Chapter 3 extra problems:
Find the derivative and simplify:

101. $f(t)=\sqrt{t}\cos t$

102. $f(t)=\dfrac{1}{\sqrt{t}}\cos t$

103. $y=\sin\theta\cos\theta$

104. $y=\sin\theta\sin\theta$

105. $y=4x^{7}\cos x$

106. $y=\pi x^{32}\cos x$

107. $\sqrt{2x}\sin x$

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110. $y=\dfrac{2}{x^{2}}-\dfrac{x}{8}-x^{2}\sqrt{x}+\dfrac{4\sqrt{x}}{x}$

111. $f(x)=x^{2}\tan x$

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

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120. $y=\cos^{4}(3x+1)$

121. $y=\dfrac{\tan 2x}{x^{2}+5x}$

122. $y=\dfrac{4}{x}-\dfrac{3x}{2}+6x^{2}\sqrt{x}-\dfrac{3x^{2}}{\sqrt{x}}$

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130. $y=3x^{3}\sqrt{4x+3}$

131. $y=\sqrt{\sin^{2}x+x^{3}}$

132. $y=\dfrac{8}{x}-\dfrac{3x}{5}+4x^{2}\sqrt{x}-\dfrac{4x^{2}}{\sqrt{x}}$

133. $y=\left(x^{2}+\sin^{2}x\right)^{6}$

134. Find the tangent line to $y=3x+4\sqrt{x}$ at the point where $x = 1$

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140. $y=\left(x^{2}+\sin^{2}x\right)^{6}$

141. $y=\dfrac{x^{2}-4x}{\sin 3x}$

142. $y=\cos^{5}(4x)$

143. $y=4x^{5}\cos 6x$

144. $y=(2x-1)^{6}(3x+4)^{8}$ (simplify by factoring)

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150. $f(x)=\dfrac{3x+2}{x^{2}-5x+1}$

151. $g(x)=\dfrac{\sqrt{x}}{3x+5}$

152. $h(x)=x^{2}\tan(3x)+\dfrac{\sqrt{x}}{x^{2}}$

153. Find the equation of the tangent line to $y=\dfrac{x^{2}}{\sqrt{x}}+2$ at the point where x=4. (Note for this problem you must find both the y-coordinate of the point, and the slope)

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160. $f(x)=\sqrt{\dfrac{x}{4x+1}}$

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

162. $h(x)=\sec^{2}(5x)$

163. $y^{2}+3xy+2x^{2}=4x$

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170. $y=\dfrac{3x-2}{(4x+1)^{3}}$

171. $y=4x^{5}\csc 6x$

172. $y=\left(x^{2}+\sin^{2}x\right)^{6}$

173. $y=\dfrac{4}{x}-\dfrac{x}{3}+2x\sqrt{x}-\dfrac{x}{\sqrt{x}}$

174. Find the tangent line to $y=\sin\left(\dfrac{\pi x}{12}\right)$ when x=2 (you should be giving me an exact number for the y-coordinate and the slope, not a calculator number)

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180. $y=3x^{2}+12\sqrt{2x^{3}-3x^{2}}$

181. $y=\dfrac{0.1x^{4}+.5x^{2}-5x+13}{x}$

182. a. Find the formula for the rate of change of the volume of a spherical balloon ($V=\dfrac{4}{3}\pi r^{3}$) with respect to its radius.
b. Find the rate of change of the volume of the balloon when the radius is 3 in.
c. Find the rate of change of the volume of the balloon when the radius is 4 in.

183. $x\sin(y)=x^{2}+y^{3}$

Solutions

101. $\frac{1}{2\sqrt{t}}\cos t-\sqrt{t}\sin t=\frac{\cos t-2t\sin t}{2\sqrt{t}}$

102. $-\frac{1}{2t^{3/2}}\cos t-\frac{1}{t^{1/2}}\sin t=\frac{-\cos t-t\sin t}{2t^{3/2}}$

103. $y'=\cos^2\theta-\sin^2\theta$

104. $y'=2\sin\theta\cos\theta$

105. $y'=28x^6\cos x-4x^7\sin x$

106. $y'=32\pi x^{31}\cos x-\pi x^{32}\sin x$

$\frac{\sqrt{2}}{2\sqrt{x}}\sin x+\sqrt{2x}\cos x=\frac{\sqrt{2}(\sin x+x\cos x)}{2\sqrt{x}}$

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110. $y'=-\frac{4}{x^3}-\frac{1}{8}-\frac{5}{2}x^{3/2}-\frac{2}{x^{3/2}}$

111. $f'(x)=2x\tan x+x^2\sec^2 x$

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

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120. $y'=12\cos^3(3x+1)$

121. $y'=\frac{2(x^2+5x)\sec^2 2x-(2x+5)\tan 2x}{(x^2+5x)^2}$

122. $y'=-\frac{4}{x^2}-\frac{3}{2}+15x^{3/2}-\frac{9x^{1/2}}{2}$

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130. $y'=\frac{3x^2(14x+9)}{\sqrt{4x+3}}$

131. $y'=\frac{(2\sin x\cos x+3x^2)}{2\sqrt{\sin^2 x+x^3}}$

132. $y=-\frac{8}{x^2}-\frac{3}{5}+10x^{3/2}-6x^{1/2}$

133. $y=6\left(x^2+\sin^2 x\right)^5(2x+2\sin x\cos x)$

134. $y-7=5(x-1)\Rightarrow y=5x+2$

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140. $y'=6\left(x^2+\sin^2 x\right)^5(2x+2\sin x\cos x)$

141. $y'=\frac{(2x-4)\sin 3x-(x^2-4x)3\cos 3x}{\sin^2 3x}$

142. $y'=12\cos^4(4x)$

143. $y'=4x^4(5\cos 6x-6x\sin 6x)$

144. $y'=12(2x-1)^5(3x+4)^7[7x+2]$
(simplify by factoring)

Find the derivative and simplify:

150. $f'(x)=\frac{-3x^2-4x+13}{(x^2-5x+1)^2}$

151. $g'(x)=\frac{-3x+5}{2\sqrt{x}(3x+5)^2}$

152. $h'(x)=2x\tan(3x)+x^2\sec^2(3x)-\frac{3}{2x^{5/2}}$

153. $y-10=3(x-4)\Rightarrow y=3x-2$

160.

$f'(x)=\frac{1}{2(4x+1)^2}\cdot\sqrt{\frac{4x+1}{x}}=\frac{\sqrt{4x^2+x}}{2x(4x+1)^2}$

161. $g'(x)=\frac{2(2x+4)^4(3x-49)}{(3x-5)^5}$

162. $h'(x)=10\sec^2(5x)\tan(5x)$

163. $\frac{dy}{dx}=\frac{4-4x-3y}{2y+3x}$

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170. $y'=\frac{3(-8x+9)}{(4x+1)^4}$

171. $y'=4x^4\csc(6x)(5-6x\cot(6x))$

172. $y'=6\left(x^2+\sin^2 x\right)^5(2x+2\sin x\cos x)$

173. $y'=-\frac{4}{x^2}-\frac{1}{3}+3\sqrt{x}-\frac{1}{2\sqrt{x}}$

174. $y=\frac{\sqrt{3}\pi}{24}x-\frac{\sqrt{3}\pi}{12}+\frac{1}{2}$

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180. $y'=6x+\frac{36x(x-1)}{\sqrt{2x^3-3x^2}}$

181. $y'=\frac{.3x^4+.5x^2-13}{x^2}$

182. a. $\frac{dV}{dr}=4\pi r^2$

b. $\left.\frac{dV}{dr}\right|_{r=3}=36\pi\frac{in^3}{in}$ c. $\left.\frac{dV}{dr}\right|_{r=4}=64\pi\frac{in^3}{in}$

183. $\frac{dy}{dx}=\frac{2x-\sin y}{x\cos y-3y^2}$