Math 120 Homework 6: Common student errors

• Problem 1: Differentiating piecewise functions on each piece, i.e. if $f$ is defined as

$$f(x) = \begin{cases} g(x), & \text{if } x \in S, \\ h(x), & \text{if } x \in T, \end{cases}$$

concluding that

$$f'(x) = \begin{cases} g'(x), & \text{if } x \in S, \\ h'(x), & \text{if } x \in T. \end{cases}$$

So in the context of this problem,

$$f(x) = \begin{cases} x^2 \sin(1/x), & \text{if } x \neq 0, \\ 0, & \text{if } x = 0, \end{cases}$$

it is valid to simply differentiate $x^2 \sin(1/x)$ and conclude that $f'(c) = 2c \sin(1/c) - \cos(1/c)$ by limits are a local property (because there is an open interval around $c$ such that $f(x) = x^2 \sin(1/x)$ on that open interval). However, for $c = 0$, it is not valid to differentiate the constant function $0$ and conclude that $f'(0) = 0$.

• Problem 3: Thinking that $f(x) - f(c) = (x - c)f^*(c)$ rather than $(x - c)f^*(x)$.

• Problem 4: Not computing enough iterations to be able to guarantee that $x$ is 1.18 to three significant figures.