Mathematics 1100Y – Calculus I: Calculus of one variable
### Trent University, Summer 2010

Assignment #3
This and that
Due on Wednesday, 2 June, 2010.

It was noted in class, and is also noted in the text, that $f(x) = \sin\left(\frac{1}{x}\right)$ is not continuous at $a = 0$, from which it follows that is not differentiable at $a = 0$. By way of contrast:

1. Verify that $g(x) = x \sin\left(\frac{1}{x}\right)$ is continuous, but not differentiable, at $a = 0$. *[3]*

2. Verify that $h(x) = x^2 \sin\left(\frac{1}{x}\right)$ is differentiable at $a = 0$. *[2]*

A hair 2π *cm* long lies on the surface of a spherical balloon while it is being inflated. The balloon remains spherical at all times, and the hair, which doesn't stretch or shrink, remains as straight as possible on its surface.
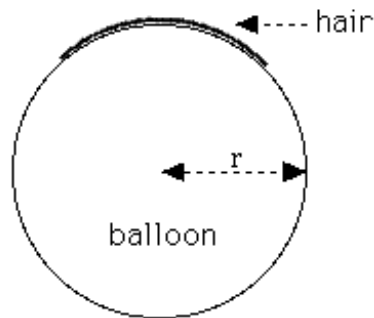
3. How is the radius of the balloon changing when it is 4 *cm*, if the ends of the hair are moving apart at 1 *cm/s* at that instant? *[3]*

4. At the same instant, how quickly is the midpoint of the hair approaching the straight line between the two ends? *[2]*

The Only Solution

We shall have to evolve
problem-solvers galore –
since each problem they solve
creates ten problems more.

Piet Hein