MATH 19 – Exam 2 Additional Problems

This is a large collection of problems found in the textbook, which are relevant to Exam 2. You should not attempt to do all the problems, but within each section you should try $1-2$ from each group of problems. Make sure to pick a variety of problems (for example, #13 and #14 in section 3.2 are very similar; you would be better off choosing #13 and #15)

3.2 Derivatives of Exponential and Logarithmic Functions

For this chapter, use properties of logarithms to rewrite "ln" expressions (do not use the chain rule). For example, write $\ln(4x^2) = \ln(4) + \ln(x^2) = \ln(4) + 2\ln(x)$, then differentiate.

In Problems 7–12, use logarithmic properties to write in simpler form. (If necessary, review Section 1.6).

7. $\ln\frac{x}{y}$ **8.** $\ln e^x$

9. $\ln x^5$ **10.** $\ln xy$

11. $\ln\frac{uv^2}{w}$ **12.** $\ln\frac{u^2}{v^3w}$

A *In Problems 13–30, find $f'(x)$.*

13. $f(x) = 5e^x + 3x + 1$ **14.** $f(x) = -7e^x - 2x + 5$

15. $f(x) = -2\ln x + x^2 - 4$ **16.** $f(x) = 6\ln x - x^3 + 2$

17. $f(x) = x^3 - 6e^x$ **18.** $f(x) = 9e^x + 2x^2$

19. $f(x) = e^x + x - \ln x$ **20.** $f(x) = \ln x + 2e^x - 3x^2$

21. $f(x) = \ln x^3$ **22.** $f(x) = \ln x^8$

23. $f(x) = 5x - \ln x^5$ **24.** $f(x) = 4 + \ln x^9$

25. $f(x) = \ln x^2 + 4e^x$ **26.** $f(x) = \ln x^{10} + 2\ln x$

27. $f(x) = e^x + x^e$ **28.** $f(x) = 3x^e - 2e^x$

29. $f(x) = xx^e$ **30.** $f(x) = ee^x$

B *In Problems 31–38, find the equation of the line tangent to the graph of f at the indicated value of x.*

31. $f(x) = 3 + \ln x; x = 1$ **32.** $f(x) = 2\ln x; x = 1$

33. $f(x) = 3e^x; x = 0$ **34.** $f(x) = e^x + 1; x = 0$

35. $f(x) = \ln x^3; x = e$ **36.** $f(x) = 1 + \ln x^4; x = e$

37. $f(x) = 2 + e^x; x = 1$ **38.** $f(x) = 5e^x; x = 1$

In Problems 43–46, first use appropriate properties of logarithms to rewrite $f(x)$, and then find $f'(x)$.

43. $f(x) = 10x + \ln 10x$ **44.** $f(x) = 2 + 3\ln\frac{1}{x}$

45. $f(x) = \ln\frac{4}{x^3}$ **46.** $f(x) = x + 5\ln 6x$

3.3 Derivatives of Products and Quotients

A *In Problems 9–34, find $f'(x)$ and simplify.*

9. $f(x) = 2x^3(x^2 - 2)$

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

11. $f(x) = (x - 3)(2x - 1)$

12. $f(x) = (3x + 2)(4x - 5)$

13. $f(x) = \dfrac{x}{x - 3}$

14. $f(x) = \dfrac{3x}{2x + 1}$

15. $f(x) = \dfrac{2x + 3}{x - 2}$

16. $f(x) = \dfrac{3x - 4}{2x + 3}$

17. $f(x) = 3xe^x$

18. $f(x) = x^2e^x$

19. $f(x) = x^3 \ln x$

20. $f(x) = 5x \ln x$

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

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

23. $f(x) = (0.4x + 2)(0.5x - 5)$

24. $f(x) = (0.5x - 4)(0.2x + 1)$

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

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

27. $f(x) = (x^2 + 2)(x^2 - 3)$

28. $f(x) = (x^2 - 4)(x^2 + 5)$

29. $f(x) = \dfrac{x^2 + 2}{x^2 - 3}$

30. $f(x) = \dfrac{x^2 - 4}{x^2 + 5}$

31. $f(x) = \dfrac{e^x}{x^2 + 1}$

32. $f(x) = \dfrac{1 - e^x}{1 + e^x}$

33. $f(x) = \dfrac{\ln x}{1 + x}$

34. $f(x) = \dfrac{2x}{1 + \ln x}$

B *In Problems 47–56, find the indicated derivatives and simplify.*

47. $f'(x)$ for $f(x) = (2x + 1)(x^2 - 3x)$

48. y' for $y = (x^3 + 2x^2)(3x - 1)$

49. $\frac{dy}{dt}$ for $y = (2.5t - t^2)(4t + 1.4)$

50. $\frac{d}{dt}[(3 - 0.4t^3)(0.5t^2 - 2t)]$

51. y' for $y = \frac{5x - 3}{x^2 + 2x}$

52. $f'(x)$ for $f(x) = \frac{3x^2}{2x - 1}$

53. $\frac{d}{dw}\frac{w^2 - 3w + 1}{w^2 - 1}$

54. $\frac{dy}{dw}$ for $y = \frac{w^4 - w^3}{3w - 1}$

55. y' for $y = (1 + x - x^2)\,e^x$

56. $\frac{dy}{dt}$ for $y = (1 + e^t)\ln t$

3.4 The Chain Rule

A *In Problems 9–16, replace ? with an expression that will make the indicated equation valid.*

9. $\frac{d}{dx}(3x + 4)^4 = 4(3x + 4)^3$?

10. $\frac{d}{dx}(5 - 2x)^6 = 6(5 - 2x)^5$?

11. $\frac{d}{dx}(4 - 2x^2)^3 = 3(4 - 2x^2)^2$?

12. $\frac{d}{dx}(3x^2 + 7)^5 = 5(3x^2 + 7)^4$?

13. $\frac{d}{dx}e^{x^2+1} = e^{x^2+1}$?

14. $\frac{d}{dx}e^{4x-2} = e^{4x-2}$?

15. $\frac{d}{dx}\ln(x^4 + 1) = \frac{1}{x^4 + 1}$?

16. $\frac{d}{dx}\ln(x - x^3) = \frac{1}{x - x^3}$?

In Problems 17–34, find $f'(x)$ and simplify.

17. $f(x) = (5 - 2x)^4$

18. $f(x) = (9 - 5x)^2$

19. $f(x) = (4 + 0.2x)^5$

20. $f(x) = (6 - 0.5x)^4$

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

22. $f(x) = (5x^2 - 3)^6$

23. $f(x) = e^{5x}$

24. $f(x) = 6e^{-2x}$

25. $f(x) = 3e^{-6x}$

26. $f(x) = e^{x^2 + 3x + 1}$

27. $f(x) = (2x - 5)^{1/2}$

28. $f(x) = (4x + 3)^{1/2}$

29. $f(x) = (x^4 + 1)^{-2}$

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

31. $f(x) = 3\ln(1 + x^2)$

32. $f(x) = 2\ln(x^2 - 3x + 4)$

33. $f(x) = (1 + \ln x)^3$

34. $f(x) = (x - 2\ln x)^4$

B *In Problems 41–56, find the indicated derivative and simplify.*

41. y' if $y = 3(x^2 - 2)^4$

42. y' if $y = 2(x^3 + 6)^5$

43. $\dfrac{d}{dt}2(t^2 + 3t)^{-3}$

44. $\dfrac{d}{dt}3(t^3 + t^2)^{-2}$

45. $\dfrac{dh}{dw}$ if $h(w) = \sqrt{w^2 + 8}$

46. $\dfrac{dg}{dw}$ if $g(w) = \sqrt[3]{3w - 7}$

47. $g'(x)$ if $g(x) = 4xe^{3x}$

48. $h'(x)$ if $h(x) = \dfrac{e^{2x}}{x^2 + 9}$

49. $\dfrac{d}{dx}\dfrac{\ln(1 + x^2)}{3x}$

50. $\dfrac{d}{dx}[x\ln(1 + e^x)]$

51. $F'(t)$ if $F(t) = (e^{t^2+1})^3$

52. $G'(t)$ if $G(t) = (1 - e^{2t})^2$

53. y' if $y = \ln(x^2 + 3)^{3/2}$

54. y' if $y = [\ln(x^2 + 3)]^{3/2}$

55. $\dfrac{d}{dw}\dfrac{1}{(w^3 + 4)^5}$

56. $\dfrac{d}{dw}\dfrac{1}{(w^2 - 2)^6}$

3.5 Implicit Differentiation

B *In Problems 17–34, use implicit differentiation to find y' and evaluate y' at the indicated point.*

17. $y - 5x^2 + 3 = 0; (1, 2)$

18. $5x^3 - y - 1 = 0; (1, 4)$

19. $x^2 - y^3 - 3 = 0; (2, 1)$

20. $y^2 + x^3 + 4 = 0; (-2, 2)$

21. $y^2 + 2y + 3x = 0; (-1, 1)$

22. $y^2 - y - 4x = 0; (0, 1)$

23. $xy - 6 = 0; (2, 3)$

24. $3xy - 2x - 2 = 0; (2, 1)$

25. $2xy + y + 2 = 0; (-1, 2)$

26. $2y + xy - 1 = 0; (-1, 1)$

27. $x^2y - 3x^2 - 4 = 0; (2, 4)$

28. $2x^3y - x^3 + 5 = 0; (-1, 3)$

29. $e^y = x^2 + y^2; (1, 0)$

30. $x^2 - y = 4e^y; (2, 0)$

31. $x^3 - y = \ln y; (1, 1)$

32. $\ln y = 2y^2 - x; (2, 1)$

33. $x \ln y + 2y = 2x^3; (1, 1)$

34. $xe^y - y = x^2 - 2; (2, 0)$

3.6 Related Rates

No extra problems – you only need to study Examples 1 and 2 in the notes. See extra credit assignment on MyLab Math if you would like to attempt other problems.

4.1 (beginning only) First Derivative and Graphs

In Problems 33–48, find the intervals on which $f(x)$ is increasing, the intervals on which $f(x)$ is decreasing, ~~and the local extrema.~~

33. $f(x) = 3x^2 - 12x + 2$

34. $f(x) = 5x^2 - 10x - 3$

35. $f(x) = -2x^2 - 16x - 25$

36. $f(x) = -3x^2 + 12x - 5$

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

38. $f(x) = -x^3 - 2x - 5$

39. $f(x) = x^3 - 3x + 5$

40. $f(x) = -x^3 + 3x + 7$

41. $f(x) = -3x^3 - 9x^2 + 72x + 20$

42. $f(x) = 3x^3 + 9x^2 - 720x - 15$

43. $f(x) = x^4 + 4x^3 + 30$

44. $f(x) = x^4 - 8x^3 + 32$

45. $f(x) = (x + 3)e^x$

46. $f(x) = (x + 2)e^x$

47. $f(x) = (x^2 - 4)^{2/3}$

48. $f(x) = (x^2 - 4)^{1/3}$

Miscellaneous

In Problems 61–66, find $f'(x)$ and find the equation of the line tangent to the graph of f at $x = 2$.

61. $f(x) = (1 + 3x)(5 - 2x)$

62. $f(x) = (7 - 3x)(1 + 2x)$

63. $f(x) = \dfrac{x - 8}{3x - 4}$

64. $f(x) = \dfrac{2x - 5}{2x - 3}$

65. $f(x) = \dfrac{x}{2^x}$

66. $f(x) = (x - 2)\ln x$

In Problems 67–70, find $f'(x)$ and find the value(s) of x where $f'(x) = 0$.

67. $f(x) = (2x - 15)(x^2 + 18)$

68. $f(x) = (2x - 3)(x^2 - 6)$

69. $f(x) = \dfrac{x}{x^2 + 1}$

70. $f(x) = \dfrac{x}{x^2 + 9}$

In Problems 35–40, find $f'(x)$ and the equation of the line tangent to the graph of f at the indicated value of x. Find the value(s) of x where the tangent line is horizontal.

35. $f(x) = (2x - 1)^3$; $x = 1$

36. $f(x) = (3x - 1)^4$; $x = 1$

37. $f(x) = (4x - 3)^{1/2}$; $x = 3$

38. $f(x) = (2x + 8)^{1/2}$; $x = 4$

39. $f(x) = 5e^{x^2-4x+1}$; $x = 0$

40. $f(x) = \ln(1 - x^2 + 2x^4)$; $x = 1$

C *In Problems 57–62, find $f'(x)$ and find the equation of the line tangent to the graph of f at the indicated value of x.*

57. $f(x) = x(4 - x)^3$; $x = 2$

58. $f(x) = x^2(1 - x)^4$; $x = 2$

59. $f(x) = \dfrac{x}{(2x - 5)^3}$; $x = 3$

60. $f(x) = \dfrac{x^4}{(3x - 8)^2}$; $x = 4$

61. $f(x) = \sqrt{\ln x}$; $x = e$

62. $f(x) = e^{\sqrt{x}}$; $x = 1$

In Problems 63–68, find $f'(x)$ and find the value(s) of x where the tangent line is horizontal.

63. $f(x) = x^2(x - 5)^3$

64. $f(x) = x^3(x - 7)^4$

65. $f(x) = \dfrac{x}{(2x + 5)^2}$

66. $f(x) = \dfrac{x - 1}{(x - 3)^3}$

67. $f(x) = \sqrt{x^2 - 8x + 20}$

68. $f(x) = \sqrt{x^2 + 4x + 5}$

In Problems 45–52, find y' and the slope of the tangent line to the graph of each equation at the indicated point.

45. $(1 + y)^3 + y = x + 7$; $(2, 1)$

46. $(y - 3)^4 - x = y$; $(-3, 4)$

47. $(x - 2y)^3 = 2y^2 - 3$; $(1, 1)$

48. $(2x - y)^4 - y^3 = 8$; $(-1, -2)$

49. $\sqrt{7 + y^2} - x^3 + 4 = 0$; $(2, 3)$

50. $6\sqrt{y^3 + 1} - 2x^{3/2} - 2 = 0$; $(4, 2)$

51. $\ln(xy) = y^2 - 1$; $(1, 1)$

52. $e^{xy} - 2x = y + 1$; $(0, 0)$