The Weekly Rigor

101 Problems in Calculating Derivatives Using the Chain Rule with Solutions
(Part 1)

INTRODUCTION

The purpose of these practice problems is to make the calculus student a master of the chain rule. The first set of 101 problems include a wide variety of function types. Each of the function types are grouped together with multiple examples to aid comprehension and confidence in the most efficient way possible. This set also minimizes notational variations (e.g., all the functions are named "$f(x)$") and unnecessary constant numbers. The next set is in random order and does *not* include any problems dealing with exponential, logarithmic, or trigonometric functions. The third set does include exponential and logarithmic functions, but not trigonometric. The fourth and final set includes all the types of functions, in random order.

SET 1 PROBLEMS

Find the derivative $f'(x)$ of each of the following functions.

1. $f(x) = (x^2 + 3)^4$

2. $f(x) = (x^2 + 2)^{\frac{3}{2}}$

3. $f(x) = (x^3 + x^2 + 2)^5$

4. $f(x) = (x^3 + x^2 + 4)^{\frac{5}{3}}$

5. $f(x) = (x^2 + 2)^{-3}$

6. $f(x) = (x^3 + x^2 + 1)^{-\frac{1}{2}}$

7. $f(x) = \frac{1}{(x^5 + x^2)^3}$

8. $f(x) = \frac{1}{(x^4 + x)^{\frac{5}{6}}}$

9. $f(x) = \frac{1}{(x^5 + x^2)^{\frac{3}{7}}}$

10. $f(x) = \sqrt{x^2 + 3}$

11. $f(x) = \sqrt[4]{x^3 + x^2 + 4}$

12. $f(x) = \sqrt[3]{(x^2 + x)^2}$

13. $f(x) = \left(\sqrt{x^3 + 4}\right)^3$

14. $f(x) = \frac{1}{\sqrt[3]{x-1}}$

15. $f(x) = \frac{1}{\sqrt{(x^3 + x)^5}}$

16. $f(x) = \left(\frac{x^2 + 3}{x+1}\right)^3$

17. $f(x) = \left(\frac{x-3}{x+8}\right)^4$

18. $f(x) = \left(\frac{x^2 - 4}{x^3 + 7}\right)^5$

19. $f(x) = \left(\frac{x^4 - x^5}{x^2 + x^3}\right)^3$

20. $f(x) = \left(x^{\frac{2}{3}} + x^{\frac{1}{2}}\right)^3$

21. $f(x) = \left(\sqrt{x} + \sqrt[3]{x^2}\right)^{\frac{4}{3}}$

22. $f(x) = \left(\sqrt[3]{x^5} + \sqrt[5]{x^{\frac{9}{2}}}\right)^{\frac{4}{3}}$

23. $f(x) = \sqrt[5]{1 + x^{\frac{2}{3}}}$

24. $f(x) = \sqrt[4]{\sqrt{x} + x^{\frac{4}{3}}}$

25. $f(x) = \left(x^{\frac{3}{4}} + x^{\frac{1}{2}}\right)^{-4}$

26. $f(x) = \dfrac{1}{\left(\sqrt[3]{x} + x^2\right)^{-2}}$

27. $f(x) = \dfrac{1}{\sqrt[4]{\sqrt{x} + x}}$

28. $f(x) = \dfrac{1}{\sqrt[5]{\left(\sqrt{x} + x^{\frac{1}{3}}\right)^2}}$

29. $f(x) = e^{3x}$

30. $f(x) = e^{\frac{2}{5}x}$

31. $f(x) = e^{x^2}$

32. $f(x) = e^{x^3}$

33. $f(x) = e^{e^x}$

34. $f(x) = e^{e^{2x}}$

35. $f(x) = e^{\ln(x)}$

36. $f(x) = e^{\ln(x^2)}$

37. $f(x) = e^{\arctan(x)}$

38. $f(x) = e^{\arccos(2x)}$

39. $f(x) = (e^x + e^{-x})^3$

40. $f(x) = \dfrac{1}{\sqrt{e^{2x} - e^{3x}}}$

41. $f(x) = \ln(2x)$

42. $f(x) = \ln(3x)$

43. $f(x) = \ln(x^2)$

44. $f(x) = \ln(3x^2)$

45. $f(x) = \ln^2(x)$

46. $f(x) = \ln^3(5x)$

47. $f(x) = \ln^4(3x^5)$

48. $f(x) = \ln(e^x)$

49. $f(x) = \ln\left(e^{x^2}\right)$

50. $f(x) = \ln(\ln(x))$

51. $f(x) = \ln(\ln(2x))$