CLS Homework #4 Notes and Common Errors

Homework Due: 15 February 2019
Problems Graded: 2.4.3, 2.4.10, and 2.5.16

- General Notes -

1. The most common topics that I saw people struggle on in this homework were the chain rule and the product rule. That's okay, these take some time to learn, but it would be a really good idea to review them (even if you already feel comfortable with them).

- Problem 2.4.3 -

1. This was a challenging problem since it asked you to synthesize information from a real-world scenario and to turn it into math. There is a really good explanation on the course web page that I would recommend taking a gander at. Another way the solution could have been found would have been to recognize that the area could be expressed as

$$A(t) = (100 - 2t)^2$$

which gives

$$A'(t) = 2(100 - 2t) \cdot (-2)$$

by the Chain Rule. Hence, $A'(5) = -360 \ \frac{\text{feet}^2}{\text{day}}$.

- Problem 2.4.10 -

1. This problem was dealing with the chain rule in a more general form. When taking the derivative of $h(x) = (f(x))^6$, you get $h'(x) = 6(f(x))^5 \cdot f'(x)$. Then you only need to plug in the numbers that you are given in the problem.

- Problem 2.5.16 -

1. In this problem you needed to take the derivative twice to obtain the *second derivative* of the given function. Part (a) went pretty well, but a lot of people tripped up on part (b), so here is a more detailed solution:

   Let $f(t) = 2^{3t-2}$. Then we have

$$\begin{aligned} \frac{d}{dt}[f(t)] &= \frac{d}{dt}[2^{3t-2}] \\ f'(t) &= \ln(2) \cdot 2^{3t-2} \cdot \frac{d}{dt}[3t-2] \qquad \text{Chain Rule} \\ &= \ln(2) \cdot 2^{3t-2} \cdot 3 \\ &= 3\ln(2) \cdot 2^{3t-2}. \end{aligned}$$

This then gives us

$$\begin{aligned}
\frac{d}{dt}[f'(t)] &= \frac{d}{dt}[3\ln(2)\cdot 2^{3t-2}] \\
f''(t) &= 3\ln(2)\cdot\frac{d}{dt}[2^{3t-2}] && \text{Constant Multiple Rule} \\
&= 3\ln(2)\cdot(\ln(2)\cdot 2^{3t-2}\cdot 3) && \text{Chain Rule} \\
&= 9\ln(2)^2\cdot 2^{3t-2} && \text{Simplify.}
\end{aligned}$$

As for part (d), there were a lot of people that forgot to apply the product rule to the function at each step. Please be careful and look at the equations carefully before you start taking derivatives. If you have any questions on this part, please let me know and I will be happy to go over it.