Students will write the equation of the horizontal or oblique asymptote of a rational function. Students will find the point of intersection between a graph and its horizontal asymptote.

Directions: Write the equation of the horizontal or oblique asymptote.

1st: Look at the degree of the polynomial in the numerator AND the denominator

Example:

Degree 2 → $4x^2 + 2x - 5$ N = 2

Degree 4 → $3x^4 + 5x - 10$ D = 4

2nd: Using the degree, determine which category it fits in

Which Category????

The numerator degree (N) is less than the denominator degree (D). $N < D$	The numerator degree (N) is the same as the denominator degree (D) $N = D$	Numerator degree (N) is **one** more than the denominator degree (D). $N = D + 1$
Answer: The horizontal asymptote is: $y = 0$ **Example:** $R(x) = \frac{4x^2+2x-5}{3x^4+5x-10}$ 2 < 4 so Horizontal Asymptote is $y = 0$ **Example:** $f(x) = \frac{x}{x^3+1}$ **Example:** $g(x) = \frac{x^{17}+x^3+5}{x^{18}+x^2}$	Answer: The horizontal asymptote is the fraction formed from the numerator's leading coefficient divided by the denominator's leading coefficient. $y = \frac{leading\ coefficient}{leading\ coefficient}$ **Example:** $R(x) = \frac{4x^5-8x^2-15}{3x^5+5x-9}$ Horizontal Asymptote: $y = \frac{4}{3}$ **Example:** $y = \frac{7x^{10}+3x^2}{14x^{10}+5}$ $y = \frac{1}{2}$ **Example:**	Answer: There is **no** horizontal asymptote!!!! There is an oblique (slanted) asymptote. You must divide to find the equation of the oblique asymptote! 3 = 2+1 **Example:** $\frac{4x^3+2x-10}{x^2+1}$ Divide $4x^3 + 2x - 10$ by $x^2 + 1$. The division won't work completely and you'll have a remainder. Keep only the quotient portion as your equation: 1: 4x | ; x^2: $4x^3$ | -2x 4x ?? I can't continue. The oblique asymptote is $y = 4x$

Find the horizontal or oblique asymptotes for each rational function below

$R(x) = \frac{4x^2+x-4}{4x^2+5x+3}$	$R(x) = \frac{x^3-2x+6}{x^4-7x^2+7x-16}$	$R(x) = \frac{3x^3-4x-2}{2x^3+5x}$	$R(x) = \frac{3x^3-2x-5}{x^2+2}$
$y = 1$	$y = 0$	$y = \frac{3}{2}$	2: 6x | ; x^2: $3x^3$ | -8x 3x ? $y = 3x$

$R(x) = \frac{2x^2+2x-3}{x^2-4x-4}$ has a horizontal asymptote. It is: $y = 2$ Find the point of intersection (if it exists) between the graph and the asymptote. Graphs can, but don't always, cross the horizontal/oblique asymptotes.

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

$2(x^2-4x-4) = 2x^2+2x-3$

$2x^2-8x-8 = 2x^2+2x-3$

$-8x-8 = 2x-3$

$-8 = 10x-3$

$-5 = 10x$

$-1/2 = x$

P.O.I.

$(-1/2, 2)$

Given $R(x) = \frac{4x^2+4x-3}{3x^2-4x-4}$, sketch a graph using the information given below. To save time, I've found most of the information for you. ☺

a) x-intercept(s)

$(-\frac{3}{2}, 0)$ $(\frac{1}{2}, 0)$

b) y-intercept

$(0, \frac{3}{4})$

c) vertical asymptote(s)

$x = -\frac{2}{3}$ $x = 2$

d) horizontal asymptote(s)

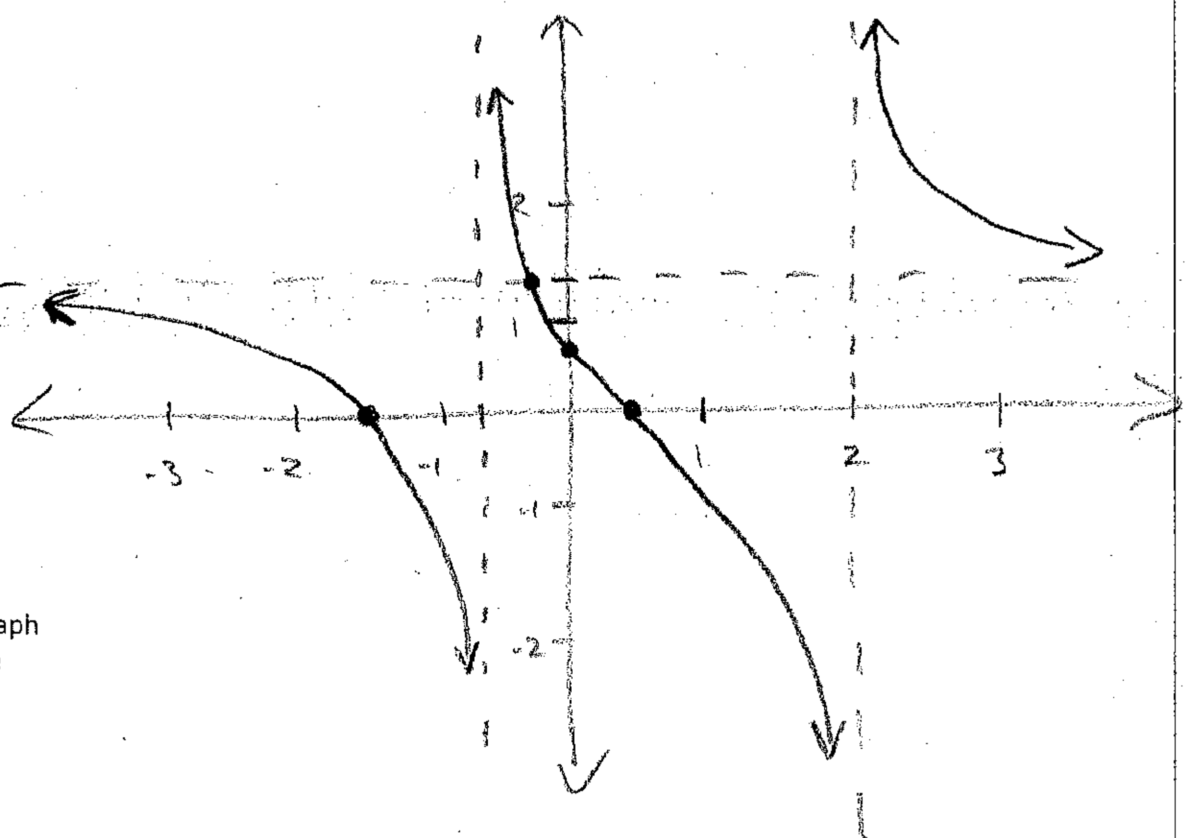
$y = \frac{4}{3}$

e) oblique asymptote(s)

None

f) intersection point of the graph and the horizontal asymptote

$(-\frac{1}{4}, \frac{4}{3})$



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