

MAT 265 Review Problems for
Mastery Exam

Find the derivatives $\left(\frac{dy}{dx}\right)$ of each of the following functions.

1. $y = 5x^2 - 5\sqrt{x} - \frac{3}{x}$

2. $y = x^2 2^x + \pi^2$

3. $y = \frac{\sqrt{x}}{\sqrt{x} - 1}$

4. $y = \left(\frac{\cos x}{1 - \sin x}\right)^2$

5. $y = (17x^2 - 5x)^{50}$

6. $y = e^{2x} \sin(3x)$

7. $y = \ln(\ln x) + e^{x^2}$

8. $y = \sqrt{10^{5-x}}$

9. $y = \sqrt{\cot(x)}$

10. $y = (x^2 + 1) \arctan x$

11. $y = \ln\left(\frac{1}{x}\right) + 1$

12. $y = \frac{2}{1 - x^2}$

13. $y = \arcsin(x^2)$

14. $y = \ln(\cos x)$

15. $y = \cos^3(\sqrt{x})$

16. $y = \ln(3x) \csc(6x)$

17. $y = x(\ln(x) - x)$

18. $y = e^{\ln x^2} - 3x^{-7}$

19. $y = mx + b$ (m and b constant)

20. $y = \frac{\tan x}{x^2 - 1}$

21. $y = [\arccos(x)]^3$

22. $y = \frac{2}{3} x^{(3-e)}$

23. $y = \arctan(e^x)$

24. $y = \frac{e^x + e^{-x}}{2}$

25. $y = (\sec(x))e^x$

26. $y = \frac{2}{e^x + e^{-x}}$

27. $y = (ax)\tan(bx)$ (a and b constant)

28. $y = \frac{1}{1 - e^{-x}}$

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

30. $2xy + 2y^2 = x$

31. $y = A \sin(Bx - C) + D$
(A, B, C and D constant)

32. $y = \cot(\sqrt{x})$

33. $y = 6x^{-\frac{3}{2}} + 7x^{\frac{1}{5}} + 1$

34. $y = 3\cos(5x) + 3\sin(x^9)$

35. $y = \frac{4}{3} \cdot 3^{x^2 - x}$

36. $y = 5^x + 3x^7$

37. $y = \tan(6x)$

38. $y = \cot^{-1}(5x)$

39. $y = \sqrt{2x} + \frac{1}{x^2} + \pi$

40. $y = \frac{1}{2} \ln(x^2 - x)$

41. $y = \frac{1}{2} \cos x - \frac{1}{3} \sin x$

42. $y = 2^x + 3 \ln x$

43. $y = \tan(3)e^x$

44. $y = \frac{\sin^2 x + \cos^2 x}{x}$

45. $y = \frac{\sin(2x)}{\cos(2x)}$

46. $y = \frac{\sin x}{x^2}$

47. $y = \tan(\sin x) + \frac{1}{\pi}$

48. $2y = x^2 + \sin y$

49. $y = \sin^3(3x^2 - 2x + 1)$

50. $y = x^2 \tan\left(\frac{1}{x}\right)$

51. $y = 4x^3 - 2\sqrt{x} - \frac{4}{x}$

52. $y = x^3 3^x + e^2$

53. $y = \frac{\sqrt{2x}}{\sqrt{2x+5}}$

54. $y = \left(\frac{1 + \cos x}{\sin x} \right)^2$

55. $y = (3x^2 - x)^{10}$

56. $y = e^{3x} \cos(2x)$

57. $y = \ln(\ln x) + e^{\sin x}$

58. $y = \frac{1}{3x}$

59. $y = \sqrt{\cos x}$

60. $y = (1-x^2) \cos^{-1}(x)$

61. $y = \ln\left(\frac{2}{x^2}\right) + 3$

62. $y = \frac{-7}{1-x^3}$

63. $y = \arccos(x^3)$

64. $y = \ln(\sec(x))$

65. $y = \sin^2(\sqrt{x})$

66. $y = \sec(e^x) \ln(x)$

67. $y = x^2(x - \ln x)$

68. $y = \ln e^{x^2} - 4x^{-6}$

69. $y = cx + d$ (c and d constant)

70. $y = \frac{\tan x}{4-x^2}$

71. $y = [\sec^{-1}(x)]^4$

72. $y = \frac{4}{3} x^{\left(\frac{3}{4} - \pi\right)}$

73. $y = \arctan(\ln x)$

74. $y = \frac{1}{2}(e^x - e^{-x})$

75. $y = (\cot(3x))e^{-x}$

76. $y = \frac{e}{e^x - e^{-x}}$

77. $y = bx \tan(cx)$ (b and c constant)

78. $y = \frac{4}{3 - 2e^{-x}}$

79. $f(x) = \frac{x}{e^x}$

80. $4xy - 3y^2 = 2x$

81. $y = A \cos(Bx - C)$
(A, B, C and D constant)

82. $y = \cos(\sqrt{x})$

83. $y = \frac{4}{3} x^{-\frac{3}{4}} + 6 x^{\frac{1}{6}} + 7$

84. $y = 4 \sin(10x) - 3 \sin(x^7)$

85. $y = \ln(3) 3^{(2x-x^3)} + e^2$

86. $y = 4^x - 7x^3$

87. $y = \tan(6x^2 - 1)$

88. $y = \sec^{-1}(8x)$

89. $y = \sqrt{3x} + \frac{1}{x^3} + \pi$

90. $y = 3 \ln(4x - x^3)$

91. $y = \frac{1}{2} \cos x - \frac{1}{3} \sin x$

92. $y = 3^x + 2 \ln x$

93. $y = \sin(3) e^x$

94. $y = \frac{\sec^2 x - \tan^2 x}{x}$

95. $y = \frac{\cos(3x)}{\sin(3x)}$

96. $y = \frac{\cos x}{x^3}$

97. $y = \sin(\sin x) + \frac{1}{e}$

98. $3y = x^3 + \cos y$

99. $y = \cos^2(3x^2 - 7x)$

100. $y = x^3 \sin\left(\frac{1}{x}\right)$

101. $y = 7x^2 - 3\sqrt{x} + \frac{2}{x}$

102. $y = x^4 4^x + 4x$

103. $y = \frac{\sqrt{5x} + 1}{\sqrt{5x}}$

104. $y = \left(\frac{\cos x}{3 + \sin x}\right)^3$

105. $y = (x^2 - 3x)^{25}$

$$106. y = e^{10x} \sin(20x)$$

$$107. y = 4 \ln(\ln x) + e^{x^3}$$

$$108. y = \frac{1}{7x}$$

$$109. y = \sqrt{\sin x - 1}$$

$$110. y = (x^3 + x) \cot^{-1}(x)$$

$$111. y = \ln\left(\frac{1}{x^3}\right) + \ln(e)$$

$$112. y = \frac{2}{x^4 - 3}$$

$$113. y = \csc^{-1}(x^3)$$

$$114. y = \ln(x + \sin x)$$

$$115. y = \cos^4(\sqrt{x})$$

$$116. y = \tan(x) \ln(x)$$

$$117. y = x^2(\ln(x) - x^2)$$

$$118. y = e^{\ln(x^3)} - 4x^{-2}$$

$$119. y = k_1 x + k_2 \text{ (} k_1 \text{ and } k_2 \text{ constant)}$$

$$120. y = \frac{\tan x}{2x - 1}$$

$$121. y = [\arcsin(x)]^7$$

$$122. y = 2x^{\left(\frac{1}{2}\right)^{-e}}$$

$$123. y = \arccos(\ln x)$$

$$124. y = \frac{e^x + e^{-x}}{e}$$

$$125. y = \sec(e^x) + \pi^2$$

$$126. y = \frac{\pi}{e^x + e^{-x}}$$

$$127. y = (k_1 x) \tan(k_2 x) \text{ (} k_1 \text{ and } k_2 \text{ constant)}$$

$$128. y = \frac{4}{e^{-x} + 4}$$

$$129. y = \frac{e^x}{1-x}$$

$$130. 3xy - 4y^2 = 2x$$

$$131. y = a \cos(bx + c) + d$$

(a, b, c and d constant)

132. $y = \tan\sqrt{x}$

133. $y = 4x^{-\frac{1}{5}} + 6x^{\frac{2}{7}} + 4$

134. $y = 10\sin(-2x) + 4\cos(x^3)$

135. $y = \ln(2)2^{x^3-x} + e^2$

136. $y = 10^x + 10x^{10}$

137. $y = \cos(-4x)$

138. $y = \csc^{-1}(e^x)$

139. $y = \sqrt{10x} + \frac{4}{x^3} - e$

140. $y = \frac{1}{3}\ln(3x - 2x^3)$

141. $y = x^2 \cot(x^2)$

142. $y = 5^x + 2 \ln x$

143. $y = \sin(2)e^x$

144. $y = \frac{\csc^2 x - \cot^2 x}{x}$

145. $y = \frac{\sin(9x)}{\cos(9x)}$

146. $y = \frac{\cos x}{x^7}$

147. $y = \sin(\tan x) + \frac{1}{7}$

148. $3y = 2x^2 + \cos y$

149. $y = \cos^2(1 - 2x + x^2)$

150. $y = 4x^5 \tan\left(\frac{-1}{x}\right)$

151. $y^4 + xy = x^3 - x + 2$, find $\frac{dy}{dx}$

152. $\cos(xy) = \frac{x^2}{y}$, find $\frac{dy}{dx}$

153. $e^{xy^2} = x + x^2 y$, find $\frac{dy}{dx}$

154. $\sqrt{x + y^3} + \sqrt{y} = 2x$, find $\frac{dy}{dx}$

MAT 265 Mastery Exam Review Answers

**Note: There is a reasonable assumption
that most of these answers are not
incorrect.**

1. $10x - \frac{5}{2\sqrt{x}} + \frac{3}{x^2}$
2. $2^x(2x + x^2 \ln 2)$
3. $-\frac{1}{2\sqrt{x}(\sqrt{x}-1)^2}$
4. $\frac{2 \cos x}{(1 - \sin x)^2}$
5. $50(17x^2 - 5x)^{49}(34x - 5)$
6. $2e^{2x} \sin 3x + 3e^{2x} \cos 3x$
7. $\frac{1}{x \ln x} + 2xe^{x^2}$
8. $-\frac{10^{0.5(5-x)} \ln(10)}{2}$
9. $\frac{-\csc^2(x)}{2\sqrt{\cot(x)}}$
10. $2x \arctan x + 1$
11. $-\frac{1}{x}$
12. $\frac{4x}{(1-x^2)^2}$
13. $\frac{2x}{\sqrt{1-x^4}}$
14. $-\tan x$
15. $-\frac{3 \cos^2 \sqrt{x} \sin \sqrt{x}}{2\sqrt{x}}$
16. $\frac{\csc(6x)}{x} - \ln(3x) \csc(6x) \cot(6x)$
17. $\ln x - 2x + 1$
18. $2x + \frac{21}{x^8}$
19. m
20. $\frac{(x^2 - 1) \sec^2 x - 2x \tan x}{(x^2 - 1)^2}$
21. $-\frac{3(\arccos x)^2}{\sqrt{1-x^2}}$
22. $\frac{2}{3}x^{2-e}(e-3)$
23. $\frac{e^x}{1+e^{2x}}$
24. $\frac{1}{2}e^x - \frac{1}{2}e^{-x}$
25. $\sec(x)e^x(\sec x + \tan x)$
26. $-\frac{2(e^x - e^{-x})}{(e^x + e^{-x})^2}$
27. $a \tan bx + abx(\sec^2 bx)$
28. $-\frac{e^{-x}}{(1-e^{-x})^2}$
29. $\frac{xe^x - e^x}{x^2}$
30. $\frac{1-2y}{2x+4y}$
31. $AB \cos(Bx - C)$
32. $\frac{-\csc(\sqrt{x}) \cot(\sqrt{x})}{2\sqrt{x}}$
33. $-\frac{9}{x^{5/2}} + \frac{7}{5x^{4/5}}$
34. $-15 \sin 5x + 27x^8 \cos x^9$
35. $\frac{4}{3}3^{x^2-x}(2x-1) \ln 3$
36. $5^x \ln 5 + 21x^6$
37. $6 \sec^2 6x$
38. $-\frac{5}{1+25x^2}$
39. $\frac{1}{\sqrt{2x}} - \frac{2}{x^3}$
40. $\frac{2x-1}{2(x^2-x)}$
41. $-\frac{1}{2} \sin x - \frac{1}{3} \cos x$

42. $2^x \ln 2 + \frac{3}{x}$
43. $e^x \tan 3$
44. $-\frac{1}{x^2}$
45. $2 \sec^2 2x$
46. $\frac{x \cos x - 2 \sin x}{x^3}$
47. $\cos x \sec^2(\sin x)$
48. $\frac{2x}{2 - \cos y}$
49. $3 \sin^2(3x^2 - 2x + 1) \cos(3x^2 - 2x + 1)(6x - 2)$
50. $2x \tan\left(\frac{1}{x}\right) - \sec^2\left(\frac{1}{x}\right)$
51. $12x^2 - \frac{1}{\sqrt{x}} + \frac{4}{x^2}$
52. $3^x(3x^2 + x^3 \ln 3)$
53. $\frac{5}{\sqrt{2x}(\sqrt{2x} + 5)^2}$
54. $\frac{-2(1 + \cos x)^2}{\sin^3 x}$
55. $10(6x - 1)(3x^2 - x)^9$
56. $e^{3x}(3 \cos 2x - 2 \sin 2x)$
57. $\frac{1}{x \ln x} + e^{\sin x} \cos x$
58. $-\frac{1}{3x^2}$
59. $-\frac{\sin x}{2\sqrt{\cos x}}$
60. $-2x \cos^{-1}(x) - \sqrt{1 - x^2}$
61. $-\frac{2}{x}$
62. $-\frac{21x^2}{(1 - x^3)^2}$
63. $-\frac{3x^2}{\sqrt{1 - x^6}}$
64. $\tan x$
65. $\frac{\sin \sqrt{x} \cos \sqrt{x}}{\sqrt{x}}$
66. $y = e^x \sec(e^x) \tan(e^x) \ln(x) + \frac{\sec(e^x)}{x}$
67. $3x^2 - x - 2x \ln x$
68. $2x + \frac{24}{x^7}$
69. c
70. $\frac{(4 - x^2) \sec^2 x + 2x \tan x}{(4 - x^2)^2}$
71. $\frac{4(\sec^{-1} x)^3}{x\sqrt{x^2 - 1}}$
72. $\left(1 - \frac{4}{3}\pi\right)x^{-\left(\frac{1}{4} + \pi\right)}$
73. $\frac{1}{x[1 + (\ln x)^2]}$
74. $\frac{1}{2}(e^x + e^{-x})$
75. $-e^{-x}(\cot(3x) + 3 \csc^2(3x))$
76. $-\frac{e(e^x + e^{-x})}{(e^x - e^{-x})^2}$
77. $b \tan cx + bcx \sec^2 cx$
78. $\frac{-8e^{-x}}{(3 - 2e^{-x})^2}$
79. $\frac{1 - x}{e^x}$
80. $\frac{1 - 2y}{2x - 3y}$
81. $-AB \sin(Bx - C)$
82. $-\frac{\sin \sqrt{x}}{2\sqrt{x}}$
83. $-x^{-7/4} + x^{-5/6}$
84. $40 \cos 10x - 21x^6 \cos x^7$
85. $(\ln 3)^2 3^{2x - x^3} (2 - 3x^2)$
86. $4^x \ln 4 - 21x^2$
87. $12x \sec^2(6x^2 - 1)$

88. $\frac{1}{x\sqrt{64x^2-1}}$
89. $\frac{\sqrt{3}}{2\sqrt{x}} - \frac{3}{x^4}$
90. $\frac{12-9x^2}{4x-x^3}$
91. $-\frac{1}{2}\sin x - \frac{1}{3}\cos x$
92. $3^x \ln 3 + \frac{2}{x}$
93. $e^x \sin 3$
94. $-\frac{1}{x^2}$
95. $-3\csc^2 3x$
96. $-\frac{x \sin x + 3 \cos x}{x^4}$
97. $\cos x [\cos(\sin x)]$
98. $\frac{3x^2}{3 + \sin y}$
99. $(14-12x)\cos(3x^2-7x)\sin(3x^2-7x)$
100. $3x^2 \sin\left(\frac{1}{x}\right) - x \cos\left(\frac{1}{x}\right)$
101. $14x - \frac{3}{2\sqrt{x}} - \frac{2}{x^2}$
102. $4^x(4x^3 + x^4 \ln 4) + 4$
103. $\frac{-5}{2\sqrt{(5x)^3}}$
104. $\frac{3\cos^2 x(-3\sin x - 1)}{(3 + \sin x)^4}$
105. $25(2x-3)(x^2-3x)^{24}$
106. $10e^{10x}(\sin 20x + 2\cos 20x)$
107. $\frac{4}{x \ln x} + 3x^2 e^{x^3}$
108. $-\frac{1}{7x^2}$
109. $\frac{\cos x}{2\sqrt{\sin x - 1}}$
110. $(3x^2 + 1)\cot^{-1}(x) - x$
111. $-\frac{3}{x}$
112. $-\frac{8x^3}{(x^4 - 3)^2}$
113. $-\frac{3}{x\sqrt{x^6 - 1}}$
114. $\frac{1 + \cos x}{x + \sin x}$
115. $-\frac{2\cos^3 \sqrt{x} \sin \sqrt{x}}{\sqrt{x}}$
116. $\frac{\tan x}{x} + \sec^2 x \ln x$
117. $x + 2x \ln x - 4x^3$
118. $3x^2 + \frac{8}{x^3}$
119. k_1
120. $\frac{(2x-1)\sec^2 x - 2 \tan x}{(2x-1)^2}$
121. $\frac{7(\arcsin x)^6}{\sqrt{1-x^2}}$
122. $(1-2e)x^{-\left(\frac{1}{2}+e\right)}$
123. $-\frac{1}{x\sqrt{1-(\ln x)^2}}$
124. $\frac{e^x - e^{-x}}{e}$
125. $e^x \sec(e^x) \tan(e^x)$
126. $-\frac{\pi(e^x - e^{-x})}{(e^x + e^{-x})^2}$
127. $k_1 \tan k_2 x + k_1 k_2 x \sec^2 k_2 x$
128. $\frac{4e^{-x}}{(e^{-x} + 4)^2}$
129. $y = \frac{(2-x)e^x}{(1-x)^2}$
130. $\frac{2-3y}{3x-8y}$
131. $-ab \sin(bx + c)$

132. $\frac{\sec^2 \sqrt{x}}{2\sqrt{x}}$
133. $-\frac{4}{5}x^{-6/5} + \frac{12}{7}x^{-5/7}$
134. $-20\cos(-2x) - 12x^2 \sin x^3$
135. $(\ln 2)^2(3x^2 - 1)2^{x^3 - x}$
136. $10^x \ln 10 + 100x^9$
137. $4\sin(-4x)$
138. $\frac{1}{\sqrt{e^{2x} - 1}}$
139. $\frac{5}{\sqrt{10x}} - \frac{12}{x^4}$
140. $\frac{1 - 2x^2}{3x - 2x^3}$
141. $2x \cot(x^2) - 2x^3 \csc^2(x^2)$
142. $5^x \ln 5 + \frac{2}{x}$
143. $e^x \sin 2$
144. $-\frac{1}{x^2}$
145. $9\sec^2 9x$
146. $\frac{-x \sin x - 7 \cos x}{x^8}$
147. $\sec^2 x \cos(\tan x)$
148. $\frac{4x}{3 + \sin y}$
149. $(4 - 4x) \cos(1 - 2x + x^2) \sin(1 - 2x + x^2)$
150. $20x^4 \tan\left(-\frac{1}{x}\right) - 4x^3 \sec^2\left(-\frac{1}{x}\right)$
151. $y' = \frac{3x^2 - y - 1}{4y^3 + x}$
152. $y' = \frac{2xy + y^3 \sin(xy)}{x^2 - xy^2 \sin(xy)}$
153. $y' = \frac{1 + 2xy - y^2 e^{xy^2}}{2xye^{xy^2} - x^2}$
154. $y' = \frac{2 - 0.5(x + y^3)^{-0.5}}{1.5y^2(x + y^3)^{-0.5} + 0.5y^{-0.5}}$