

# INTRODUCTION TO CALCULUS

MATH 1A

## UNIT 9: WORKSHEET

**Problem 1:** Compute the limit:

$$\lim_{x \rightarrow 0} \frac{\sin(3x) + x}{x^2 + x}$$

**Solution:**

4

**Problem 2:** Evaluate the following limit:

$$\lim_{x \rightarrow 1} (x - 1) / \log(x - 1)$$

**Solution:**

L'Hospital gives 0. We should check however, whether this is really a case for Hospital. The example is not appropriate because it is not of the form  $0/0$ . It is of the form  $0/\text{infinity}$  which is zero.

**Problem 3:** Find the limit:

$$\lim_{x \rightarrow \infty} \log(7x + 3) / \log(9x + 4)$$

**Solution:**

Hospital and then again applying Hospital gives 1.

**Problem 4:** Find the limit (see Figure 1 below)

$$\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{x} ?$$

**Solution:**

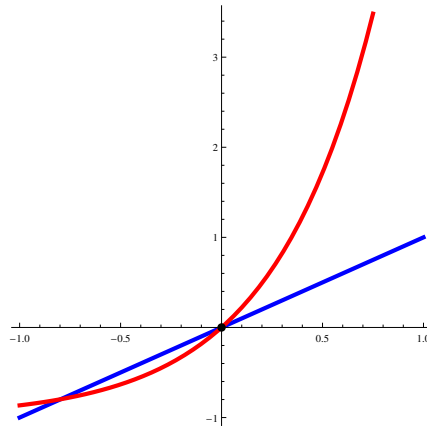
The limit is  $1/2$ .

**Problem 5:** And now evaluate the following limit

$$\lim_{x \rightarrow -1} (x^2 + 2x + 1)/(x + 1) .$$

**Solution:**

Healing simplifies to  $x + 1$  which has the limit 0. Also sending it to the hospital works. It is the limit  $(2x + 2)/1$  for  $x \rightarrow -1$  which is 0.



The functions  $e^{2x} - 1$  and  $x$ .

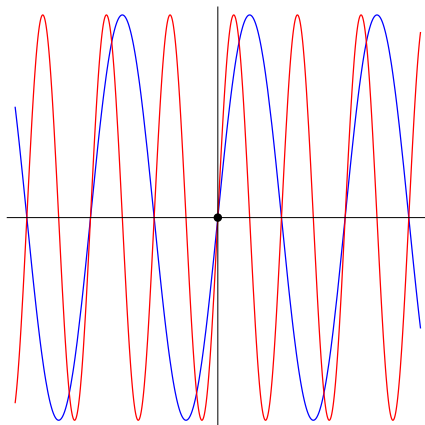
**Problem 6:** Apply l'Hospital's rule to get the limit of

$$f(x) = \frac{\sin(200x)}{\sin(300x)}$$

for  $x \rightarrow 0$ .

**Solution:**

$200/300$ .



**Problem 7:** What does l'Hospital's rule tell about the limit

$$f(x) = \frac{\sin(200x)}{\sin(300x)}$$

for  $x \rightarrow \pi$ .

**Solution:**

We again gives 200/300 Evaluating  $\cos(200\pi)$  gives 1.

**Problem 8:** What does l'Hospital's rule tell about the limit

$$f(x) = \frac{\cos(200x)}{\cos(300x)}$$

for  $x \rightarrow 0$ .

**Solution:**

Nothing. We can evaluate the limit directly and see that the result is 1.

**Problem 9:** What does l'Hospital tell you about

$$\lim_{x \rightarrow 1} (x + 1)/(x - 1)$$

**Solution:**

This is a case  $2/0$  which is infinity. There is no limit. Hospital can not be applied. The patient is dead already, can not be rescued.

**Problem 10:** And finally a joke:

$$f(x) = \lim_{x \rightarrow 0} 1/1 \stackrel{\text{Hospital}}{=} \lim_{x \rightarrow 0} 0/0 = \mathbf{not\ defined}$$

**Solution:**

$1/1$  is perfectly healthy and does not have to be sent to the hospital! In this case actually the treatment is deadly.