

7. [6 points] As part of a final project in a chemistry class, Alex is studying a reaction that combines a small amount of catalyst with a large amount of another reagent. The lab manual indicates that if the amount of reagent used is  $R + x$ , where  $R$  is the (large) intended amount and  $x$  is a small variation from that, then the amount of catalyst required is  $c(x) = k\sqrt{R + x}$ . However, Chris thinks that it would be reasonable (and easier!) to use  $c(x) = k\sqrt{R}(1 + \frac{x}{2R})$  instead.

(a) [4 points of 6] Are Chris' and the lab book's expressions consistent? Explain. (Hint: your answer should not involve graphing.)

(b) [2 points of 6] Assuming that the two expressions are consistent, is Chris' estimate an over- or underestimate of the actual amount of catalyst required? Why?