

THE UNIVERSITY OF SYDNEY
MATH1901/06 DIFFERENTIAL CALCULUS (ADVANCED)

Semester 1

Assignment 2

2009

This assignment is due by 4:00pm on **Tuesday, 26 May, 2009**. It should be posted in the glass-fronted collection boxes on the verandah of Carslaw Level 3. These boxes are at the end of the verandah closest to Eastern Avenue. (NOT the glass-fronted collection boxes near the pyramids on Carslaw Level 3, nor the open wooden pigeonholes.) Please do not post your assignment before the due date since the boxes are also used for the collection of assignments in other units. Your assignment must be stapled inside a manilla folder, and a cover sheet must be signed and attached.

This assignment is worth 5% of the assessment for this unit of study. It covers topics on limits, continuity, differentiability and Taylor polynomials from Weeks 3–10 of lectures.

1. [9 marks, 3 for each part] Calculate the following limits or prove that they do not exist. (Allow $+\infty$ and $-\infty$ as values that a limit can take.)
 - (a) $\lim_{x \rightarrow \infty} \sinh x \sinh(e^{-x})$.
 - (b) $\lim_{(x,y) \rightarrow (0,0)} \frac{x^4 y^2}{(x^2 + y^2)^2}$.
 - (c) $\lim_{(x,y) \rightarrow (0,0)} \frac{x^4}{y + x^2}$, where the limit is taken along all possible paths that never intersect the parabola $y = -x^2$ except at their common endpoint $(0, 0)$.

2. [6 marks, 3 for each part] Find the absolute maximum and minimum values taken by the following functions on the interval $[2, 3]$:
 - (a) $f(x) = (1 - 1/x)^{-x}$,
 - (b) $g(x) = x^{1/x}$.

3. [5 marks] Let $G(x) = \frac{1}{2}\{\cos(x^{1/4}) + \cosh(x^{1/4})\}$ for $x \geq 0$. Use suitable Taylor polynomials to find the right derivatives $G'_+(0)$ and $G''_+(0)$ at $x = 0$.