Mathematics 1110H – Calculus I: Limits, derivatives, and Integrals
TRENT UNIVERSITY, Fall 2020
Assignment #2
Continuity and Differentiability
Due on Friday, 9 October.

Submission: Scanned or photographed handwritten solutions are fine, so long as they are legible. Submission as a single pdf is strongly preferred, but other common formats are probably OK. (If not, we'll get back to you! :-) Please submit your solutions via Blackboard's Assignments module. If that fails, please email your solutions to the instructor at: `sbilaniuk@trentu.ca`

1 Verify that $f(x) = |x|$ is continuous but not differentiable at $x = 0$. *[3]*

Consider the function $g(x) = \begin{cases} x^2 \sin\left(\dfrac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$.

2. Verify that $g(x)$ is continuous at 0 and explain why $g(x)$ is continuous for all $x \neq 0$. *[2]*

3. Verify that $g(x)$ is differentiable at 0 and explain why $g(x)$ is differentiable for all $x \neq 0$. *[2]*

4. Work out $g'(x)$ for all x and determine for which values of x it is continuous and/or differentiable at x. *[3]*

Hint: Recall that if a function is differentiable at some point, then it must be continuous at that point. (It follows that if it fails to be continuous at some point, it can't be differentiable there either.) This can save you a bit of time in question **4**.