

### Answer on Question #46292 – Math – Calculus

Give an example of a rational function that has a horizontal asymptote at  $y = 1$  and a vertical asymptote at  $x = 4$ .

**Solution.**

Consider the function  $f(x) = \frac{x+4}{x-4}$ .

Vertical asymptotes are vertical lines which correspond to the zeroes of the denominator of a rational function. In our case only zero of the denominator is  $x = 4$ . So, we have one vertical asymptote  $x = 4$ .

A horizontal asymptote is a  $y$  –value on a graph which a function approaches but does not actually reach.

The location of the horizontal asymptote is determined by looking at the degrees of the numerator ( $n$ ) and denominator ( $m$ ).

If  $n < m$ , the  $x$  –axis,  $y = 0$  is the horizontal asymptote.

If  $n = m$ , then  $y = \frac{an}{bm}$  is the horizontal asymptote. That is, the ratio of the leading coefficients of the numerator and denominator.

If  $n > m$ , there is no horizontal asymptote. However, if  $n = m + 1$ , there is an oblique or slant asymptote.

In our case  $n = m = 1$ ,  $a = b = 1$ .

So, we have the horizontal asymptote  $y = 1$ .