

# ASYMPTOTES

Informal definition of asymptote: a line that a graph approaches but never intersects.

Asymptotes are lines, so they must be written as equations. A vertical line is written in the form  $x = a$ , and a horizontal line is written in the form  $y = b$ .

**Vertical asymptotes** are found at values of  $x$  that make the denominator of a function zero but do NOT make the numerator zero.

- Values of  $x$  that make both the numerator and denominator zero result in *removable discontinuities* (holes) in the graph.

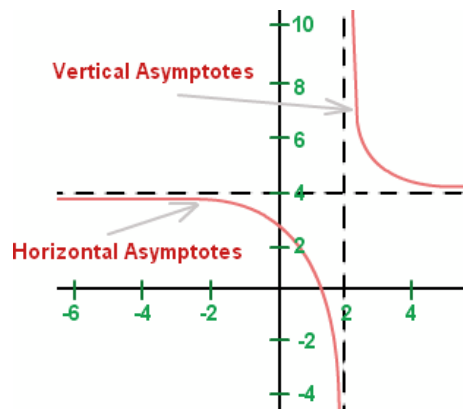
**Horizontal asymptotes** describe what happens to a function as  $x$  approaches infinity or negative infinity. They are found by comparing the degrees of numerator and denominator.

If the greater degree is in the numerator, there is no horizontal asymptote.

If the greater degree is in the denominator, the H.A. is  $y = 0$ .

If the numerator and denominator have the same degree, the H.A. is

$$y = \frac{\text{Leading coefficient of numerator}}{\text{Leading coefficient of denominator}}$$



If a value of  $x$  makes both the numerator and denominator zero (they have a common factor), we need to look at the remaining function after dividing out the common factor. That value of  $x$  usually gives us a **removable discontinuity** (which is a hole in the graph), but it might also give us a vertical asymptote.