## MA 171: Calculus I

## FUNCTIONS FOR THE GATEWAY EXAM

**Instructions:**

- The list below includes 150 functions (five sets of 30).
- A "Gateway Exam" consists of ten randomly selected functions (two from each set of 30) and you are asked to find their derivatives.
- Only complete and mistake free answers will count.
- You are not allowed to use calculators, books, or notebooks during the test.

1. $f(x) = x^3 - 3x^2 + 5x - 7$
2. $f(x) = x^{-1} + 2x^{-2} + 3x^{-3}$
3. $f(x) = 6x^{2/3} - 8x^{-3/2} + 10$
4. $f(x) = \dfrac{1}{x} - \dfrac{2}{x^2} + \dfrac{3}{x^3}$
5. $f(x) = 4\sqrt{x} + \dfrac{1}{\sqrt{x}}$
6. $f(x) = 5x^{10} - 10\sqrt[5]{x}$
7. $f(x) = \dfrac{1}{2x} - \dfrac{1}{3x^2} + \dfrac{1}{4x^3}$
8. $f(x) = 5x^{1/5} - 4x^{1/4} + 3x^{1/3}$
9. $f(x) = 3x - 1 + \dfrac{1}{3x}$
10. $f(x) = -x^{4/5} + x^{-4/5}$
11. $f(x) = 3e^x - e^3$
12. $f(x) = 2e^x + 3^x + 4$
13. $f(x) = 2 \cdot 3^x + 4 \cdot 5^x - 6x^2$
14. $f(x) = 3\ln x - x^2 \ln 3$
15. $f(x) = 4\sqrt{x} + \dfrac{1}{4}\ln x$
16. $f(x) = x^2 + 2\ln x$
17. $f(x) = 2e^x - 3\ln x$
18. $f(x) = 2\ln x - 3 \cdot 4^x$
19. $f(x) = (\ln 2)x^3 + 2^3 \ln x$
20. $f(x) = e^x \ln 3 + \dfrac{3^x}{\ln 3}$
21. $f(x) = 2\sin x - 3\cos x + \tan x$
22. $f(x) = x^4 - 4\tan x$
23. $f(x) = e^x + \sin x - \cos x - x^e$
24. $f(x) = \left(\sin\dfrac{\pi}{6} + \cos\dfrac{\pi}{4}\right) - \dfrac{\pi}{6}\sin x + \dfrac{\pi}{4}\cos x$
25. $f(x) = e^\pi(\sin x + \cos x) + (\sin\pi + \cos\pi)e^x$
26. $f(x) = 2\tan x + 3\ln x - 4\cos x$
27. $f(x) = 3\cos x - 4\arcsin x + 5$
28. $f(x) = \tan x + \arctan x$
29. $f(x) = \left(\sin\dfrac{\pi}{3}\right)\cos x - \left(\cos\dfrac{\pi}{3}\right)\arcsin x$
30. $f(x) = \left(\tan\dfrac{\pi}{4}\right)\arctan x - \dfrac{\pi}{4}\tan x$

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

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

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

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

35. $f(x) = (4\sqrt{x} + 3)(x^3 - 4x)$

36. $f(x) = (x^2 - 3)(x^4 + 3x^2 + 9)$

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

38. $f(x) = (e^x + x)(\ln x - x)$

39. $f(x) = (x^2 + 2^x)(x - \ln x)$

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

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

42. $f(x) = (2e^x + 1)(3x^2 + 2)(4x^3 - 5)$

43. $f(x) = (2x+1)(3e^x + 2)(4\ln x + 3)$

44. $f(x) = (2x^2 - 1)(4\sqrt{x} - 3)(6\sqrt[3]{x} - 5)$

45. $f(x) = 2^x(x^5 - 2)(5\ln x + 2)$

46. $f(x) = (2\sin x + cosx)(2\cos x - \sin x)$

47. $f(x) = (x^2 + 1)(\sin x - 3\cos x)$

48. $f(x) = e^x(3\sin x - 5\cos x)$

49. $f(x) = (x + \sin x)(x - \cos x)$

50. $f(x) = (3e^x - 2\sin x)(5e^x + 4\cos x)$

51. $f(x) = (3x^2 + 1)(\arcsin x - 3)$

52. $f(x) = (x^2 + 1)\arctan x$

53. $f(x) = (\sin x + \cos x)(2\arcsin x + 3)$

54. $f(x) = e^x(\arctan x + \pi)$

55. $f(x) = (2\sin x - 3\tan x)(3\arctan x + 2\arcsin x)$

56. $f(x) = (2^x + 3\sin x)(3^x - 2\cos x)$

57. $f(x) = (\ln x + 1)\arctan x$

58. $f(x) = (2\sin x - 3\ln x)(3\arcsin x + 2e^x)$

59. $f(x) = (\tan x - 2e^x)(2\arctan x + \ln x)$

60. $f(x) = (3\sin x - \arcsin x)(3\tan x + \arctan x)$

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

62. $f(x) = \dfrac{x + 3}{x^3 + 1}$

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

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

65. $f(x) = \dfrac{8\sqrt{x}}{x + 8}$

66. $f(x) = \dfrac{e^x}{x}$

67. $f(x) = \dfrac{e^x - x^2}{e^x + x^2}$

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

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

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

71. $f(x) = \dfrac{\ln x}{3x}$

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

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

74. $f(x) = \dfrac{2e^x + 3}{4 \ln x + 5}$

75. $f(x) = \dfrac{5 \ln x + 4}{3e^x + 2}$

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

77. $f(x) = \dfrac{x^2 - \sin x}{x + \cos x}$

78. $f(x) = \dfrac{\sin x + \cos x}{\tan x + 1}$

79. $f(x) = \dfrac{\tan x - 1}{\sin x - \cos x}$

80. $f(x) = \dfrac{x - \cos x}{x + \sin x}$

81. $f(x) = \dfrac{2e^x - \sin x}{\cos x}$

82. $f(x) = \dfrac{e^x - 3 \cos x}{\sin x}$

83. $f(x) = \dfrac{3e^x + \tan x}{\sin x + \cos x}$

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

85. $f(x) = \dfrac{\sin x - 2 \ln x}{\cos x + x^2}$

86. $f(x) = \dfrac{2 \sin x + \arctan x}{3 \cos x - \arctan x}$

87. $f(x) = \dfrac{\ln x - \arcsin x}{e^x + \sin x}$

88. $f(x) = \dfrac{x^2 - \arcsin x}{x + \cos x}$

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

90. $f(x) = \dfrac{3 \tan x + 2 \arcsin x}{\arctan x - \sin x}$

91. $f(x) = (2x^5 - 6x^3 + 10x - 14)^{10}$

92. $f(x) = (3x^2 - 2x + 1)^{100}$

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

94. $f(x) = \sqrt[5]{x^5 + 1}$

95. $f(x) = (x^3 - 3x^2 + 5x - 7)^{5/3}$

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

97. $f(x) = e^{2\sqrt{x}+1}$

98. $f(x) = e^{\sin x - 2\cos x}$

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

100. $f(x) = e^{2\arcsin x - 3}$

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

102. $f(x) = 3^{\sin x - 2\cos x}$

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

104. $f(x) = 3^{x - 2\ln x}$

105. $f(x) = 4^{\sin x - e^x}$

106. $f(x) = \ln(x^4 + x^2 + 1)$

107. $f(x) = \ln(8\sqrt{x} + 1)$

108. $f(x) = \ln(e^x - x^2)$

109. $f(x) = \ln(2e^x + 3\ln x)$

110. $f(x) = \ln(2\sin x + 3\cos x)$

111. $f(x) = \sin(3x^2 - 2e^x)$

112. $f(x) = \cos(2x + \ln x)$

113. $f(x) = \sin(3e^x - \ln x)$

114. $f(x) = \cos(2e^x + 5\ln x)$

115. $f(x) = \tan(x^2 + 3\ln x)$

116. $f(x) = \tan(e^x - \sin x)$

117. $f(x) = \arcsin(3x^2 + \cos x)$

118. $f(x) = \arcsin(2\ln x + e^x)$

119. $f(x) = \arctan(x^3 - 3e^x)$

120. $f(x) = \arctan(2e^x + 5\ln x)$

121. $f(x) = (x^2+3)^4(x^3+2)^5$

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

123. $f(x) = (x^3-3x)^2(2\ln x+5)^3$

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

125. $f(x) = (e^x+2\ln x)^2(x^2-2^x)^3$

126. $f(x) = \dfrac{(2e^x+1)^3}{(x^2+1)^4}$

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

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

129. $f(x) = \left(\dfrac{e^x+2x}{2e^x-x}\right)^4$

130. $f(x) = \left(\dfrac{3\ln x+x^3}{e^x+3}\right)^2$

131. $f(x) = e^{x^3+x}\cdot\ln(x^2+1)$

132. $f(x) = e^{2x+3}\cdot\sin(x^3+x)$

133. $f(x) = e^{2x-1}[\sin(x^2+x+1)+2]$

134. $f(x) = \tan(x^2+1)\cdot\ln(x^4-2x^2+3)$

135. $f(x) = \arctan(3x)\cdot e^{2x^3-3}$

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

137. $f(x) = \dfrac{\ln(x^4+x^2+1)}{(x^4+x^2+1)^3}$

138. $f(x) = \dfrac{\sin(x^2+e^x)}{(x+\cos x)^2}$

139. $f(x) = \ln(x+\sqrt{x^2+1})$

140. $f(x) = \ln(x^2+e^{x^3+1})$

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

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

143. $f(x) = \sqrt{\dfrac{2x-\sin x}{3x+\cos x}}$

144. $f(x) = \sqrt[3]{\dfrac{e^x+x^2}{2e^x-x}}$

145. $f(x) = \sqrt[3]{\dfrac{2\sin x+\cos x}{\sin x-3\cos x}}$

146. $f(x) = \Big(3e^{x^2+x+1}+\ln(x^2+x+1)\Big)^2$

147. $f(x) = \Big(2\ln(x^2+3)-e^{x^3+1}\Big)^4$

148. $f(x) = \sin(e^{x^2-3}+1)$

149. $f(x) = \cos\big(\ln(x^4+x^2+1)+2\big)$

150. $f(x) = \tan\big(\ln(x^4-x^2+1)+3\big)$