

Horizontal Asymptotes

We need to know what degrees of polynomials are

$$x^3 = \text{degree } 3$$

$$5x^4 = \text{degree } 4$$

$$x = \text{degree } 1$$

$$2 = \text{degree } 0$$

For the polynomial $7x^2 + 3x^3 + \underline{x^4}$, the highest degree = 4

We need to know the highest degree of the numerator and denominator to find horizontal asymptotes.

N = highest degree of numerator

D = highest degree of denominator

Examples: $\frac{2x^3}{3x}$, $N=3$
 $D=1$

$$\frac{2x + 4x^3}{x + 6x^2}, N=3$$
$$D=2$$

Once you have N & D , you need to choose which case:

Case 1: $D > N$

Asymptote is $y=0$

Example: $\frac{3}{x}$, $\frac{2x^2 + 3x}{x^4}$, $\frac{x}{x^2}$

Case 2: $D = N$

Asymptote is $y = \frac{D}{N}$ where D and N are coefficients of the highest powers

Example: $\frac{2x + 3x^2}{3 + 2x^2}$, asymp $\rightarrow y = \frac{3}{2}$

Case 3: $D < N$

No Asymptote

$$\frac{4x^4 + 2x^2}{9x^4}, \text{ asymp } \rightarrow y = \frac{4}{9}$$