**Limits Graphically**
By: Lic. Lucy Solís

Tecnológico de Monterrey Preparatoria

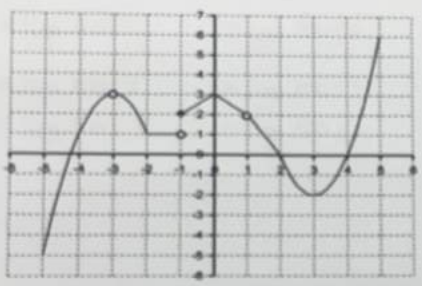
Name Caro Salazar G. Group 401 Date Aug. 13th

I. Based on the graph find the following limits.

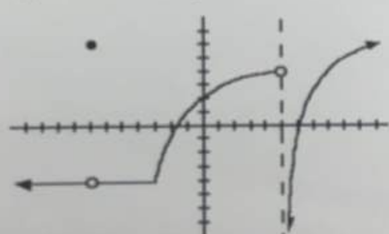
a) $\lim_{x \to -3^-} f(x) = 3$ b) $\lim_{x \to -3^+} f(x) = 3$ c) $\lim_{x \to -3} f(x) = 3$

d) $\lim_{x \to 0^-} f(x) = 2$ e) $\lim_{x \to 0^+} f(x) = 2$ f) $\lim_{x \to 0} f(x) = 2$

g) $\lim_{x \to 3^-} f(x) = -2$ h) $\lim_{x \to 3^+} f(x) = -2$ i) $\lim_{x \to 3} f(x) = -2$



II. Given this graph of f(x) answer the following:



1) f(5) = 3

2) f(-7) = 6

3) $\lim_{x \to 0^-}[f(x)] = 2$ 4) $\lim_{x \to 0^+}[f(x)] = 2$ 5) $\lim_{x \to 0}[f(x)] = 2$ f(0) = 2

6) $\lim_{x \to -7^-}[f(x)] = -4$ 7) $\lim_{x \to -7^+}[f(x)] = -4$ 8) $\lim_{x \to -7}[f(x)] = -4$ f(-7) = 6

9) $\lim_{x \to 5^-}[f(x)] = 4$ 10) $\lim_{x \to 5^+}[f(x)] = -\infty$ 11) $\lim_{x \to 5}[f(x)] = 3$ f(5) = 3

Continuity at a Point
By: Lucy Solís

Tecnológico de Monterrey Preparatoria

Name Caro Salazar G. Group________ Date 1/septiembre

***A function is continuous at x = c if there is no interruption in the graph of f(x) at x = c. Continuity can be destroyed by a hole, an asymptote, a break or a point that is undefined***

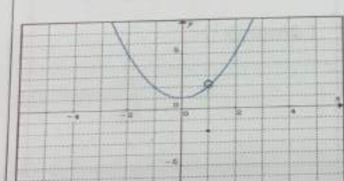
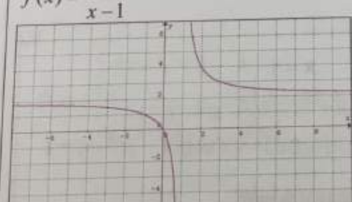
***When the discontinuity is because of an undefined point the discontinuity is known as removable.***

Examples of discontinuities
http://www.mathwarehouse.com/calculus/continuity/what-are-types-of-discontinuities.php

There are three conditions for a function to be continuous at x = c:

1) $f(c)$ is defined
2) $\lim_{x \to c} f(x)$ Exists
3) $\lim_{x \to c} f(x) = f(c)$

I. With your teacher discuss the continuity at the given point

| | |
|---|---|
| 1) $y = \begin{cases} x^2+1 & \text{if } x \neq 1 \\ -2 & \text{if } x = 1 \end{cases}$  | at x = 1<br>Discontinous at x=1<br>Removable |
| 2) $f(x) = \dfrac{2x}{x-1}$  | At x = 1<br>Discontinous at x=1<br>continuous except at x = 1<br>Non-removable |

ACT 1.12 *Application of limits*
By: *Lucy Solis*

Tecnológico de Monterrey Preparatoria

95

Name Caro Salazar G  Group_______ Date_______

**1. Calculating a Child's Dosage**

Since most pharmaceutical reference manuals only list adult dosages, pediatricians have to be especially careful when calculating dosages for their patients. Fortunately, there are several methods to choose from when calculating how much of a particular antibiotic or medication should be prescribed to a child. In this activity, we focus on one calculation method Young's Rule.

If we let $d$ = the child's dosage (in mg), $D$ = the adult dosage (in mg), and $A$ = the child's age (in years), then we have the following:

Young's Rule: $d = \frac{DA}{A+12}$

a) Suppose the adult dosage of an antibiotic is 100mg per day. Use the Young's Rule to determine the corresponding children's dosage for the given ages.

| Child's Age | Young's Rule |
|---|---|
| 2 | 14.28 |
| 4 | 25 |
| 6 | 33.33 |
| 8 | 40 |
| 10 | 45.45 |
| 12 | 50 |

b) Use Geogebra to graph the function $d = \frac{DA}{A+12}$ ?

c) The value of A could be negtive? Explain ?

d) If a 2 year-old child takes 12.5 mg ¿What is the adult dosage? D = 87.5

e) Find the $\lim_{A \to +\infty} d(D)$ and explain the meaning of this value in the context

$\lim_{A \to +\infty} d(D) = 100$

2. Environment. A utility company burns coal to generate electricity. The cost C in dollars of removing p% of the air pollutants in the stack emissions is

86

**By:** *Lucy Solis*

Name caro Salazar G. 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 $f(x) = \frac{x^2}{x^2+1}$

Analyzing $x \to +\infty$

| x | f(x) (6 decimal places) |
|---|---|
| 0 | 0 |
| 1 | .5 |
| 4 | .941176 |
| 10 | .990099 |
| 50 | .999600 |
| 100 | .999900 |
| 1000 | .999999 |
| 10000 | .99999999 |

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?

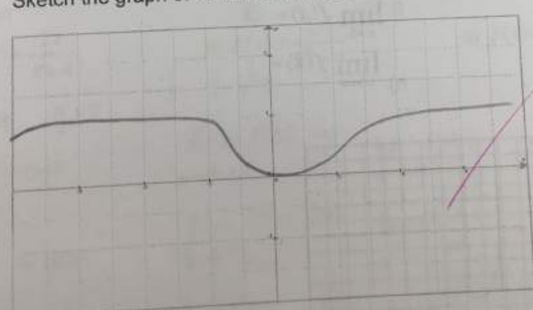
Analyzing $x \to -\infty$

| x | f(x) (6 decimal places) |
|---|---|
| 0 | 0 |
| -1 | -1/2 |
| -4 | -.9411 |
| -10 | -.9900 |
| -50 | -.9996 |
| -100 | -.99999 |
| -1000 | -.9999 |
| -10000 | -.999999 |

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?

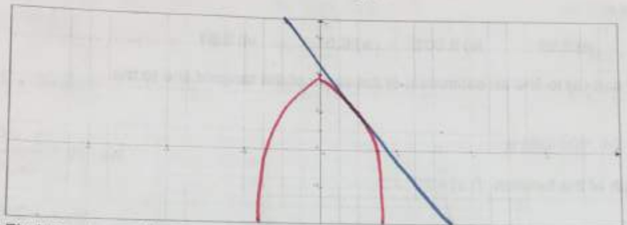
Sketch the graph of the function and state the horizontal asymptote



**Slope of Tangent Line Using Secant Line and Concept of Limits**
**By:** *Designing Team*

Name Cairo Salazar G. Group________ Date 9 / Agosto

1. a) Sketch the graph of the function $f(x) = -x^2 + 4$



Find the slope of the secant line passing through the points P(1,3) and Q (given below)

b) Write the solpes in the following table:

| $Q(x, -x^2+4)$ | $m$ | | $Q(x, -x^2+4)$ | $m$ | |
|---|---|---|---|---|---|
| (0,4) | −1 | $m = \frac{4-3}{0-1}$ | (2,0) | −3 | $m = \frac{0-3}{2-1}$ |
| (0.5, 3.75) | −3/2 | $m = \frac{3.75-3}{.5-1}$ | (1.5, 1.75) | −2.5 | $m = \frac{1.75-3}{1.5-1}$ |
| (0.9, 3.19) | −1.9 | $m = \frac{3.19-3}{.9-1}$ | (1.1, 2.79) | −2.1 | $m = \frac{2.79-3}{1.1-1}$ |
| (0.95, 3.0975) | −1.95 | $m = \frac{3.0975-3}{.95-1}$ | (1.05, 2.8975) | −2.05 | $m = \frac{2.8975-3}{1.05-1}$ |
| (0.99, 3.0199) | −1.99 | $m = \frac{3.0199-3}{.99-1}$ | (1.01, 2.9799) | −2.01 | $m = \frac{2.9799-3}{1.01-1}$ |
| (0.999, 3.001999) | −1.999 | $m = \frac{3.0019-3}{.999-1}$ | (1.001, 2.997999) | −2.001 | $m = \frac{2.9979-3}{1.001-1}$ |

c) Which value is being approximated by the secant line when the point Q approaches the point P(1,3)? −2 ← Approximation by secant

d) Based on the prevoius information find the slope of the tangent line passing through (1, 3)

−2 ← slope of tangent

e) Find the equation of the tangent line at the point (1, 3)

tangent $y = mx + b$

$y - y_1 = m(x - x_1)$

$y - 3 = -2(x - 1)$

$y - 3 = -2x + 2$

$y = -2x + 2 + 3$

$y = -2x + 5$

2. The point (2,1) lies on the curve $f(x) = \frac{1}{x-1}$.

a) If Q is the point $\left(x, \frac{1}{x-1}\right)$, find the slope of the secant line PQ (round to six decimals) for the following values of x:

i) 1.5 $m = \frac{2-1}{1.5-2}$ $m = -2$

ii) 1.75 $m = \frac{\frac{4}{3}-1}{1.75-2}$ $m = -1.33$

iii) 1.9 $m = \frac{\frac{10}{9}-1}{1.9-2}$ $m = -1.11$

iv) 1.99 $m = \frac{\frac{100}{99}-1}{1.99-2}$ $m = -1.0101$

v) 1.999 $m = \frac{\frac{1000}{999}-1}{1.999-2}$ $m = -1.0010$