The Weekly Rigor

No. 168 "A mathematician is a machine for turning coffee into theorems." September 9, 2017

101 Problems in Calculating Derivatives Using the Chain Rule with Solutions

(Part 4)

52. $f'(x) = \frac{1}{(1+x^2)\arctan(x)}$

53. $f'(x) = \frac{1}{\sqrt{1-x^2}\arcsin(x)}$

54. $f'(x) = \frac{6(\ln(2x)+\ln(x))^2}{x}$

55. $f'(x) = -2\left(\ln^2(x^5) - \ln(x)\right)^{-3}\left(\frac{10\ln(x^5)+1}{x}\right)$

56. $f'(x) = 3\cos(3x)$

57. $f'(x) = -\frac{1}{2}\sin\left(\frac{1}{2}x\right)$

58. $f'(x) = 3\sec^2(3x)$

59. $f'(x) = 2x\cos(x^2)$

60. $f'(x) = -\frac{3}{4}x^{\frac{-1}{4}}\sin\left(x^{\frac{3}{4}}\right)$

61. $f'(x) = 5x^4\sec^2(x^5)$

62. $f'(x) = 2\sin(x)\cos(x)$

63. $f'(x) = -3\cos^2(x)\sin(x)$

64. $f'(x) = 4\tan^3(x)\sec^2(x)$

65. $f'(x) = 10x\sin^4(x^2)\cos(x^2)$

66. $f'(x) = -10x\cos^4(x^2)\sin(x^2)$

67. $f'(x) = 20x^4\tan^3(x^5)\sec^2(x^5)$

68. $f'(x) = e^x\cos(e^x)$

69. $f'(x) = e^{3x}\sec^2(e^{3x})$

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

71. $f'(x) = \frac{2\arctan(x)}{1+x^2}$

72. $f'(x) = \frac{6\arctan(x)}{1+9x^2}$

73. $f'(x) = \frac{3\arcsin^2(x)}{\sqrt{1-x^2}}$

74. $f'(x) = \frac{6x\arcsin^2(x^2)}{\sqrt{1-x^4}}$

75. $f'(x) = \frac{-e^x}{\sqrt{1-e^{2x}}}$

76. $f'(x) = \frac{\cos(\arctan(x))}{1+x^2}$

77. $f'(x) = \frac{\sec^2(\arcsin(x))}{\sqrt{1-x^2}}$

78. $f'(x) = \frac{\cos(x)}{1+\sin^2(x)}$

79. $f'(x) = \frac{\sec^2(x)}{\sqrt{1-\tan^2(x)}}$

80. $f'(x) = \frac{1}{\sqrt{1-\arccos^2(x)}}\left(\frac{-1}{\sqrt{1-x^2}}\right)$

81. $f'(x) = \frac{1}{1+\arcsin^2(x)}\left(\frac{1}{\sqrt{1-x^2}}\right)$

82. $f'(x) = \cot(x)$

83. $f'(x) = \frac{1}{2\sqrt{x}(1+\sqrt{x})}$

84. $f'(x) = \sec^2(\sin(x))\cos(x)$

85. $f'(x) = 9x^2(x^3+1)^2(5+x^2)^4 + 8x(x^3+1)^3(5+x^2)^3$

86. $f'(x) = 8x(x^2+3)^3(x^2+2)^{\frac{3}{2}} + 3x(x^2+3)^4(x^2+2)^{\frac{1}{2}}$

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

88. $f'(x) = \frac{3}{2}x^2(x^3+1)^{-\frac{1}{2}}(x^2+1)^4 + 8x(x^3+1)^{\frac{1}{2}}(x^2+1)^3$

89. $f'(x) = 2\cos(2x)\cos(3x) - 3\sin(2x)\sin(3x)$

90. $f'(x) = e^{2x}\tan^2(x)\left[2\tan(x) + 3\sec^2(x)\right]$

91. $f'(x) = \frac{8x(x^2+3)^3(x^2+2)^{\frac{3}{2}}+3x(x^2+2)^{\frac{1}{2}}(x^2+3)^4}{(x^2+2)^3}$

92. $f'(x) = \frac{2e^{2x}\sin(3x)+3\cos(3x)e^{2x}}{\sin^2(3x)}$

93. $f'(x) = \frac{\frac{\arctan(3x)}{x} - \frac{3\ln(4x)}{1+9x^2}}{\arctan^2(3x)}$

94. $f'(x) = -4\sin(4x)e^{\cos(4x)}$

95. $f'(x) = \frac{e^{\tan(\ln(3x))}\sec^2(\ln(3x))}{x}$

96. $f'(x) = -6\sin(2x)\cos(\cos(2x))\sin^2(\cos(2x))$

97. $f'(x) = 12\cos(3x)\tan^3\left(\ln\left(e^{\sin(3x)}\right)\right)\sec^2\left(\ln\left(e^{\sin(3x)}\right)\right)$

98. $f'(x) = -8xe^{\sin(x^2)}\cos(x^2)\tan\left(e^{\sin(x^2)}\right)\ln^3\left(\cos\left(e^{\sin(x^2)}\right)\right)$

99. $f'(x) = \frac{-20\sin(\ln(5x))\arctan^3(\cos(\ln(5x)))}{x(1+\cos^2(\ln(5x)))}$

100. $f'(x) = \\ 24x^3\cos\left(\sin^2\left(\sin^3(x^4)\right)\right)\left(\sin\left(\sin^3(x^4)\right)\right)\left(\cos\left(\sin^3(x^4)\right)\right)\left(\sin^2(x^4)\right)\left(\cos(x^4)\right)$

101. $f'(x) = \frac{\cos\left(\ln\left(e^{\sqrt{x}}\right)\right)}{2\sqrt{x}\left(1+\sin^2\left(\ln\left(e^{\sqrt{x}}\right)\right)\right)}$