REVIEW OF DIFFERENTIATION

Rules

1. Constant: $\frac{d}{dx}c = 0$

2. Constant Multiple: $\frac{d}{dx}cf(x) = cf'(x)$

2. Sum: $\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

4. Product: $\frac{d}{dx}f(x)g(x) = f(x)g'(x) + g(x)f'(x)$

5. Quotient: $\frac{d}{dx}\frac{f(x)}{g(x)} = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$

6. Chain: $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$

7. Power: $\frac{d}{dx}x^n = nx^{n-1}$

8. Power: $\frac{d}{dx}[g(x)]^n = n[g(x)]^{n-1}g'(x)$

Functions

Trigonometric:

9. $\frac{d}{dx}\sin x = \cos x$

10. $\frac{d}{dx}\cos x = -\sin x$

11. $\frac{d}{dx}\tan x = \sec^2 x$

12. $\frac{d}{dx}\cot x = -\csc^2 x$

13. $\frac{d}{dx}\sec x = \sec x \tan x$

14. $\frac{d}{dx}\csc x = -\csc x \cot x$

Inverse trigonometric:

15. $\frac{d}{dx}\sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$

16. $\frac{d}{dx}\cos^{-1} x = -\frac{1}{\sqrt{1-x^2}}$

17. $\frac{d}{dx}\tan^{-1} x = \frac{1}{1+x^2}$

18. $\frac{d}{dx}\cot^{-1} x = -\frac{1}{1+x^2}$

19. $\frac{d}{dx}\sec^{-1} x = \frac{1}{|x|\sqrt{x^2-1}}$

20. $\frac{d}{dx}\csc^{-1} x = -\frac{1}{|x|\sqrt{x^2-1}}$

Hyperbolic:

21. $\frac{d}{dx}\sinh x = \cosh x$

22. $\frac{d}{dx}\cosh x = \sinh x$

23. $\frac{d}{dx}\tanh x = \operatorname{sech}^2 x$

24. $\frac{d}{dx}\coth x = -\operatorname{csch}^2 x$

25. $\frac{d}{dx}\operatorname{sech} x = -\operatorname{sech} x \tanh x$

26. $\frac{d}{dx}\operatorname{csch} x = -\operatorname{csch} x \coth x$

Inverse hyperbolic:

27. $\frac{d}{dx}\sinh^{-1} x = \frac{1}{\sqrt{x^2+1}}$

28. $\frac{d}{dx}\cosh^{-1} x = \frac{1}{\sqrt{x^2-1}}$

29. $\frac{d}{dx}\tanh^{-1} x = \frac{1}{1-x^2}$

30. $\frac{d}{dx}\coth^{-1} x = \frac{1}{1-x^2}$

31. $\frac{d}{dx}\operatorname{sech}^{-1} x = -\frac{1}{x\sqrt{1-x^2}}$

32. $\frac{d}{dx}\operatorname{csch}^{-1} x = -\frac{1}{|x|\sqrt{x^2+1}}$

Exponential:

33. $\frac{d}{dx}e^x = e^x$

34. $\frac{d}{dx}a^x = a^x(\ln a)$

Logarithmic:

35. $\frac{d}{dx}\ln|x| = \frac{1}{x}$

36. $\frac{d}{dx}\log_a x = \frac{1}{x(\ln a)}$

BRIEF TABLE OF INTEGRALS

1. $\int u^n\,du = \frac{u^{n+1}}{n+1} + C,\ n \neq -1$

2. $\int \frac{1}{u}\,du = \ln|u| + C$

3. $\int e^u\,du = e^u + C$

4. $\int a^u\,du = \frac{1}{\ln a}a^u + C$

5. $\int \sin u\,du = -\cos u + C$

6. $\int \cos u\,du = \sin u + C$

7. $\int \sec^2 u\,du = \tan u + C$

8. $\int \csc^2 u\,du = -\cot u + C$

9. $\int \sec u \tan u\,du = \sec u + C$

10. $\int \csc u \cot u\,du = -\csc u + C$

11. $\int \tan u\,du = -\ln|\cos u| + C$

12. $\int \cot u\,du = \ln|\sin u| + C$

13. $\int \sec u\,du = \ln|\sec u + \tan u| + C$

14. $\int \csc u\,du = \ln|\csc u - \cot u| + C$

15. $\int u \sin u\,du = \sin u - u\cos u + C$

16. $\int u \cos u\,du = \cos u + u\sin u + C$

17. $\int \sin^2 u\,du = \frac{1}{2}u - \frac{1}{4}\sin 2u + C$

18. $\int \cos^2 u\,du = \frac{1}{2}u + \frac{1}{4}\sin 2u + C$

19. $\int \tan^2 u\,du = \tan u - u + C$

20. $\int \cot^2 u\,du = -\cot u - u + C$

21. $\int \sin^3 u\,du = -\frac{1}{3}\left(2 + \sin^2 u\right)\cos u + C$

22. $\int \cos^3 u\,du = \frac{1}{3}\left(2 + \cos^2 u\right)\sin u + C$

23. $\int \tan^3 u\,du = \frac{1}{2}\tan^2 u + \ln|\cos u| + C$

24. $\int \cot^3 u\,du = -\frac{1}{2}\cot^2 u - \ln|\sin u| + C$

25. $\int \sec^3 u\,du = \frac{1}{2}\sec u \tan u + \frac{1}{2}\ln|\sec u + \tan u| + C$

26. $\int \csc^3 u\,du = -\frac{1}{2}\csc u \cot u + \frac{1}{2}\ln|\csc u - \cot u| + C$

27. $\int \sin au \cos bu\,du = \frac{\sin(a-b)u}{2(a-b)} - \frac{\sin(a+b)u}{2(a+b)} + C$

28. $\int \cos au \cos bu\,du = \frac{\sin(a-b)u}{2(a-b)} + \frac{\sin(a+b)u}{2(a+b)} + C$

29. $\int e^{au} \sin bu\,du = \frac{e^{au}}{a^2+b^2}\left(a\sin bu - b\cos bu\right) + C$

30. $\int e^{au} \cos bu\,du = \frac{e^{au}}{a^2+b^2}\left(a\cos bu + b\sin bu\right) + C$

31. $\int \sinh u\,du = \cosh u + C$

32. $\int \cosh u\,du = \sinh u + C$

33. $\int \operatorname{sech}^2 u\,du = \tanh u + C$

34. $\int \operatorname{csch}^2 u\,du = -\coth u + C$

35. $\int \tanh u\,du = \ln(\cosh u) + C$

36. $\int \coth u\,du = \ln|\sinh u| + C$

37. $\int \ln u\,du = u\ln u - u + C$

38. $\int u \ln u\,du = \frac{1}{2}u^2 \ln u - \frac{1}{4}u^2 + C$

39. $\int \frac{1}{\sqrt{a^2-u^2}}\,du = \sin^{-1}\frac{u}{a} + C$

40. $\int \frac{1}{\sqrt{a^2+u^2}}\,du = \ln\left|u + \sqrt{a^2+u^2}\right| + C$

41. $\int \sqrt{a^2-u^2}\,du = \frac{u}{2}\sqrt{a^2-u^2} + \frac{a^2}{2}\sin^{-1}\frac{u}{a} + C$

42. $\int \sqrt{a^2+u^2}\,du = \frac{u}{2}\sqrt{a^2+u^2} + \frac{a^2}{2}\ln\left|u + \sqrt{a^2+u^2}\right| + C$

43. $\int \frac{1}{a^2+u^2}\,du = \frac{1}{a}\tan^{-1}\frac{u}{a} + C$

44. $\int \frac{1}{a^2-u^2}\,du = \frac{1}{2a}\ln\left|\frac{a+u}{a-u}\right| + C$

***Note*:** Some techniques of integration, such as integration by parts and partial fractions, are reviewed in the *Student Resource Manual* that accompanies this text.