Name:____ Date:___________
PCH: Vertical and Horizontal Asymptotes Ms. Loughran

Do Now:

1. Graph $y = \frac{x^4 - 2x^2 + 1}{x^2 - 1}$. State the domain, range and coordinates of any hole(s), *x*- and *y*-intercepts.

A vertical asymptote is a vertical line that guides the graph of the function but is not part of it. It can never be crossed by the graph because it occurs at the x-value that is not in the domain of the function

A horizontal asymptote describes a function's "end behavior." That means how the graph behaves as *x* approaches $\pm\infty$.

Examples:

1. What is the end behavior of $y = \frac{x^3 + 5}{2x^3 + x^2 + 1}$?

2. What is the end behavior of $y = \frac{2x-3}{x^2+2}$?

3. What is the end behavior of $y = \frac{x^2-4}{x^2-2x+3}$?

4. What is the end behavior of $y = \frac{x^2}{x+1}$?

Let r be the **REDUCED** rational function

$$r(x) = \frac{a_n x^n + a_{n-1}x^{n-1} + \ldots + a_1 x + a_0}{b_m x^m + b_{m-1}x^{m-1} + \ldots + b_1 x + b_0}$$

1. The vertical asymptotes of r are the lines $x = a,$ where a is a zero of the denominator.

   In other words:

2. (a) If $n < m,$ then r has a horizontal asymptote of $y =$

   In other words:

   (b) If $n = m,$ then r has a horizontal asymptote of $y =$

   In other words:

   (c) If $n > m,$ then r has.

   In other words:

Graphs can intersect horizontal asymptotes, but can never intersect a vertical asymptote. So you must always check if a graph intersects its horizontal asymptote.

Function	Hole(s)	Vertical Asymptote(s)	Horizontal Asymptote Does graph intersect HA?	*x*-intercept(s)	*y*-intercept
$y=\frac{1-x}{x+3}$					
$y=\frac{x-2}{x^2-4}$					
$y=\frac{x^2-x-20}{x+4}$					
$y=\frac{x^2-x-20}{x+1}$					
$y=\frac{2x^3}{x^3+x}$					
$y=\frac{x-1}{x^2-4}$					