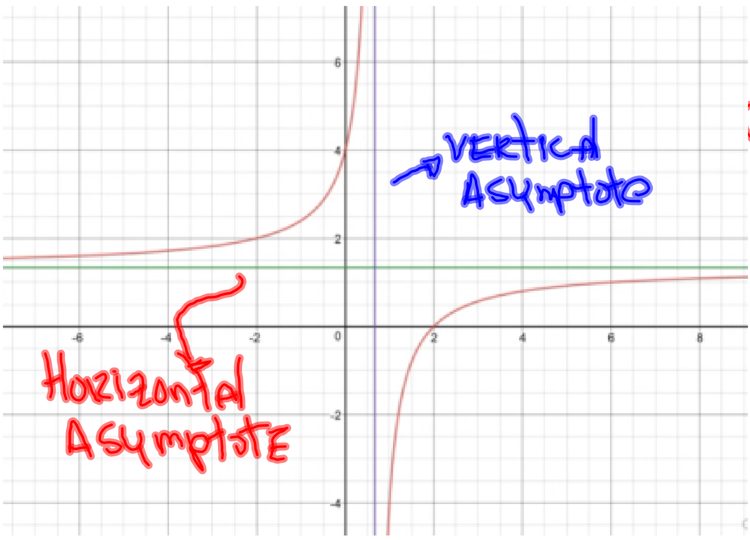
Lesson #16

Aim: What are other types of Asymptotes for rational equations?

Do Now: Graph (use calculator)

1) $f(x) = \dfrac{-4x+8}{2-3x}$ 2) $h(x) = \dfrac{3x^3 - x}{x^3 - 1}$

Find any Asymptote; Describe any other behavior?



coefficient

Greatest exponent in Numerator: Degree

$y = \dfrac{-4x+8}{2-3x} = \dfrac{4(-x+2)}{(2-3x)}$

1) Degree Numerator = Denominator

a) Find the greatest exponent Numerator take its coefficient

b) same as a but in the Denominator

$\dfrac{-4}{-3}$

∴ Horizontal Asymptote

At $x = \dfrac{-4}{-3} = \dfrac{4}{3} = 1.\!$

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

$\boxed{\begin{array}{c}\text{Degrees} \\ \frac{2}{3}\end{array}}$

$2 < 3$

~~No Horizontal Asymptotes~~

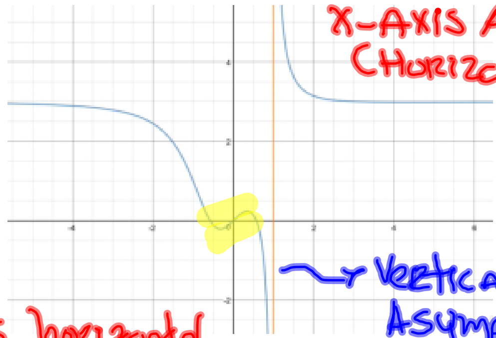
X-AXIS Asymptote (Horizontal)

Vertical Asymptotes

$x^3 - 1 = 0$

$x = 1$

Horizontal Asymptotes



Note: unlike vertical Asymptotes, horizontal or other type of Asymptote can be crossed at some point

Note Degree of Numerator (m)
Degree of Denominator (n)

* $m < n$ Horizontal Asymptote at $y = 0$ (x-axis)

$m > n$ No Horizontal Asymptote

$m = n$ Horizontal Asymptote at $y = \frac{a}{b}$
where "a" is the leading coefficient of numerator & "b" is the leading coefficient of denominator.

* Note: Even when the graph does not show them.

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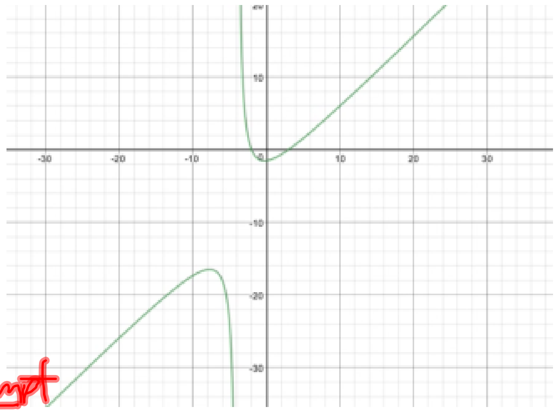
find the Asymptote(s)

$$f(x) = \frac{x^2 - x - 6}{x + 4}$$



$$\frac{x^2-x-6}{x+4} = \frac{(x-3)(x+2)}{(x+4)}$$

Vertical Asympt.

$x+4=0$

$x=-4$

Horizontal Asympt

Degree Numerator > Degree of Denominator

∴ No Horizontal Asympt.

more Asympt.

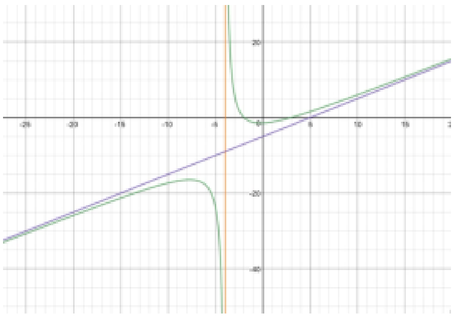
Divide $1x^2 - 1x - 6 \div x + 4$

use synthetic Division

a) $x+4=0$
$x=-4$

b)

-4	1	-1	-6
		-4	20
	1	-5	$+14$



c) write your answer (Quotient)

$$\underbrace{x-5}_{\text{Quotient}} + \left.\frac{14}{x+4}\right\} \text{Remainder}$$

d) A New asymptote at the Quotient: ex) $x-5$