Limits at infinity; horizontal asymptotes

By: *Lucy Solis*

Name _____ Group_____Date_____

Objective The student investigates the behavior of a graph when x grows larger and larger to positive or negative values(it means $x \to +\infty$ or $x \to -\infty$)

In order to analyze the limits at infinity

a) Complete the table of values and sketch the graph of $f(x) \quad \frac{x}{x+1}$

Analyzing $x \to +\infty$

x	f(x) (6 decimal places)
0	
1	
4	
10	
50	
100	
1000	
10000	

Graph

a) What is happening with the graph, as x grows larger and larger to positive values?

b) How could you write an expression that shows the situation symbolically using limits?

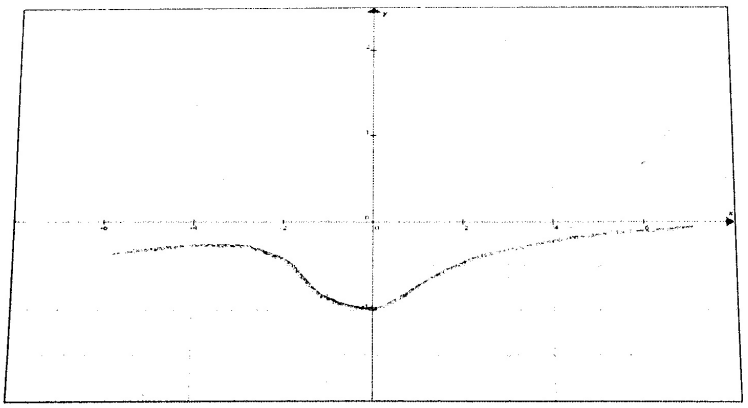
Analyzing $x \to -\infty$

x	f(x) (6 decimal places)
0	0
-1	-1/2
-4	-.9411
-10	-0.99009
-50	-0.999600
-100	-0.9999001
-1000	-0.9999999
-10000	-0.99999999

c) What is happening with the graph, as x grows larger and larger to negative values?

d) How could you write an expression that shows the situation symbolically using limits?

Sketch the graph of the function and state the horizontal asymptote



[Note If $\lim_{x \to \cdot\cdot} f(x) = L$ where L is a real number then the horizontal line $y = L$ is a horizontal asymprote of the curve (graph) of $f(x)$]

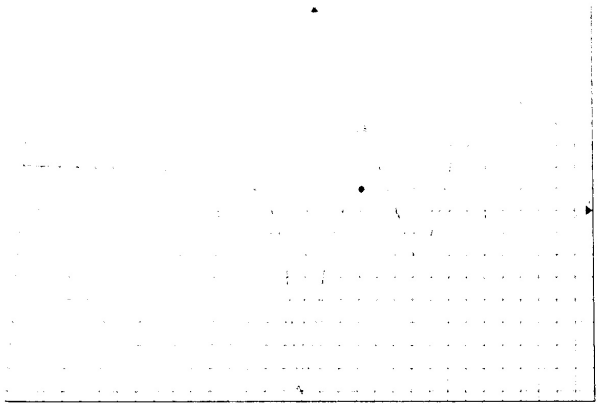
Practice

1 For the funtion $f(x)$ whose graph is given, find the following limits

a) $\lim_{x \to \cdot\cdot} f(x)$ b) $\lim_{x \to \cdot\cdot} f(x)$

c) $\lim_{x \to \cdot\cdot} f(x)$ d) $\lim_{x \to \cdot\cdot} f(x)$

e) $\lim_{x \to \cdot\cdot} f(x)$ f) $\lim_{x \to \cdot\cdot} f(x)$



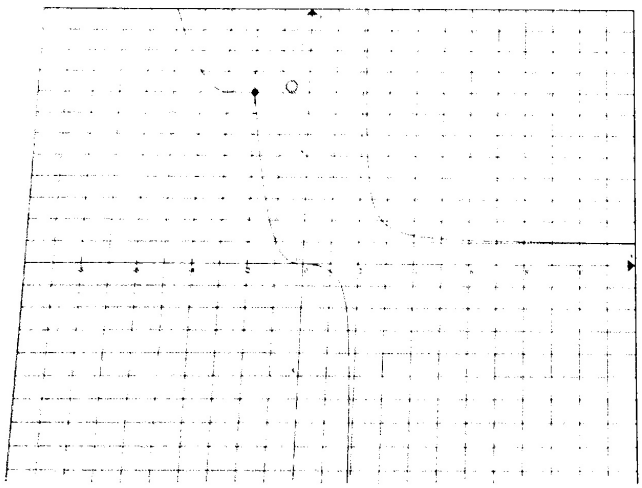
2. For the function $f(x)$ whose graph is given, find the following limits

a) $\lim_{x \to -2^-} f(x) =$ b) $\lim_{x \to -2} f(x) =$

c) $\lim_{x \to -2} f(x) =$ d) $\lim_{x \to 2} f(x) =$

e) $\lim_{x \to 2^-} f(x) =$ f) $\lim_{x \to 2} f(x) =$

g) $\lim_{x \to -\infty} f(x) =$ h) $\lim_{x \to +\infty} f(x) =$



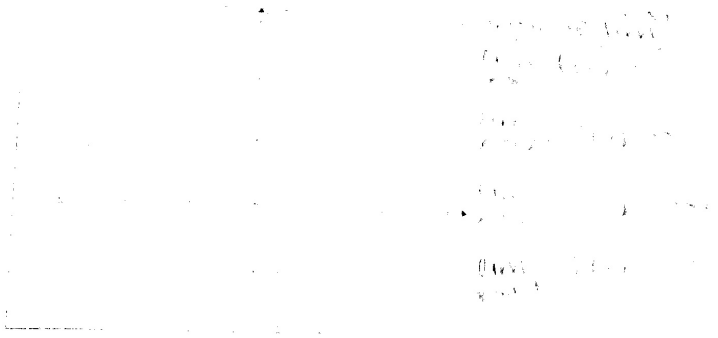
...x = c if there is no interruption in the graph of f(x) at ... the discontinuity is because of an undefined ... be destroyed by a hole, an asymptote, a break or ... oint that known as removable.

Examples of discontinuities

There are ...

Date ...

3 Find an estimation of the infinite limits, limits at infinity, and asymptotes for the function $f(x)$ (give the answer using integer numbers) whose graph is given



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4. Sketch the graph of a function that satisfies all the given conditions

a) $\lim_{x\to 1^-} f(x) = +\infty$ $\lim_{x\to 1} f(x) = -\infty$ $\lim_{x\to +\infty} f(x) = 3$ $\lim_{x\to -\infty} f(x) = 3$

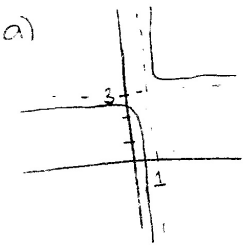
b) $\lim_{x\to 2} f(x) = \infty$ $\lim_{x\to +\infty} f(x) = 4$ $\lim_{x\to -\infty} f(x) = 3$

5. Find the vertical and horizontal asymptotes, write the answer using the limit notation

a) $f(x) = \dfrac{2x}{x+4}$ b) $f(x) = \dfrac{2x^2}{x^2-4}$ c) $f(x) = \dfrac{3x^2}{x^2+1}$

④

a)



b)