College of the Holy Cross
Math 135 (Calculus I)
Worksheet 10: Derivative Rules

Use the algebra and the product, quotient, and/or chain rules to calculate the derivative of each function. Simplify your answers as much as possible.

1. $f(x) = 1 + x + x^2 + x^3$.
2. $f(x) = 1 + x^{-1} + x^{-2} + x^{-3}$.
3. $f(x) = \sqrt{1 - x^2}$.
4. $f(x) = \dfrac{1}{\sqrt{1 - x^2}}$.
5. $f(x) = \sqrt{1 + x + x^2 + x^3}$.
6. $f(x) = \dfrac{1 + x + x^2 + x^3}{x^{3/2}}$.
7. $f(x) = \sqrt{x^2 + 4}$.
8. $f(x) = \sqrt{(x^2 + 4)^3}$.
9. $f(x) = \dfrac{1}{\sqrt{x^2 + 4}}$.
10. $f(x) = (1 - x)^8(1 + x)^9$.
11. $f(x) = (1 - x)^{1/3}(1 + x)^{2/3}$.
12. $f(x) = (1 - x)^p(1 + x)^q$.
13. $f(x) = x^n e^{-x}$.
14. $f(x) = x^n \sin x$.
15. $f(x) = 1 + \cos x$.
16. $f(x) = (1 + \cos x)^5$.
17. $f(x) = \sqrt{1 + \cos x}$.
18. $f(x) = \cos(x^2)$.
19. $f(x) = \cos^2 x$.
20. $f(x) = 1 + \cos^5 x$.
21. $f(x) = 1 + \sqrt{\cos x}$.
22. $f(x) = \dfrac{1 + \cos x}{1 - \cos x}$.
23. $f(x) = \sqrt{\dfrac{1 + \cos x}{1 - \cos x}}$. Hint: Under the radical, multiply and divide by $1+\cos x$.
24. $f(x) = (1 + e^x)^5$.
25. $f(x) = 1 + e^{5x}$.
26. $f(x) = 1 + e^{x^5}$.
27. $f(x) = \dfrac{e^x}{1 + e^x}$.
28. $f(x) = \dfrac{e^x - e^{-x}}{e^x + e^{-x}}$.
29. $f(x) = e^{n \ln x}$.
30. $f(x) = x^x$. Hint: Write this as $e^{u(x)}$.
31. $f(x) = e^{e^x}$.
32. $f(x) = \ln(x^2 + 4)$.
33. $f(x) = \ln \cos x$.
34. $f(x) = \ln(1 + e^x)$.
35. $x^n \ln x$.
36. $f(x) = \ln \sqrt{\left|\dfrac{1 + x}{1 - x}\right|}$.
37. $f(x) = \ln |x + \sqrt{1 + x^2}|$.
38. $f(x) = x\sqrt{1 + x^2} + \ln |x + \sqrt{1 + x^2}|$.
39. $f(x) = \ln |\sec x + \tan x|$.
40. $f(x) = xe^x \sin x$.