

Reminder:  
Sometimes a value of  $x$  that seems to be a vertical asymptote is actually a hole

Vertical Asymptote  
 $x$ -value that makes just the bottom of fraction zero.

Horizontal Asymptote  
(Degrees)

If Degree on top is bigger than Degree on Bottom: NO H.A.

If the Degree on bottom is bigger than the Degree on top H.A.

If Degrees are equal H.A.  $y = \frac{LC}{LC}$

Find all horizontal and vertical asymptotes

A)  $f(x) = \frac{x+1}{x}$

H.A.  $y = \frac{1}{1} = 1$

V.A.  $x = 0$

B)  $f(x) = 2^x$

C)  $f(x) = \frac{-3x^2+1}{x^2-1}$

H.A.  $y = \frac{-3}{1}$   
 $y = -3$

$x^2 - 1 = 0$   
 $(x+1)(x-1) = 0$   
 $x = -1 \quad x = 1$

V.A.  $x = \pm 1$

E)  $f(x) = \frac{3x^3+3}{x^2+1}$

H.A. None

V.A. None

D)  $f(x) = \frac{3x-9}{x^2-9}$

H.A.  $y = 0$   $(x+3)(x-3)$   
 $x = -3$   ~~$x = 3$~~

V.A.  $x = -3$

$x^2 - 9 = 0$

F)  $f(x) = \frac{x+5}{x^3-27}$

H.A.  $y = 0$

V.A.  $x = 3$

Determine if each function is continuous. If the function is not continuous, find the x-axis location of each discontinuity and classify each discontinuity as infinite or removable. Also find any horizontal asymptotes.

V.A. Holes

A)  $f(x) = \frac{3x^2 + 15x}{x + 5}$

B)  $f(x) = \frac{x^2 + 3x}{x + 2}$

P.O.D =  $x = -5$

$x = -5$  Hole

H.A. None

C)  $f(x) = \frac{9x + 6}{x^2 - 4}$

D)  $f(x) = \frac{9x + 18}{x^2 - 4}$

E)  $f(x) = \frac{x - 5}{x^2 - 4x - 5}$