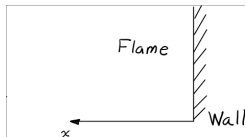# Week 4 Tutorial: Function Limits
Section 5: Mechanical Engineering (Stream 4)

Gordon D. Stubley

Fall 2008

To estimate heat transfer in a furnace, the temperature is measured at points off the furnace wall. If x is distance off the wall, the temperature, T, in the regions $0[m] \leq x \leq 0.09[m]$ and $0.11[m] \leq x \leq 0.25[m]$, can be represented by:

$$T(x) = A + \frac{Bx^2}{(x - C)^2}$$

where A, B, and C are constants. Given the following measurements, estimate the three constants to ensure accurate limits.

$x[m]$	0.001	0.005	0.010	0.095	0.105	0.75
$T[K]$	400	400	400	1250	1250	425

Photo courtesy of University of Waterloo Fire Research Laboratory

Question 2: Left / Right Limits

Problem 18, Exercise 2.2, Page 119
Evaluate, if possible, the limit of

$$f(x) = \frac{\sqrt{1+x} - 1}{x^2}$$

at $x = 0$? As part of your solution calculate $f(x)$ at ± 0.01 and ± 0.001.

Question 3: Discontinuity / Heaviside Functions

Problem 4, Exercise 2.5, Page 142
Express the function

$$f(x) = \begin{cases} 0 & x < -1 \\ x - 2 & -1 < x < 3 \\ x - 4 & 3 < x < 5 \\ 0 & 5 < x \end{cases}$$

in terms of Heaviside functions. Sketch a graph of the function.