AP Calculus AB Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lesson 2-2: *Limits Involving Infinity* Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Learning Goals:**

* *I can find and verify end behavior models for various functions.*
* *I can calculate limits as  and identify vertical and horizontal asymptotes.*

**I. Horizontal Asympotes**

1. What does represent?

2. Find.

Find the limit both based on transformations of its function family and using limit properties.

Based on the work for problem (2), do our limit properties hold for limits involving infinity? \_\_\_\_\_\_\_\_\_

**Definition:** The line is a **horizontal** asymptote of the graph of a function if either



3. Graphically determine  (sketch the graph below). Verify your answer using a table.

4. Graphically determine. *You will need to have this memorized!*

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5. Algebraically find 

**Exploration**

Even though our properties of limits still hold when , we must be careful when applying the properties. Explore below:

a. Let  and . Find and 

b. Find 

c. Given your answer to problem (5), explain the meaning of (a) and (b)

d. Let . Find , and 

e. Find . Does this answer make sense given your answer to part (c)?

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**II.`Infinite Limits as **

6. Determine  7. Determine 

**Definition:** The line is a **vertical asymptote** of the graph of a function if either



*Note*: The graph of a quotient does NOT always have a vertical asymptote when the denominator equals 0.

8. Use the graph to find .

9. Use the graph to find 

10. Use the graph to find 

**Notes**: Limits as for **rational functions**; , with , both polynomials

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Determine the limits of the following functions analytically (NO CALCULATOR). Use the limit properties and what you know about the growth rates of the individual functions that make up the below compositions.

11.  12. 

13.  14. 

**AP Exam Practice – NO CALCULATOR** (until you are finished, then verify your answer using graphs)

is  is

(A)  (A) 

(B)  (B) 1

(C) 2 (C) 0

(D) nonexistent (D) 