Derivative and Integral Formula Web Page

DERIVATIVES AND INTEGRALS

Basic Integration Formulas

1: $\frac{d}{dx}[cu] = cu'$

2: $\frac{d}{dx}[u+-v] = u'+-v'$

3: $\frac{d}{dx}[uv] = uv'+vu'$

4: $\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{u'-uv'}{v^2}$

5: $\frac{d}{dx}[c] = 0$

6: $\frac{d}{dx}[u^n] = nu^{n-1}u'$

7: $\frac{d}{dx}[x] = 1$

8: $\frac{d}{dx}[|u|] = \frac{u\,u'}{|u|}$

9: $\frac{d}{dx}[\ln u] = \frac{u'}{u}$

10: $\frac{d}{dx}[e^u] = e^u\,u'$

11: $\frac{d}{dx}[\log_a u] = \frac{u'}{(\ln a)u}$

12: $\frac{d}{dx}[a^u] = (\ln a)a^u u'$

13: $\frac{d}{dx}[\sin u] = (\cos u)u'$

14: $\frac{d}{dx}[\cos u] = -(\sin u)u'$

15: $\frac{d}{dx}[\tan u] = (\sec^2 u)u'$

16: $\frac{d}{dx}[\cot u] = -(\csc^2 u)u'$

17: $\frac{d}{dx}[\sec u] = (\sec u \tan u)u'$

18: $\frac{d}{dx}[\csc u] = -(\csc u \cot u)u'$

19: $\frac{d}{dx}[\arcsin u] = \frac{u'}{(1-u^2)^{1/2}}$

20: $\frac{d}{dx}[\arccos u] = \frac{-u'}{(1-u^2)^{1/2}}$

21: $\frac{d}{dx}[\arctan u] = \frac{u'}{1+u^2}$

22: $\frac{d}{dx}[\operatorname{arccot} u] = \frac{-u'}{1+u^2}$

23: $\frac{d}{dx}[\operatorname{arccos} u] = \frac{u'}{|u|(u^2-1)^{1/2}}$

24: $\frac{d}{dx}[\operatorname{arccsc} u] = \frac{-u'}{|u|(u^2-1)^{1/2}}$

25: $\frac{d}{dx}[\sinh u] = (\cosh u)u'$

26: $\frac{d}{dx}[\cosh u] = (\sinh u)u'$

27: $\frac{d}{dx}[\tanh u] = (\operatorname{sech}^2)u'$

28: $\frac{d}{dx}[\coth u] = -(\operatorname{csch}^2 u'$

29: $\frac{d}{dx}[\operatorname{sech} u] = -(\operatorname{sech} u \tanh u)u'$

30: $\frac{d}{dx}[\operatorname{csch} u] = -(\operatorname{csch} u \coth u)u'$

31: $\frac{d}{dx}[\sinh^{-1} u] = \frac{u'}{(u^2+1)^{1/2}}$

32: $\frac{d}{dx}[\cosh^{-1} u] = \frac{u'}{(u^2-1)^{1/2}}$

33: $\frac{d}{dx}[\tanh^{-1} u] = \frac{u'}{1-u^2}$

34: $\frac{d}{dx}[\coth^{-1} u] = \frac{u'}{1-u^2}$

35: $\frac{d}{dx}[\operatorname{sech}^{-1} u] = \frac{-u'}{u(1-u^2)^{1/2}}$

36: $\frac{d}{dx}[\operatorname{csch}^{-1} u] = \frac{-u'}{|u|(1+u^2)^{1/2}}$

Basic Differentiation Rules

1: $\int du = u + C$

2: $\int e^u du = e^u + C$

3: $\int \cos u\, du = \sin u + C$

4: $\int \sin u\, du = -\cos u + C$

5: $\int \tan u\, du = -\ln|\cos u| + C$

6: $\int \cot u\, du = \ln|\sin u| + c]$

7: $\int \sec u\, du = \ln|\sec u + \tan u| + C$

8: $\int \csc u\, du = -\ln|\csc u + \cot u| + C$

9: $\int \sec^2 = \tan u + C$

10: $\int \csc^2 = -\cot u + C$

Summary

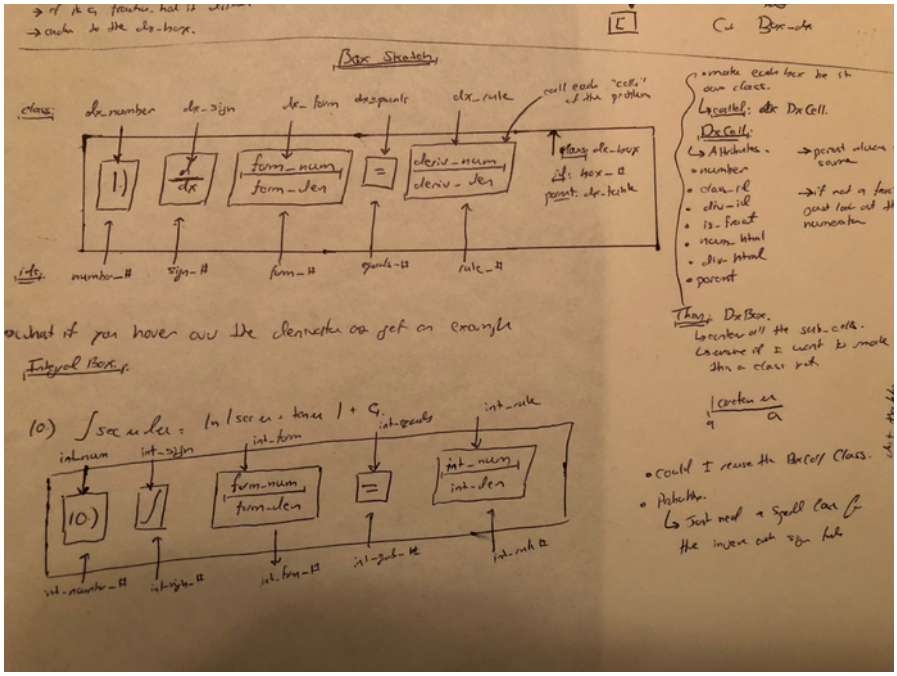
The goal of this project was to use HTML, CSS and JavaScript to create a web page that was similar to a formula sheet from a calculus textbook. I choose this object because it gave me a specific style and structure to follow. Also I wanted to automate the creation of the page so that adding or removing new formulas would be easy and wouldn't breaking the layout of the page. That made making the page a bit more complicated than making it purely in HTML. I also wanted to make the web page expandable so I would be able to add new features in the future. For example I may want to add a hover feature that may give the user a hint when they hover their mouse over a specific formula. I would also like the user to be directed to another page when a formula is clicked. The page could give details, derivations and examples of the formula in use. Overall this project was a success. The web page is almost identical to the original formula sheet [Figure 2] and I automated the creation of each formula box.

Key Challenges of the Program & Lessons Learned

Key Challenges:

One of challenges of this program was figuring out how to display math symbols. I did not use any external libraries so I was forced to think carefully and had to customize each element of the web page. For example there is no built in functionality to display a fraction bar in HTML. Therefore I had to create a workaround using stacked boxes and a border. The display of derivatives is similar but not exactly the same as with integrals. Therefore I had to be really careful in how I designed my classes.

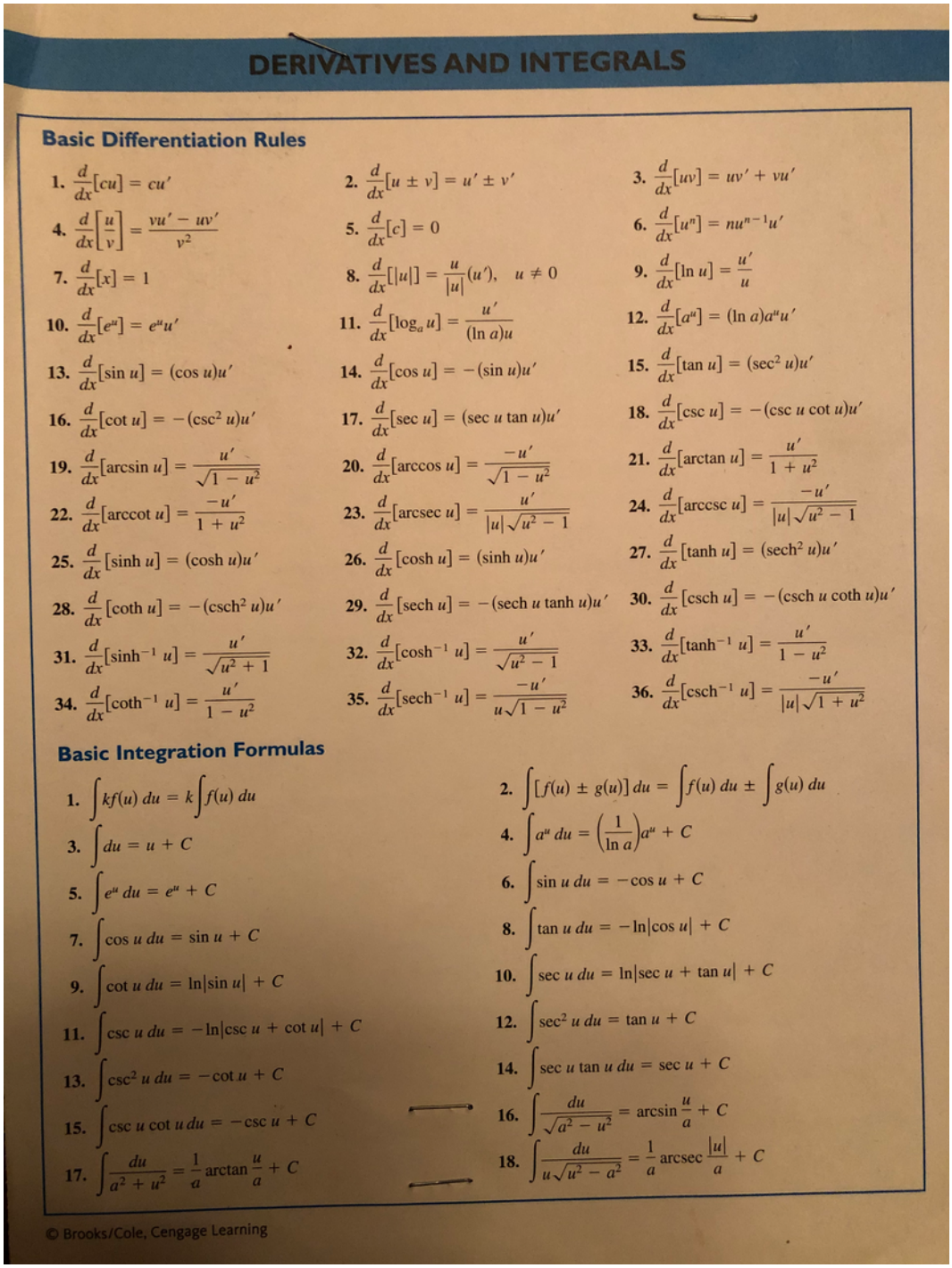
Figure 1: A Sketch of the Structure of the Program



Lessons Learned:

This program did not implement any sophisticate algorithms but there was still a number of important things that I learned. One of the most important things I am starting to learn about software development is the utility of mapping out the structure of your program. It's very temping to jump right into code, but a carefully thought out plan can save a considerable amount of time and frustration later. It is crucial to consider the attributes, functionality an other desired characteristics of the program. In this project, do so allowed me to think carefully about how I would label element and make the classes. [Figure 1]. It made my code to be much more robust, saved me time and allowed me to stay focused on the end result. Really the goal of this project was not really to make a good website or the tightest JavaScript. The goal of this website was to become better at that process. It is a slow process, but I am starting to get better at it. The next phase of this project will be to add some type of functionality that I think would improve this table. It is something that I am intimately familiar with and it will be a great exercise in incremental improvement to something that already exists.

Figure 2: The original Formula Sheet



DERIVATIVES AND INTEGRALS

Basic Differentiation Rules

1. $\frac{d}{dx}[cu] = cu'$
2. $\frac{d}{dx}[u \pm v] = u' \pm v'$
3. $\frac{d}{dx}[uv] = uv' + vu'$
4. $\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{vu' - uv'}{v^2}$
5. $\frac{d}{dx}[c] = 0$
6. $\frac{d}{dx}[u^n] = nu^{n-1}u'$
7. $\frac{d}{dx}[x] = 1$
8. $\frac{d}{dx}[|u|] = \frac{u}{|u|}(u'), \quad u \neq 0$
9. $\frac{d}{dx}[\ln u] = \frac{u'}{u}$
10. $\frac{d}{dx}[e^u] = e^u u'$
11. $\frac{d}{dx}[\log_a u] = \frac{u'}{(\ln a)u}$
12. $\frac{d}{dx}[a^u] = (\ln a)a^u u'$
13. $\frac{d}{dx}[\sin u] = (\cos u)u'$
14. $\frac{d}{dx}[\cos u] = -(\sin u)u'$
15. $\frac{d}{dx}[\tan u] = (\sec^2 u)u'$
16. $\frac{d}{dx}[\cot u] = -(\csc^2 u)u'$
17. $\frac{d}{dx}[\sec u] = (\sec u \tan u)u'$
18. $\frac{d}{dx}[\csc u] = -(\csc u \cot u)u'$
19. $\frac{d}{dx}[\arcsin u] = \frac{u'}{\sqrt{1-u^2}}$
20. $\frac{d}{dx}[\arccos u] = \frac{-u'}{\sqrt{1-u^2}}$
21. $\frac{d}{dx}[\arctan u] = \frac{u'}{1+u^2}$
22. $\frac{d}{dx}[\operatorname{arccot} u] = \frac{-u'}{1+u^2}$
23. $\frac{d}{dx}[\operatorname{arcsec} u] = \frac{u'}{|u|\sqrt{u^2-1}}$
24. $\frac{d}{dx}[\operatorname{arccsc} u] = \frac{-u'}{|u|\sqrt{u^2-1}}$
25. $\frac{d}{dx}[\sinh u] = (\cosh u)u'$
26. $\frac{d}{dx}[\cosh u] = (\sinh u)u'$
27. $\frac{d}{dx}[\tanh u] = (\operatorname{sech}^2 u)u'$
28. $\frac{d}{dx}[\coth u] = -(\operatorname{csch}^2 u)u'$
29. $\frac{d}{dx}[\operatorname{sech} u] = -(\operatorname{sech} u \tanh u)u'$
30. $\frac{d}{dx}[\operatorname{csch} u] = -(\operatorname{csch} u \coth u)u'$
31. $\frac{d}{dx}[\sinh^{-1} u] = \frac{u'}{\sqrt{u^2+1}}$
32. $\frac{d}{dx}[\cosh^{-1} u] = \frac{u'}{\sqrt{u^2-1}}$
33. $\frac{d}{dx}[\tanh^{-1} u] = \frac{u'}{1-u^2}$
34. $\frac{d}{dx}[\coth^{-1} u] = \frac{u'}{1-u^2}$
35. $\frac{d}{dx}[\operatorname{sech}^{-1} u] = \frac{-u'}{u\sqrt{1-u^2}}$
36. $\frac{d}{dx}[\operatorname{csch}^{-1} u] = \frac{-u'}{|u|\sqrt{1+u^2}}$

Basic Integration Formulas

1. $\int kf(u)\,du = k\int f(u)\,du$
2. $\int [f(u) \pm g(u)]\,du = \int f(u)\,du \pm \int g(u)\,du$
3. $\int du = u + C$
4. $\int a^u\,du = \left(\frac{1}{\ln a}\right)a^u + C$
5. $\int e^u\,du = e^u + C$
6. $\int \sin u\,du = -\cos u + C$
7. $\int \cos u\,du = \sin u + C$
8. $\int \tan u\,du = -\ln|\cos u| + C$
9. $\int \cot u\,du = \ln|\sin u| + C$
10. $\int \sec u\,du = \ln|\sec u + \tan u| + C$
11. $\int \csc u\,du = -\ln|\csc u + \cot u| + C$
12. $\int \sec^2 u\,du = \tan u + C$
13. $\int \csc^2 u\,du = -\cot u + C$
14. $\int \sec u \tan u\,du = \sec u + C$
15. $\int \csc u \cot u\,du = -\csc u + C$
16. $\int \frac{du}{\sqrt{a^2-u^2}} = \arcsin\frac{u}{a} + C$
17. $\int \frac{du}{a^2+u^2} = \frac{1}{a}\arctan\frac{u}{a} + C$
18. $\int \frac{du}{u\sqrt{u^2-a^2}} = \frac{1}{a}\operatorname{arcsec}\frac{|u|}{a} + C$

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Source Code Links:

HTML & CSS:

https://github.com/ryanA998/Derivative-and-Integral-Formula-Webpage/blob/main/form_sheet_home.html

JavaScript:

https://github.com/ryanA998/Derivative-and-Integral-Formula-Webpage/blob/main/form_sheet_script.js

GitHub:

https://github.com/ryanA998