

201-SH2-AB - Exercises #11 - Mixed Derivatives

Find dy/dx for each of the following. Use implicit or logarithmic differentiation where appropriate.

1. $x^2y^3 = \sin(2y)$
2. $y = \ln \left(\frac{\cos^3 x (3x^2 - 8)^7}{\sqrt{x}(2x - 1)^{11}} \right)$
3. $y = \cot(xe^x)$
4. $xe^y = y \sin x$
5. $y = \pi x^4 - \frac{2}{x} + \sqrt[3]{x^2} + \log_5(\sin x) + \ln 26$
6. $y = (2^{3x+1} + 4x)(\log_2(4x + 1) - 6)$
7. $y = \sqrt{\cos(3x^2 + 1)} + x$
8. $y = (x^4 - 5)^{\tan x}$
9. $y = 6(xe^x + 1)^3 + x^2$
10. $y = \sin(\ln(x^2 + x) - 7x)$
11. $y = e^{x^4-x} - \sqrt{x} + \frac{2}{x^3} - x^{\ln 3} + \log_3(5x^4 - 2x)$
12. $y = 5^{3x} \csc^4(3x^4)$
13. $y = \sqrt[3]{(x^3 - e^{x^4})^7}$
14. $y = \sec \sqrt{x^4 - 7x}$
15. $y = \sqrt[5]{2x^3 - 9 \cos(x^2)}$
16. $y = \ln \left(\frac{x^5(3x - 4)^3}{\sqrt[5]{7x - 3} \cot^3 x} \right)$
17. $\frac{x}{y} = \ln y - x^2y$
18. $y = (\sin x)^{\ln x}$
19. $y = 3(2x + 5)^2(3x - e^{2x})^6$
20. $(x + 4y)^3 = 1 - 2xy$
21. $y = (x^2 - 6)^3(1 - 9x)^4$
22. $y = \frac{8x^4}{1 + \tan x}$
23. $y = (x^2 + 5x)^{x^3-7x}$
24. $y = \frac{(9x^2 - 4)^7 \sqrt{3x^4 - 7}}{e^x \ln x^5}$
25. $y = (x^7 - 3x)^{\ln x}$
26. $y = \left(\frac{x^5 - 7x^2}{3x^4 + 9} \right)^6$
27. $y = 3^{x^3-1} \cos(3x^3)$
28. $y = \frac{1 - \tan(2x)}{1 + \ln x}$
29. $y = \frac{(x + 1)^4 \ln x}{e^{3x} \cos^2(5x)}$
30. $y = \frac{2}{x^3} - \sqrt[5]{x^2} + \log_3(\cot x) + 6^{2x} - e^2$
31. $y = \ln \left(\frac{(2x + 4)^3 e^{4x}}{\cot^5 x} \right)$
32. $y = 2x^3 e^{4x} + \tan(5x)$
33. $5y - 3x^4 y^3 + 6x^4 - 4y = 3 + 5x^6 y^3$
34. $y = e^2 x^4 - \sqrt[4]{x} + \frac{2}{\sqrt{x}} + e^{x^3}$
35. $y = (x^2 - 3x^7)^{5x}$
36. $y = \frac{5^{3x}}{\cos(2x)}$
37. $(x + 3y)^2 = x^2 + e^{2y}$
38. $y = \ln \left[\sin \left(e^{\sqrt{x}} \right) \right]$
39. $e^{x+y^2} = y \ln y - x^2y$
40. $y = \tan^4 \left(x^2 + e^{x^2} \right) + 1$
41. $y = 5xe^{2x} + \sqrt{\tan x}$
42. $y = \frac{6e^x \sqrt[5]{x^3 + 6x^2}}{(2x - 9)^6 \ln x}$
43. $y = \tan^3(e^x - x^e)$
44. $y = \frac{\log_2 x^3}{\sqrt{x} + 8 \sin x}$
45. $y = (\ln x + e^{3x})^{\sin x}$
46. $y = \frac{(2x + 5)^3 e^{5x}}{7 \tan^2 x}$
47. $y = \log_2 \sqrt{x} + 4\sqrt[3]{x^5} - 4 \cot(2x - 3)$
48. $y = \frac{\cot(3x + 1) + 4x^3}{8x^4 - 4x^8}$
49. $y = (4x^{-5} - 6x^{-3}) \left(\frac{x^4}{3} - x \right)$
50. $y = \frac{5x^2}{3} + \log_5 x - \sec(2x) + \frac{2}{\sqrt[7]{x}} + \pi^{512+e}$
51. $\cos(y - 3x) = x^2y - 2x$
52. $y = e^{x+\tan x}$
53. $y = e^{x^2-4x} + x^\pi - \frac{3}{x^5} + 4\sqrt[5]{x^7}$
54. $xy^3 + xy = 14$
55. $y = \frac{2^{x^2} - x}{\sec x}$
56. $y = \frac{4^{2x-1}}{\cot x - 3e^x}$
57. $y = \log_4(8x^3 - 6x) + 6^{4x^2-3x+1} + e^x \tan(3x^4)$
58. $y = \ln \left[\frac{(5x^3 - 7x)^3 \sqrt{x^4 - 3x}}{(x^2 - 6x^5)^2} \right]$
59. $y = 2x\sqrt{x+1}$
60. $y = (\cos x)^{x^2}$
61. $y = \sec(4x^3 + 5) + x \sin^3 x$
62. $\frac{-4x^2}{y} = x \ln y - y$
63. $y = 3(\sin x + 4x)^x$

$$\begin{array}{lll}
64. y = \ln \left(\frac{e^{5x} \sqrt{x-5}}{(3x+1) \sec x} \right)^2 & 65. y = x^{\cos(3x)} & 66. y = 2x^{x^2+1} \\
67. y = (x^3 - 4x)^{\sec(6x)} & 68. y = \sqrt{\sec(x^2 - \ln x)} & \\
69. y = \pi^3 + 3^{\pi x} - x^3 + \log_3 \pi - (\ln 3)x - \frac{3}{\pi x} & & \\
70. y = (1 + \sqrt{x})^{3x} & 71. y = x^{\sin x} (3x+2)^7 & 72. y = \frac{e^{9x} + 1}{\ln(6x^3 - 3x^5) - 3} \\
73. x^2 y^3 + 3xy^5 - 4x + 3y^2 = 7 + 7x^2 - 4y & & \\
74. y = \frac{3x + \cos x}{1 - \ln x} & 75. y = \frac{\sqrt{x^5} - 2x + \frac{2}{3x^4}}{3 - \csc(e^x)} & 76. y = \ln [(2x^2 - 1)^3 e^{2x}] \\
77. y = 8x^3 - \frac{4}{x} + \frac{5}{\sqrt{3x}} + 4\pi^2 & 78. y = (e^{7x} + \sin^4 x)^5 & 79. y = \frac{\tan x + 1}{\sec 2x} \\
80. y = \sqrt{\log_2(3x^2 + 1) + 3x^2} & 81. y = \frac{-2}{x^3} + 2\sqrt[3]{x^4} + \pi^x + e^{\pi^2} & 82. y = \ln \left[\frac{(x^4 - 6x)^3 (7x - 1)^2}{\cot^3 x} \right] \\
83. y = \frac{\sqrt{3x+2}}{x-7^x} & 84. y = 3(\cos(2x))^{x^2+2} & 85. y = \ln \left[\frac{(x^2 + 1)^4}{x^x \sqrt[3]{\tan x + 4}} \right] \\
86. y = \cos^2(\sec(1-x)) & 87. y = \sin^2(x^3 - 7^x) & 88. y = 3^x + \sqrt[5]{x^3} + \csc x - 5 \log_3 x + e^2 \\
89. y = \sec^3(\cos(1-x)) & & \\
90. y = (3x^4 - 2)^{x^3+1} & 91. y = \frac{e^x (3x-2)^4}{\ln x \sin^2(5-x)} & 92. y = x^2 \sec(\log_5 x) \\
93. y = \frac{3}{2x^6} - \sqrt[3]{x^4} + \log_8 x + \pi & 94. y = \frac{(x^3 e^{3x \sin x})^4}{\ln(2x)} & 95. (x-y)^2 + 4x - 5y - 1 = 0 \\
96. y = (5x + \sqrt{x})^{x^3+1} & 97. y = \frac{2^{5x-7}}{3x + \cot(2x)} & 98. y = \ln \left(\frac{\sqrt{x} \tan^8 x}{(x^2 + 4)^{10}} \right) \\
99. y = 2(7 - e^{2x^3})^5 (5 - 6x^4)^3 & 100. y = 3^{2x+1} + \log_7(x^2 - 7) + \sqrt[5]{x^3} - e^3 & \\
101. y = \frac{3x^3 - 3}{\sqrt[3]{x} + x} & & \\
102. y = \sqrt[6]{x^7} - \frac{6}{x^7} + \ln 5 - \sqrt{5}x + e^x - x^e & & \\
103. (x^3 + y^2 + 7)^4 = 4x + 3y + 9 & 104. x^2 y^2 + y \ln x = 4x & 105. y = 3(e^{2x} - 1)^5 (2 - 9x)^4 \\
106. y = (3x + \sqrt{x})^{x^3-2x} & 107. y = \log_3(x^2 - 7x) + \sqrt[5]{x^2} + \frac{1}{(6x^3 - 8)^2} & \\
108. y = (4x^5 + 3x)^3 (3x^2 - 1)^5 & 109. y = \frac{1 + \sin x}{x + \cos x} & 110. \ln(xy) - y^2 = 5 \\
111. y = (\cos x + 4x)^{\sqrt{x}} & 112. y = \frac{\sin^2(4x)}{x^3 + 2x} & 113. y = \frac{3x - \cot(3x)}{1 + \csc(3x)} \\
114. y = \sqrt[3]{x} - 3x^\pi - \sqrt{x^3} + 4e & 115. y = \sqrt[3]{\sec(2x^3 + 4) + 6} & 116. y = 7^{e^x} + \log_3(e^x) + \ln(x^3) + \sqrt[4]{x^3} \\
117. y = (7 - 5^{3x+1})^3 (\sec(x^3) - 7) & 118. y = (x^2 - \log_3 x + \pi^e)^{10} \sin^2 x & 119. y = \ln \left(\frac{3x^5 \cot^4 x}{(2x)^3 (3x^4 + 5)^8} \right) \\
120. y = \frac{4^x}{(3x^2 + 10x)^3} & 121. y = 2x^e + \frac{4}{\sqrt{x}} + \sqrt[3]{x^5} &
\end{array}$$

Answers:

1. $\frac{2xy^3}{2\cos(2y) - 3x^2y^2}$
2. $-3\tan x + \frac{42x}{3x^2 - 8} - \frac{1}{2x} - \frac{22}{2x - 1}$
3. $g'(x) = -\csc^2(xe^x)(e^x + xe^x)$
4. $\frac{y\cos x - e^y}{xe^y - \sin x}$
5. $4\pi x^3 + \frac{2}{x^2} + \frac{2}{3\sqrt[3]{x}} + \frac{\cos x}{(\ln 5)\sin x}$
6. $(3\ln 2 \cdot 2^{3x+1} + 4)(\log_2(4x+1) - 6) + \frac{4(2^{3x+1} + 4x)}{(4x+1)\ln 2}$
7. $\frac{1 - 6x\sin(3x^2 + 1)}{2\sqrt{\cos(3x^2 + 1) + x}}$
8. $(x^4 - 5)^{\tan x} \left(\sec^2 x \ln(x^4 - 5) + \frac{4x^3 \tan x}{x^4 - 5} \right)$
9. $18(xe^x + 1)^2(e^x + xe^x) + 2x$
10. $\cos(\ln(x^2 + x) - 7x) \left[\frac{2x + 1}{x^2 + x} - 7 \right]$
11. $e^{x^4 - x}(4x^3 - 1) - \frac{1}{2\sqrt{x}} - \frac{6}{x^4} - \ln(3)x^{\ln(3)-1} + \frac{20x^3 - 2}{(5x^4 - 2x)\ln 3}$
12. $3\ln(5) \cdot 5^{3x} \csc^4(3x^4) - 48x^3 \cdot 5^{3x} \csc(3x^4) \cot(3x^4)$
13. $\frac{7}{3}(x^3 - e^{x^4})^{4/3}(3x^2 - 4x^3e^{x^4})$
14. $\frac{(4x^3 - 7)\sec\sqrt{x^4 - 7x}\tan\sqrt{x^4 - 7x}}{2\sqrt{x^4 - 7x}}$
15. $\frac{6x^2 + 18x\sin(x^2)}{5(2x^3 - 9\cos(x^2))^{4/5}}$
16. $\frac{5}{x} + \frac{9}{3x - 4} - \frac{7}{5(7x - 3)} + \frac{3\csc^2 x}{\cot x}$
17. $\frac{2xy^3 + y}{x + y - x^2y^2}$
18. $(\sin x)^{\ln x} \left[\frac{\ln(\sin x)}{x} + \ln x \cot x \right]$
19. $12(2x + 5)(3x - e^{2x})^6 + 18(2x + 5)^2(3x - e^{2x})^5(3 - 2e^{2x})$
20. $\frac{-2y - 3(x + 4y)^2}{12(x + 4y)^2 + 2x}$
21. $6x(x^2 - 6)^2(1 - 9x)^4 - 36(x^2 - 6)^3(1 - 9x)^3$
22. $\frac{32x^3(1 + \tan x) - 8x^4 \sec^2 x}{(1 + \tan x)^2}$
23. $(x^2 + 5x)^{x^3 - 7x} \left[(3x^2 - 7)\ln(x^2 + 5x) + (x^3 - 7x) \left(\frac{2x + 5}{x^2 + 5x} \right) \right]$
24. $\frac{(9x^2 - 4)^7 \sqrt{3x^4 - 7}}{e^x \ln x^5} \left[\frac{126x}{9x^2 - 4} + \frac{6x^3}{3x^4 - 7} - 1 - \frac{1}{x \ln x} \right]$
25. $(x^7 - 3x)^{\ln x} \left[\frac{(7x^6 - 3)\ln x}{x^7 - 3x} + \frac{\ln(x^7 - 3x)}{x} \right]$
26. $6 \left(\frac{x^5 - 7x^2}{3x^4 + 9} \right)^5 \left[\frac{(5x^4 - 14x)(3x^4 + 9) - 12x^3(x^5 - 7x^2)}{(3x^4 + 9)^2} \right]$
27. $-9x^2 \cdot 3^{x^3 - 1} \sin(3x^3) + 3^{x^3 - 1} \ln 3 \cdot 3x^2 \cos(3x^3)$
28. $\frac{-2(1 + \ln x)\sec^2(2x) - \frac{1 - \tan 2x}{x}}{(1 + \ln x)^2}$
29. $\frac{(x + 1)^4 \ln x}{e^{3x} \cos^2(5x)} \left[\frac{4}{x + 1} + \frac{1}{x \ln x} - 3 + 10 \tan(5x) \right]$
30. $-\frac{6}{x^4} - \frac{2}{5x^{3/5}} - \pi - \frac{\csc^2 x}{\cot x (\ln 3)} + 2(\ln 6)6^{2x}$
31. $\frac{3}{x + 2} + 4 + \frac{5\csc^2 x}{\cot x}$
32. $6x^2e^{4x} + 8x^3e^{4x} + 5\sec^2(5x)$
33. $\frac{30x^5y^3 + 12x^3y^3 - 24x^3}{1 - 15x^6y^2 - 9x^4y^2}$
34. $4e^2x^3 - \frac{1}{4x^{3/4}} - x^{-3/2} + 3x^2e^{x^3}$
35. $(x^2 - 3x^7)^{5x} \left[5\ln(x^2 - 3x^7) + \frac{5x(2x - 21x^6)}{x^2 - 3x^7} \right]$
36. $\frac{3\ln(5) \cdot 5^{3x} \cos(2x) + 2 \cdot 5^{3x} \sin(2x)}{\cos^2(2x)}$
37. $\frac{2x - 2(x + 3y)}{6(x + 3y) - 2e^{2y}} = \frac{-3y}{3x + 9y - e^{2y}}$
38. $\frac{\cos e^{\sqrt{x}} e^{\sqrt{x}}}{2\sqrt{x} \sin e^{\sqrt{x}}}$
39. $\frac{e^{x+y^3} + 2xy}{\ln y + 1 - x^2 - 3y^2e^{x+y^3}}$
40. $4\tan^3 \left(x^2 + e^{x^2} \right) \sec^2 \left(x^2 + e^{x^2} \right) \left(2x + 2xe^{x^2} \right)$
41. $5e^{2x} + 10xe^{2x} + \frac{\sec^2 x}{2\sqrt{\tan x}}$
42. $\frac{6e^x \sqrt[5]{x^3 + 6x^2}}{(2x - 9)^6 \ln x} \left[1 + \frac{3x^2 + 12x}{5(x^3 + 6x^2)} - \frac{12}{2x - 9} - \frac{1}{x \ln x} \right]$
43. $3\tan^2(e^x - x^e) \sec^2(e^x - x^e)(e^x - ex^{e-1})$
44. $\frac{6\sqrt{x}(\sqrt{x} + 8\sin x) - x \ln 2(\log_2 x^3)(1 + 16\sqrt{x} \cos x)}{2(\ln 2)x^{3/2}(\sqrt{x} + 8\sin x)^2}$
45. $(\ln x + e^{3x})^{\sin x} \left[\cos x \ln(\ln x + e^{3x}) + \frac{\sin x}{\ln x + e^{3x}} \left(\frac{1}{x} + 3e^{3x} \right) \right]$
46. $\frac{(2x + 5)e^{5x}}{7\tan^2 x} \left[\frac{6}{2x + 5} + 5 - \frac{2\sec^2 x}{\tan x} \right]$
47. $\frac{1}{2x \ln 2} + \frac{12}{5}x^{2/3} - 4\csc^2(2x - 3)$

48. $\frac{(12x^2 - 3 \csc^2(3x + 1))(8x^4 - 4x^8) - (\cot(3x + 1) + 4x^3)(32x^3 - 32x^7)}{(8x^4 - 4x^8)^2}$
49. $(-20x^{-6} + 18x^{-4}) \left(\frac{x^4}{3} - x \right) + (4x^{-5} - 6x^{-3}) \left(\frac{4x^3}{3} - 1 \right)$
50. $\frac{10}{3}x + \frac{1}{x \ln 5} - 2 \sec(2x) \tan(2x) - \frac{2}{7x^{8/7}}$
51. $\frac{3 \sin(y - 3x) - 2xy + 2}{\sin(y - 3x) + x^2}$
52. $e^{x + \tan x} (1 + \sec^2 x)$
53. $(2x - 4)e^{x^2 - 4x} + \pi x^{\pi - 1} + \frac{15}{x^6} + \frac{28}{5}x^{2/5}$
54. $\frac{-y - y^3}{3xy^2 + x}$
55. $\frac{(2x \cdot 2^{x^2} (\ln 2) - 1) \sec x - \sec x \tan x (2^{x^2} - x)}{\sec^2 x}$
56. $\frac{2 \cdot 4^{2x-1} (\ln 4) (\cot x - 3e^x) + 4^{2x-1} (\csc^2 x + 3e^x)}{(\cot x - 3e^x)^2}$
57. $\frac{24x^2 - 6}{\ln 4(8x^3 - 6x)} + 6^{4x^2 - 3x + 1} (\ln 6)(8x - 3) + e^x \tan(3x^4)$
58. $\frac{3(15x^2 - 7)}{5x^3 - 7x} + \frac{4x^3 - 3}{2(x^4 - 3x)} - \frac{2(2x - 30x^4)}{x^2 - 6x^5}$
59. $2\sqrt{x+1} + \frac{x}{\sqrt{x+1}}$
60. $(\cos x)^{x^2} \left[2x \ln(\cos x) - \frac{x^2 \sin x}{\cos x} \right]$
61. $12x^2 \sec(4x^3 + 5) \tan(4x^3 + 5) + \sin^3 x + 3x \sin^2 x \cos x$
62. $\frac{y^2 \ln y + 8xy}{4x^2 - xy + y^2}$
63. $3(\sin x + 4x)^x \left(\ln(\sin x + 4x) + \frac{x \cos x + 4x}{\sin x + 4x} \right)$
64. $2 \left(\frac{1}{2(x-5)} + 5 - \frac{3}{3x+1} - \tan x \right)$
65. $x^{\cos(3x)} \left[\frac{\cos(3x)}{x} - 3 \sin(3x) \ln x \right]$
66. $2x^{x^2+1} \left(2x \ln x + \frac{x^2 + 1}{x} \right)$
67. $(x^3 - 4x)^{\sec(6x)} \left[6 \sec(6x) \tan(6x) \ln(x^3 - 4x) + \frac{(3x^2 - 4) \sec(6x)}{x^3 - 4x} \right]$
68. $\frac{\sec(x^2 - \ln x) \tan(x^2 - \ln x) (2x - \frac{1}{x})}{2\sqrt{\sec(x^2 - \ln x)}}$
69. $(\pi \ln 3) 3^{\pi x} - 3x^2 - \ln 3 + \frac{3}{\pi x^2}$
70. $(1 + \sqrt{x})^{3x} \left[3 \ln(1 + \sqrt{x}) + \frac{3x}{2\sqrt{x(1 + \sqrt{x})}} \right]$
71. $x^{\sin x} (3x + 1)^7 [\cos(\ln x) + \frac{\sin x}{x} + \frac{21}{3x+2}]$
72. $\frac{(9e^{9x})[\ln(6x^3 - 3x^5) - 3] - (e^{9x} + 1) \left(\frac{18x^2 - 15x^4}{6x^3 - 3x^5} \right)}{[\ln(6x^3 - 3x^5) - 3]^2}$
73. $\frac{14x + 4 - 3y^5 - 2xy^3}{3x^2y^2 + 15xy^4 + 6y + 4}$
74. $\frac{(3 - \sin x)(1 - \ln x) + \frac{3x + \cos x}{x}}{(1 - \ln x)^2}$
75. $\frac{(\frac{5}{2}x^{3/2} - 2 - \frac{8}{3x^5})(3 - \csc e^x) - (x^{5/2} - 2x + \frac{2}{3x^4}) \csc(e^x) \cot(e^x) e^x}{(3 - \csc(e^x))^2}$
76. $\frac{12x}{2x^2 - 1} + 2$
77. $24x^2 + \frac{4}{x^2} - \frac{5}{2\sqrt{3x^3}}$
78. $5(e^{7x} + \sin^4 x)^4 [7e^{7x} + 4 \sin^3 x \cos x]$
79. $\frac{\sec^2 x \sec 2x - 2(\tan x + 1) \sec 2x \tan 2x}{\sec^2 2x}$
80. $\frac{\frac{6x}{(3x^2+1) \ln 2} + 6x}{2\sqrt{\log_2(3x^2 + 1) + 3x^2}}$
81. $6x^{-4} + \frac{8}{3}x^{1/3} + \pi^x \ln \pi$
82. $y = \frac{3(4x^3 - 6)}{x^4 - 6x} + \frac{14}{7x - 1} + \frac{3 \csc^2 x}{\cot x}$
83. $\frac{\frac{3}{2}(3x+2)^{-1/2}(x-7^x) - (1-7^x \ln 7)\sqrt{3x+2}}{(x-7^x)^2}$
84. $3(\cos(2x))^{x^2+2} [2x \ln(\cos(2x)) - 2(x^2 + 2) \tan(2x)]$
85. $\frac{8x}{x^2 + 1} - \ln x - 1 - \frac{\sec^2 x}{3(\tan x + 4)}$
86. $2 \cos(\sec(1-x)) \sin(\sec(1-x) \sec(1-x) \tan(1-x))$
87. $f'(x) = 2 \sin(x^3 - 7^x) \cos(x^3 - 7^x) (3x^2 - 7^x \ln 7)$
88. $3^x \ln 3 + \frac{3}{5x^{2/5} - \csc x \cot x - \frac{5}{x \ln 3}}$
89. $3 \sec^2(\cos(1-x)) \sec(\cos(1-x)) \tan(\cos(1-x)) \sin(1-x)$
90. $(3x^4 - 2)^{x^3+1} \left[3x^2 \ln(3x^4 - 2) + \frac{12x^3(x^3 + 1)}{3x^4 - 2} \right]$
91. $\frac{e^x(3x-2)^4}{\ln x \sin^2(5-x)} \left[n1 + \frac{12}{3x-2} - \frac{1}{x \ln x} + 2 \cot(5-x) \right]$

92. $2x \sec(\log_5 x) + \frac{x}{\ln 5} \sec(\log_5 x) \tan(\log_5 x)$
94. $\frac{(x^3 e^{3x} \sin x)^4}{\ln(2x)} \left[\frac{12}{x} + 12 + 4 \cot x - \frac{1}{x \ln(2x)} \right]$
96. $(5x + \sqrt{x})^{x^3+1} \left[3x^2 \ln(5x + \sqrt{x}) + \frac{(x^3+1) \left(5 + \frac{1}{2\sqrt{x}} \right)}{5x + \sqrt{x}} \right]$
98. $\frac{1}{2x} + \frac{8 \sec^2 x}{\tan x} - \frac{20x}{x^2 + 4}$
100. $2 \ln 3 \cdot 3^{2x+1} + \frac{2x}{(x^2-7) \ln 7} + \frac{3}{5x^{2/5}}$
102. $\frac{7}{6} x^{1/6} + 42x^{-8} - \sqrt{5} + e^x - ex^{e-1}$
104. $\frac{4x - 2x^2 y^2 - y}{2x^3 t + x \ln x}$
106. $(3x + \sqrt{x})^{x^3-2x} \left[(3x^2 - 2) \ln(3x + \sqrt{x}) + \frac{(x^3 - 2x) \left(3 + \frac{1}{2\sqrt{x}} \right)}{3x + \sqrt{x}} \right]$
107. $\frac{2x-7}{(x^2-7x) \ln 3} + \frac{2}{5x^{3/5}} - \frac{36x^2}{(6x^3-8)^3}$
109. $\frac{\cos x(x + \cos x) - (1 - \sin x)(1 + \sin x)}{(x + \cos x)^2}$
111. $(\cos x + 4x)^{\sqrt{x}} \left(\frac{1}{2\sqrt{x}} \ln(\cos x + 4x) + \sqrt{x} \left(\frac{-\sin x + 4}{\cos x + 4x} \right) \right)$
113. $\frac{(3 + 3 \csc^2(3x))(1 + \csc(3x)) + (3x - \cot(3x))3 \csc(3x) \cot(3x)}{(1 + \csc(3x))^2}$
114. $\frac{1}{3x^{2/3}} - 3\pi x^{\pi-1} - \frac{3}{2} \sqrt{x}$
116. $7e^x \ln(7)e^x + \frac{1}{\ln 3} + \frac{3}{x} + \frac{3}{4x^{1/4}}$
117. $-9 \ln 5(7 - 5^{3x+1})^2(5^{3x+1})(\sec x^3 - 7) + (7 - 5^{3x+1})x^3 \sec x^3 \tan x^3(3x^2)$
118. $10(x^2 - \log_3 x + \pi^e)^9 \left(2x - \frac{1}{x \ln 3} \right) \sin^2 x + 2 \sin x \cos x(x^2 - \log_3 x + \pi^e)^{10}$
119. $\frac{2}{x} - \frac{4 \csc^2 x}{\cot x} - \frac{96x^3}{3x^4 + 5}$
121. $2ex^{e-1} - \frac{2}{x^{3/2}} + \frac{5}{3} x^{2/3}$
93. $y' = -9x^{-7} - \frac{4}{3} x^{1/3} + \frac{1}{x \ln 8}$
95. $\frac{2y - 2x - 4}{2y - 2x - 5}$
97. $\frac{2^{5x-7} \ln 2 \cdot 5(3x + \cot(2x)) - 2^{5x-7}(3 - 2 \csc^2(2x))}{(3x + \cot(2x))^2}$
99. $-60(7 - e^{2x^3})^4 x^2 e^{2x^3} (5 - 6x^4)^3 - 144x^3(7 - e^{2x^3})^5(5 - 6x^4)^2$
101. $\frac{9x^2(\sqrt[3]{x} + x) - (3x^3 - 3)(\frac{1}{3}x^{-2/3} + 1)}{(\sqrt[3]{x} + x)^2}$
103. $\frac{4 - 12x^2(x^3 + y^2 + 7)^3}{8y(x^3 + y^2 + 7^3 - 3)}$
105. $30e^{2x}(e^{2x-1})^4(2-9x)^4 - 108(e^{2x-1})^5(2-9x)^3$
108. $3(4x^5 + 3x)^2(20x^4 + 3)(3x^2 - 1)^5 + 30x(4x^5 + 3x)^3(3x^2 - 1)^4$
110. $\frac{y}{2xy^2 - x}$
112. $\frac{8 \sin(4x) \cos(4x)(x^3 + 2x) - \sin^2(4x)(3x^2 + 2)}{(x^3 + 2x)^2}$
115. $\frac{1}{3} [\sec(2x^3 + 4) + 6]^{-2/3} \sec(2x^3 + 4) \tan(2x^3 + 4)(6x^2)$
120. $\frac{4^x [\ln 4(3x^2 + 10x) - 18x - 30]}{(3x^2 + 10x)^4}$