Rational Functions Extravaganza

If the numerator's highest <u>exponent</u> is greater than that of the denominator, the graph line **"ends"** go to $y = \pm\infty$ and there is NO **horizontal symptote**.

If the numerator's highest exponent is ONE greater than the denominator's highest, then a slant asymptote exists and is found by polynomial division.*

If the numerator's highest <u>exponent</u> is equal to that of the denominator, the **"ends"** of the graph line(s) go to a **horizontal asymptote**, the equation of which is $y = \frac{6}{2} = 3$ in this case.

$$y = \frac{6x^4 + 2x^2 - x + 10}{3x^3 - 4x + 5}$$

$$y = \frac{6x^3 + 2x^2 - x + 12}{2x^3 - 9x - 4}$$

$$y = \frac{8x^3 + 2x^2 - x + 6}{2x^5 - 4x^3 + 2}$$

***y*-intercepts**: y value when $x = 0$ (Link to $y = mx + b$)

***x*-intercepts**: x value(s) when $y = 0$. These are "roots" "solutions" "answers" "zeroes" These ***x* -axis intercepts** are values of x that make the <u>numerator</u> equal zero.

Values of x that make the <u>denominator</u> equal zero (1) are forbidden, and (2) are x -values that determine **vertical asymptotes**.

If the numerator's highest <u>exponent</u> is less than that of the denominator, the **"ends"** of the graph line go to $y = 0$, the x axis, which is the **horizontal asymptote**.

*Slant asymptote here:

$$\begin{array}{r}
2x + 4 + \dfrac{5x - 10}{3x^3 - 4x + 5} \\
3x^3 - 4x + 5 \overline{\big)\, 6x^4 + 0x^3 + 4x^2 - x + 10} \\
\underline{6x^4 + 0x^3 - 8x^2 + 10x} \\
12x^2 - 11x + 10 \\
\underline{12x^2 - 16x + 20} \\
5x - 10
\end{array}$$

Equation of slant asymptote is $y = 2x + 4$y