

## MATH 361K – HOMEWORK ASSIGNMENT 11

Due Tuesday, May 5, 2009

**Please write clearly, and staple your work !**

### 1. PROBLEM

Consider the function  $f(x) = \tan x = \frac{\sin x}{\cos x}$  for  $x \in (-\frac{\pi}{2}, \frac{\pi}{2})$ .

- (a) Determine  $f'(0)$ , using the quotient rule for derivatives.
- (b) Find a continuous function  $\phi(x)$  with the property that  $\phi(0) = f'(0)$  and  $f(x) - f(y) = \phi(x)(x - y)$  for  $x \in (-\frac{\pi}{2}, \frac{\pi}{2})$ .

### 2. PROBLEMS

Determine the following limits using Bernoulli-de l'Hôpital.

- (a)  $\lim_{x \rightarrow 0} \frac{\cos x - 1}{x^2}$ .
- (b)  $\lim_{x \rightarrow 0^+} \frac{\sin x}{x^2 + x + x^{10}}$ .

### 3. PROBLEMS

Use Taylor's theorem with  $n = 2$  to approximate  $e^x$  at  $x = 0$ , and give an upper bound on the absolute value of the remainder  $R_2(x)$  for  $x \in (-1, 1)$ .

### 4. PROBLEM

Determine the derivative of  $h(x) = \sin(e^{\cos x})$  (use the chain rule twice).