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

Lesson 9-2: *L’Hôpital’s Rule* Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Learning Goal:**

* *I can find limits of indeterminate form using L’Hôpital’s Rule.*

Let’s reach back to the beginning of the school year, shake off the rust, and find some limits.

Evaluate the following limits without using a calculator:

1.  2. 

3.  4. 

5. 

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 Page 2

Why were you not able to evaluate the limits in problem (5) directly? Unlike problems (3) and (4), no amount of algebraic manipulation will change the fact that, when evaluated directly, this limit gives us **indeterminate** form . Graph the function from problem (5). What is the limit?

From the graph, you should have seen that the function has a limit. It’s nice that we can find it on our calculator, but how can we find it algebraically? Luckily for us, a guy named Guillaume François Antoine, Marquis de l'Hôpital (also spelled L’Hospital – look it up on Wikipedia) was able to solve this problem. Actually, as is usually the case in mathematics, L’Hôpital is not actually responsible for developing the following rule, but he was the first one to publish it so it bears his surname.

**L’Hôpital’s Rule**

Suppose that , that *f* and *g* are differentiable on an open interval *I* containing *a*, and that . Then



if the latter limit exists.

Remember, we are not trying to suggest that a number exists, simply that the form is the description of function behavior that we can determine.

**Example 1**

Use L’Hôpital’s Rule to evaluate . Use a graph to support your answer.

**Example 2**

What is the indeterminate form of ? L’Hôpital’s Rule applies to this indeterminate form also. Use it to evaluate the limit. Use a graph to support your answer.

Can you evaluate the limit to problem (3) on the front page using L’Hôpital’s Rule?

Page 3

**Practice**

Evaluate the following limits, using L’Hôpital’s Rule if necessary. Support your answers graphically.

1.  2. 

3.  4. 

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 Page 4

5.  6. 

7.  8. 

2016 AP Exam problem #24: (No Calculator!)

