + q_0}, p_n \neq 0, q_m \neq 0.$$

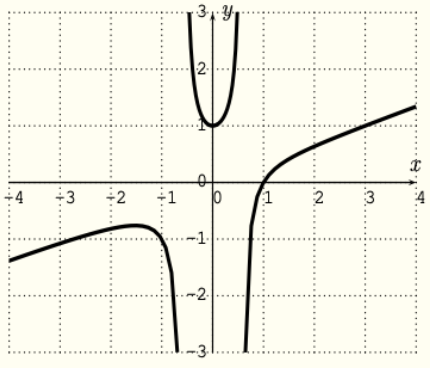
The degree of the numerator is _____. The degree of the denominator is _____.

1) If $n > m$, the graph of f has _____ horizontal asymptote.

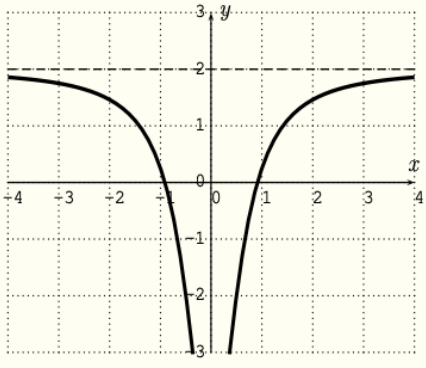
2) If $n = m$, the line _____ (which is the ration of two _____) is the horizontal asymptote of the graph of f.

3) If $n < m$, the _____ (which is_____) is the horizontal asymptote of the graph of f.

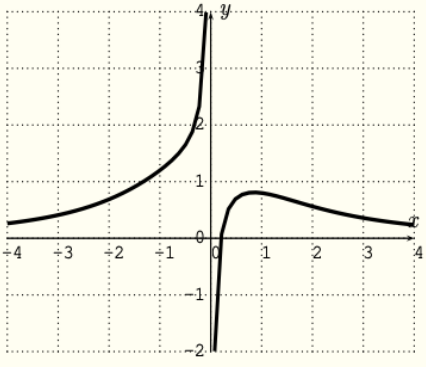
$f(x) = \frac{x^3-1}{3x^2-1}$



$f(x) = \frac{6x^2-5}{3x^2+1}$



$f(x) = \frac{5x-1}{x^3+4x}$



$\deg(p(x))$____$\deg(q(x))$ $\deg(p(x))$ ____ $\deg(q(x))$ $\deg(p(x))$____$\deg(q(x))$

_____ _____ _____