

Mastery Quiz Syllabus

MAT 272, Kostelich

The following problems are representative of the calculations that you will need to do routinely throughout the course. Your success and enjoyment of the course will be enhanced if you are able to do these exercises fluently and quickly.

Please attempt the odd-numbered problems today. The mastery quiz will be on Friday. The problems on the mastery quiz will be taken from those listed here.

Algebraic and trigonometric identities

Where possible, simplify or solve for x , as appropriate, for each expression in the following list. Give the principal value of inverse trigonometric functions, where applicable. If no simplification is possible, then so state.

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|----------------------------|----------------------------|-------------------------------------|
| 1. $\ln 3x + \ln 4y$ | 19. $\frac{1}{2} \ln(x^2)$ | 37. $\tan^{-1} 1$ |
| 2. $\ln x^3 + \ln x^4$ | 20. $\cos^2 x - 1$ | 38. $\cos^{-1}(1/\sqrt{2})$ |
| 3. $\ln(x^2 + 1)$ | 21. $\cos(-x)$ | 39. $\sin^{-1}(-\sqrt{3}/2)$ |
| 4. $\ln 1$ | 22. $\sin(-x)$ | 40. $\tan^{-1} \sqrt{3}$ |
| 5. $\ln e$ | 23. $\cos(\pi/4)$ | 41. $\tan^{-1} -1$ |
| 6. $\ln e^x$ | 24. $\sin(\pi/4)$ | 42. $\cos^{-1} -1$ |
| 7. $\ln(x^2)$ | 25. $\tan(\pi/4)$ | 43. $\ln(2x + 2) = 3t$ |
| 8. $e^{\ln(2x)}$ | 26. $\cos(\pi/3)$ | 44. $e^x = 2t$ |
| 9. $e^{2 \ln x}$ | 27. $\sin(\pi/3)$ | 45. $\frac{1}{x+1} = t + 1$ |
| 10. $e^{(\ln x)/2}$ | 28. $\tan(\pi/3)$ | 46. $\cos x = \sqrt{2}$ |
| 11. $e^{\ln 7 - \ln 8}$ | 29. $\cos(3\pi/4)$ | 47. $x^2 + 4x + 3 = 0$ |
| 12. $e^{t \ln 0.8}$ | 30. $\sin(3\pi/4)$ | 48. $x^3 + 2x^2 + x = 0$ |
| 13. $e^{-t \ln 2}$ | 31. $\tan(3\pi/4)$ | 49. $\tan x = 1$ |
| 14. e^0 | 32. $\cos(-\pi/6)$ | 50. $\sin x = \frac{1}{2} \sqrt{2}$ |
| 15. $2^{1/2}$ | 33. $\cos(-5\pi/3)$ | 51. $\tan x = -1/\sqrt{3}$ |
| 16. $e^{2t} \cdot 2e^{-t}$ | 34. $\sin(-\pi/6)$ | 52. $\cos x = -1$ |
| 17. $e^{2t} + 2e^{-t}$ | 35. $\sin(-3\pi/4)$ | |
| 18. $\frac{1}{e^{-2t}}$ | 36. $\tan(-\pi/3)$ | |

Derivatives

Find the indicated derivative of each of the following expressions.

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| 53. $\frac{d}{dt}(e^{-3t})$ | 63. $\frac{d}{dt}(e^{-t} + e^{-2t})$ | 72. $\frac{d}{dt}(3t^2 + 1)^{3/2}$ |
| 54. $\frac{d}{dt}(e^{2t} \cos 2t)$ | 64. $\frac{d}{dt}(e^{-t}e^{-2t})$ | 73. $\frac{d}{dx}\left(\frac{1}{x^3}\right)$ |
| 55. $\frac{d}{dt}\left(\frac{3}{t}\right)$ | 65. $\frac{d}{dt}(\ln 2t)$ | 74. $\frac{d}{dt}\left(\frac{2}{t^4}\right)$ |
| 56. $\frac{d}{dx}(\sin 5x)$ | 66. $\frac{d}{dt}\sqrt{3t^2 + 1}$ | 75. $\frac{d}{dt}\left(\frac{t}{t+1}\right)$ |
| 57. $\frac{d}{dx}(\tan x)$ | 67. $\frac{d}{dx}[(2x+4)^{10}]$ | 76. $\frac{d}{dt}\left(\frac{1}{\sqrt[3]{t+1}}\right)$ |
| 58. $\frac{d}{dt}(3t^3 + 4t^2 + 2t + 1)$ | 68. $\frac{d}{dx}\left(9x^8 + \frac{1}{x^2}\right)$ | 77. $\frac{d}{dt}\left(\frac{1}{4t^{1/3}}\right)$ |
| 59. $\frac{d}{dt}(t \cos t)$ | 69. $\frac{d}{dx}\left(\frac{x}{3x^2 - 1}\right)$ | 78. $\frac{d}{dt}(2t^{4/3})$ |
| 60. $\frac{d}{dt}(t \sin 2t)$ | 70. $\frac{d}{dx}\left(\frac{2}{(x+1)^2}\right)$ | 79. $\frac{d}{dt}(t^{3/4} + 1)$ |
| 61. $\frac{d}{dt}(te^{-t})$ | 71. $\frac{d}{dx}\left(\frac{1}{\sqrt{2x+1}}\right)$ | 80. $\frac{d}{dt}(2t+1)^{1/4}$ |
| 62. $\frac{d}{dt}(e^{-t}(\sin t + \cos 2t))$ | | |

Limits

Evaluate each of the following limits. If the limit does not exist, then so state. Note that some of the limits may be $+\infty$ or $-\infty$; an infinite limit is not the same as a limit that does not exist. Give the principal value of the limits of inverse trigonometric functions, where applicable.

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|---|---|--|
| 81. $\lim_{t \rightarrow \infty} e^{-t}$ | 88. $\lim_{x \rightarrow 0} e^{-x}$ | 95. $\lim_{x \rightarrow 0} \frac{x}{3x^2 + 1}$ |
| 82. $\lim_{x \rightarrow \infty} e^x$ | 89. $\lim_{x \rightarrow 0} xe^{-x}$ | 96. $\lim_{x \rightarrow \infty} \frac{x}{3x^2 + 1}$ |
| 83. $\lim_{x \rightarrow \infty} e^{2-x}$ | 90. $\lim_{x \rightarrow 0} \sin x$ | 97. $\lim_{x \rightarrow \infty} \frac{x^2 + 1}{x}$ |
| 84. $\lim_{x \rightarrow \infty} e^{1/x}$ | 91. $\lim_{x \rightarrow 0} \cos x$ | 98. $\lim_{x \rightarrow 0} \frac{x+1}{x-1}$ |
| 85. $\lim_{x \rightarrow \infty} \cos x$ | 92. $\lim_{x \rightarrow 0} \tan x$ | 99. $\lim_{x \rightarrow 1} \frac{x+1}{x-1}$ |
| 86. $\lim_{x \rightarrow \infty} \tan x$ | 93. $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ | 100. $\lim_{x \rightarrow \infty} \frac{3x^2 + 1}{4x^3 + x}$ |
| 87. $\lim_{x \rightarrow \infty} \tan^{-1} x$ | 94. $\lim_{x \rightarrow 0} \frac{\cos x}{x}$ | |

101. $\lim_{x \searrow 0} \ln 2x$

102. $\lim_{x \rightarrow 1/2} \ln 2x$

103. $\lim_{x \rightarrow \infty} \ln 2x$

Integrals

Evaluate each of the integrals in the following list.

104. $\int (3t^2 + 1) dt$

114. $\int \frac{1}{2t-1} dt$

124. $\int \cos 2t dt$

105. $\int (4t^3 + 2t) dt$

115. $\int \frac{3}{(2t+1)^2} dt$

125. $\int \frac{\sin 3t}{2} dt$

106. $\int \frac{dx}{x^3}$

116. $\int e^{-3t} dt$

126. $\int_0^{\pi/8} \cos 2t dt$

107. $\int \frac{dx}{3x^4}$

117. $\int te^{-t} dt$

127. $\int_0^{\pi/4} \cos 2t \sin 2t dt$

108. $\int \sqrt{x} dx$

118. $\int \frac{2}{e^{2t}} dt$

128. $\int_0^{\pi/4} e^t \cos t dt$

109. $\int \sqrt[3]{x} dx$

119. $\int \frac{x}{x^2+1} dx$

129. $\int_0^{\pi/4} \tan x dx$

110. $\int x^{5/4} dx$

120. $\int \frac{x^2+1}{x} dx$

130. $\int \frac{1}{2x^2+x} dx$

111. $\int \frac{1}{4t} dt$

121. $\int \frac{1}{x^2+1} dx$

131. $\int \frac{x}{\sqrt{x^2+1}} dx$

112. $\int \frac{1}{4t^2} dt$

122. $\int \frac{x^3}{4x^4+1} dx$

132. $\int (t+1)^{2/3} dt$

113. $\int \frac{1}{3t+2} dt$

123. $\int t \cos t dt$

133. $\int \frac{1}{(t+2)^{1/3}} dt$